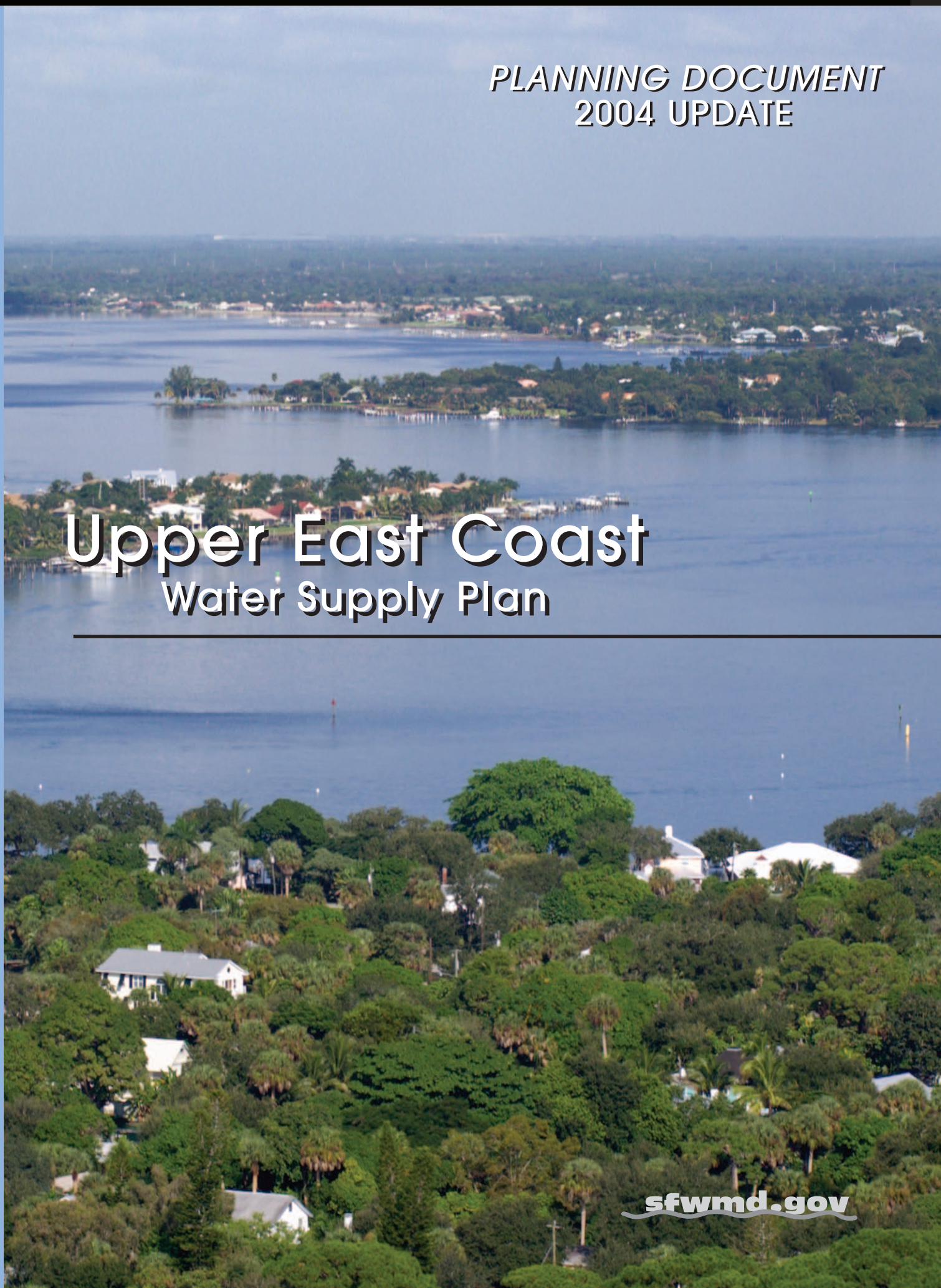
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PLANNING DOCUMENT
2004 UPDATE



Upper East Coast
Water Supply Plan

sfwmd.gov

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2004 Update
June 2004

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Water Supply Department
South Florida Water Management District

Acknowledgements

The South Florida Water Management District (SFWMD) would like to recognize and thank the Water Resources Advisory Commission (WRAC) Regional Water Supply Workshop participants for their contributions, comments, advice, information and assistance throughout the development of this Plan Update.

Furthermore, the SFWMD expresses appreciation to all District staff who contributed to the development and production of this 2004 Plan Update.

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Executive Summary

The Upper East Coast (UEC) Planning Area is projected to experience substantial population growth by the year 2025. Population is forecast to increase by over 50 percent from year 2000 numbers to almost a half a million people, with expansion occurring mostly in the coastal areas. Conversely, agriculture—primarily citrus located in the western portion of the region—is projected to decrease slightly due to current industry markets, and development pressure. In addition to human needs, there are numerous coastal and inland environmental resources within this region that depend on water resources for sustainability. It is the intent of the Florida Legislature to promote the availability of sufficient water for all existing and future reasonable-beneficial uses and to protect and enhance natural systems. This region receives 55 inches of rainfall annually on average, but with a wide range seasonally and annually. Meeting human water demands, while addressing the water needs of the environment, makes development of proactive water supply strategies imperative to the economic and environmental sustainability of the area.

The first *Upper East Coast Water Supply Plan* was completed in 1998. This 2004 Update builds on knowledge gained in the 1998 Plan, assumptions in the 1998 Plan, as well as activities that have taken place since its adoption. Water users, utilities, the environmental community and local governments should be recognized for their proactive efforts, including development of alternative water sources and environmental restoration efforts. These contributions help to ensure that water needs of this region will be met.

The South Florida Water Management District considered the interests and concerns of water users, the environment and other stakeholders in the planning area as paramount, and made great efforts to encourage full participation in developing this Plan. A series of public workshops were held during the plan development process to solicit input. The planning effort provided a forum to weigh projected urban, agricultural and environmental water demands against available supplies. Public participation has significantly refined and improved this Plan.

Eight water source options were identified to address the water supply needs of the UEC Planning Area through at least 2025. These options either make additional water available from historically used sources or other sources, or provide additional management through conservation and storage of the options. The options are (in no implied priority):

- Aquifer storage and recovery
- Conservation
- Floridan Aquifer System
- Reclaimed Water
- Reservoirs
- Seawater
- Surface Water
- Surficial Aquifer System

Overall, from a regional perspective, it was concluded that with appropriate management and diversification of water supply sources, there is sufficient water to meet the needs of this region during a 1-in-10 year drought condition through 2025. In addition to the recommendations of this Plan, the Comprehensive Everglades Restoration Plan (CERP) will maximize water resources by addressing issues of timing, retention and freshwater flow regimes to the coastal environmental resources in the planning area, and increase availability of fresh water for future use.

This assessment concluded that existing public water supply and landscape irrigation uses have maximized the use of the Surficial Aquifer, the traditional source of water for urban water needs, in the coastal areas. Increased withdrawals are limited due to potential impacts on wetland systems, and increased vulnerability to saltwater intrusion in the vicinity of public water supply wellfields. In the western portions of the planning area, where surface water from the regional canal system is heavily used for agricultural needs, analysis showed that existing surface water supplies are inadequate to meet existing, as well as future demands. Surface water availability is essentially a function of climate and storage—currently, there are excess amounts during the summer wet season, and insufficient supplies during dry winter months.

The problem of timing is especially illustrated by the impacts of freshwater discharges to environmental systems. Excessive discharges can temporarily decrease the salinity of the estuarine systems, in some cases to essentially fresh water, resulting in the loss of historic seagrass and oyster bed systems. Insufficient freshwater discharges can increase the salinity, in some cases to essentially salt water, resulting in negative environmental impacts. In this region, excess discharges have been a far larger issue.

For public water supply, the scenario that showed the most promise of satisfying projected demands was continued use of the Surficial Aquifer at current levels and continued development of the Floridan Aquifer to meet the growing needs for potable water. The Floridan Aquifer is a saline water source found at depths greater than 600 feet below the land surface in the UEC Planning Area that requires desalination treatment (salt removal) prior to potable use. Most of the coastal utilities have already begun transitioning to the Floridan Aquifer; with 20 percent of the water to meet 2000 potable needs originating from the Floridan Aquifer. The South Florida Water Management District realizes the need for greater understanding of the impact of long-term, sustained withdrawals from this aquifer. Developing a regional Floridan Aquifer water quality groundwater model and related monitoring of the Floridan Aquifer has become a priority in this planning area.

The scenario that showed the most promise of meeting future needs for landscape irrigation was continued use of the Surficial Aquifer at current levels and continued development of reclaimed water to meet growing needs for irrigation water. Additional withdrawals from the Surficial Aquifer for landscape irrigation may be possible on a project-by-project basis. Reuse of reclaimed water however, appears to be a more significant source of irrigation water supply. In 2003, over 40 percent or 8 million gallons per day of the wastewater treated in the region was reused for a beneficial purpose—

mostly for irrigation of residential lots, golf courses, medians and other green space. The remaining 12 million gallons per day of wastewater not developed for reuse is potentially available water. To promote increased use of reclaimed water in the future, local governments and utilities are encouraged to consider establishing mandatory reuse zones, or geographic areas where the use of reclaimed water is required as part of development orders. Development of supplemental sources could be used to increase reuse in some systems.

For agricultural irrigation, predominately citrus, a combination of surface water from the C-23, C-24, C-25 and C-44 canals, supplemented with Floridan Aquifer water, is sufficient to meet the existing and projected needs during a 1-in-10 year drought event. Due to changes in economic conditions in the citrus industry, projections of increases in the 1998 Plan in irrigated agricultural acreage have been reassessed. Growth in overall agricultural demand from 2000 levels is not anticipated. Construction of storage reservoirs proposed in the CERP Indian River Lagoon – South Project will enhance surface water availability and reduce reliance on the Floridan Aquifer. Implementation of voluntary best management practices identified by the citrus industry, continued conversion of seepage/flood irrigation systems to microirrigation, and the use of the existing agricultural mobile irrigation labs can further reduce agricultural water use.

Strong emphasis should be placed on conserving water through implementation of user-specific water conservation plans. Savings can be realized through proactive, cooperative efforts between water users, utilities, local governments and the District. Conservation plans should be multi-faceted, including local government policies, such as water conservation ordinances, public education, retrofits of indoor and outdoor devices, use of alternative water sources and continued emphasis on water conservation in the District's expanded Consumptive Use Permitting Program. Continued use of existing mobile irrigation labs will also support this effort.

Freshwater discharges from the C-23, C-24, C-25 and C-44 canals to the St. Lucie River and Estuary and the Indian River Lagoon pose problems in maintaining a healthy estuarine system. High volume, prolonged freshwater releases from Lake Okeechobee via the C-44 Canal and increased local basin runoff, also have a dramatic effect on water quality and the health of the estuarine system. A minimum flow and level was established for the St. Lucie River and Estuary in 2002. The analysis shows that the MFL is currently being met and no additional actions are required to ensure compliance for at least 20 years into the future. Construction of the CERP Indian River Lagoon – South Project Implementation Report recommendations and the Ten Mile Creek Critical Restoration Project initiated in 2003, will address regional storage and freshwater flows from the watershed; the CERP and possible modifications to the Lake Okeechobee Regulation Schedule will further address freshwater discharges from Lake Okeechobee to the St. Lucie River via the C-44 Canal. Water reservations for the protection of fish and wildlife will be established for the St. Lucie River and southern Indian River Lagoon pursuant to the CERP Indian River Lagoon – South Project Implementation Report.

In contrast to concerns of freshwater encroachment in estuarine systems, the Loxahatchee River has been significantly affected by the creation of the Jupiter Inlet. In addition, construction of the C-18 Canal and installation of drainage projects for agricultural and urban development have lowered water tables and reduced the amount of fresh water available to the Loxahatchee River. These changes have significantly altered natural flow patterns allowing salt water to move further up the river resulting in the displacement of freshwater wetland species by estuarine species. A minimum flow and level was established for the Northwest Fork of the Loxahatchee River in 2002. Implementation of projects in the 2002 Northern Palm Beach County Comprehensive Water Management Plan and recommendations in the 2000 Lower East Coast Regional Water Supply Plan are beginning to address freshwater flows to the Loxahatchee River. Approximately 44,800 acre-feet of storage have been purchased in the L-8 Reservoir, the G-160 Loxahatchee Slough Structure in northeastern Palm Beach County has been completed and construction of the G-161 Northlake Boulevard Structure has begun. In addition to structural improvements that will benefit environmental water supply, establishment of a water reservation for the Northwest Fork of the Loxahatchee River, development of a restoration plan, completion of the CERP North Palm Beach County Part 1 Project Implementation Report and establishment of minimum flows and levels for the tributaries to the Northwest Fork of the Loxahatchee River will further address freshwater timing and flow to this system.

In addition to administrative rule development, structural improvements and restoration plans, local governments and users will play a key role in the successful implementation of this Plan. Examples include adoption of conservation ordinances, homeowner awareness programs, land use decisions and development of water source options by local utilities and users.

The conclusions and recommendations of this 2004 UEC Water Supply Plan are consistent with those of the 1998 UEC Water Supply Plan. Much progress has been made in implementing the recommendations of the 1998 Plan and development of alternative water sources; water users have diversified their supply sources and reduced reliance on the Surficial Aquifer. Most coastal utilities are utilizing the Floridan Aquifer to meet their future needs; reclaimed water use in the areas has increased and offsets use of groundwater; and conversion of agricultural seepage irrigation systems to microirrigation has continued. In addition, significant efforts since 1998 have resulted in strategies and designs for surface water storage to better manage freshwater flows to the coastal resources.

Finally, successful implementation of this Plan will require coordination with other regional and local government planning efforts and include continued public participation in guiding the implementation of recommendations. Looking ahead to 2025, the recommendations outlined in this Plan, in addition to other efforts, should ensure that water resources in this region are prudently managed and available to meet anticipated demands.

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Acronyms and Abbreviations

AFSIRS	Agricultural Field Scale Irrigation Requirements Simulation
ASR	aquifer storage and recovery
AWS	alternative water supply
BMP	Best Management Practice
BOR	Basis of Review
C&SF Project	Central and Southern Florida Flood Control Project
CERP	Comprehensive Everglades Restoration Plan
cfs	cubic feet per second
CR	County Road
CUP	Consumptive Use Permitting
District	South Florida Water Management District
DSS	domestic self-supply
DWMP	District Water Management Plan
DWSA	Districtwide Water Supply Assessment
EDR	Electrodialysis Reversal
EQIP	Environmental Quality Improvement Program
ET	evapotranspiration
F.A.C.	Florida Administrative Code
FAS	Floridan Aquifer System
FASS	Florida Agricultural Statistics Service
FAWN	Florida Automated Weather Network
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FPL	Florida Power & Light
FPUA	Fort Pierce Utilities Authority
F.S.	Florida Statutes
FTE	full-time equivalent
FWC	Florida Fish and Wildlife Conservation Commission

GPD	gallons per day
GPM	gallons per minute
IFAS	Institute of Food and Agricultural Sciences
IRL	Indian River Lagoon
JSOC	Joint Statement of Commitment
LEC	Lower East Coast
LEC Plan	Lower East Coast Regional Water Supply Plan
MFL	minimum flow and level
MGD	million gallons per day
MIL	mobile irrigation laboratory
MODFLOW	MODular 3-dimensional finite-difference groundwater FLOW model
NA	Not Applicable
NGVD	National Geodetic Vertical Datum
NPBCCWMP	North Beach Palm County Comprehensive Water Management Plan
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
P2000	Preservation 2000
PIR	Project Implementation Report
PWS	public water supply
RO	reverse osmosis
RWSP	Regional Water Supply Plan
SAS	Surficial Aquifer System
SFWMD	South Florida Water Management District
SJRWMD	St. Johns River Water Management District
SRF	State Revolving Fund
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management
TAZ	Traffic Analysis Zone
TBD	To be determined
TDR	transfer of development rights
TMDL	total maximum daily load

UEC	Upper East Coast
UEC Plan	Upper East Coast Regional Water Supply Plan
UIC	Underground Injection Control
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDA–NRCS	U.S. Department of Agriculture, Natural Resources Conservation Service
USGS	United States Geological Survey
VEC	valued ecosystem component
WaterSIP	Water Savings Incentive Program
WCI	Water Conservation Initiative
WRAC	Water Resources Advisory Commission
WRDA	Water Resources Development Act
WSE	Water Supply and Environmental

CHAPTER 1
Introduction

The South Florida Water Management District (SFWMD or District) develops long-term comprehensive regional water supply plans to provide for current and future water use, while protecting south Florida's water resources. Chapter 373, Florida Statutes (F.S.), requires the District to prepare water supply plans for regions where projected water demands have the potential of outstripping available supply over the next 20 years during a 1-in-10 year drought condition. The SFWMD has committed to preparing water supply plans for each of its four planning areas (**Figure 1**), which cumulatively cover the entire District. Hydrologic divides or watershed boundaries of major surface water systems generally define these regions. The regional water supply plans are updated every five years.

The Upper East Coast (UEC) Planning Area consists of Martin and St. Lucie counties and eastern Okeechobee County. The first water supply plan for the UEC Planning Area was completed in 1998 (1998 Plan) and had a planning horizon of 2020. Overall, the 1998 Plan concluded that historically used sources of water, especially the Surficial Aquifer System in the coastal portions of the region, would not be sufficient to meet projected water demands during a 1-in-10 year drought condition. However, the 1998 Plan further concluded that with appropriate management and diversification of water supply sources, there is sufficient water to meet the needs of the region. The recommendations of the 1998 Plan are being realized, including increased use of the Floridan Aquifer and reclaimed water, and increased urban and agricultural water conservation. Progress is also being made on developing much needed surface water storage to address freshwater flows to the coastal resources in the region.

This 2004 UEC Water Supply Plan Update (2004 Update) is the first update to the 1998 Plan. The 2004 Update has a planning horizon of 2025. The UEC Planning Area continues to experience rapid growth in its urban area, while agricultural acreage is projected to decrease slightly from 2000 levels. Agricultural water demand, which accounts for 73 percent of the overall water demand in the planning area, is expected to decrease by approximately 7 percent through the planning horizon. At the same time, the region's population is projected to increase by 52 percent, from 320,000 to over 486,000. Overall water demand is projected to increase by 15 percent to 337 million gallons per day. These demands need to be met, while meeting the needs of the environment. Minimum flows and levels (MFLs) have been established for the St. Lucie River Estuary and the Northwest Fork of the Loxahatchee River and a restoration plan is being developed for the Loxahatchee River.

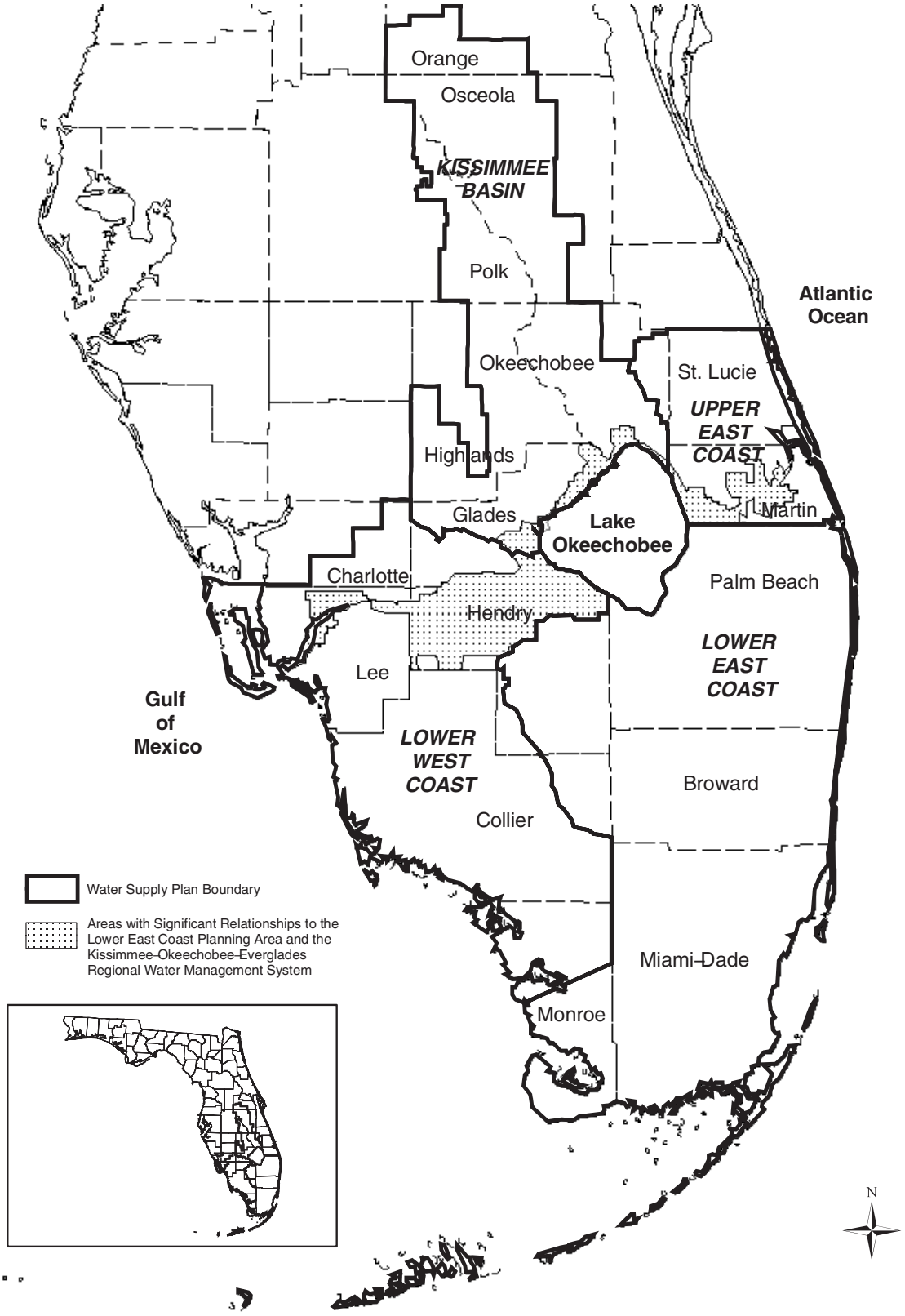


Figure 1. Planning Areas of the South Florida Water Management District.

Establishment of an initial water reservation for the Northwest Fork of Loxahatchee River has been initiated; and, the Indian River Lagoon – South Project Implementation Report presently indicates the District will adopt initial reservations of existing water for the protection of fish and wildlife for the St. Lucie River and southern Indian River Lagoon. Additionally, the District will reserve water made available by the CERP Indian River Lagoon – South Project for protection of fish and wildlife. This update will address urban, agricultural and environmental needs.

PURPOSE

The purpose of water supply planning is to develop strategies to meet future water demands of urban and agricultural uses, while meeting the needs of the environment. This process identifies areas where historically used sources of water will not be adequate to meet future demands, and evaluates several water source options to meet the deficit.

Legal Authority and Requirements

Water supply planning activities were first required of the state's water management districts following adoption of the *Florida Water Resources Act of 1972* (Chapter 373, Florida Statutes). The authors of "*A Model Water Code*" (Maloney *et al*., 1972), upon which much of Chapter 373 is based, theorized that proper water resource allocation could best be accomplished within a statewide, coordinated planning framework. The *State Water Use Plan* and the *State Water Policy* were the primary documents formulated to meet this objective.

With the passage of subsequent legislative amendments, the Legislature eliminated the State Water Use Plan and called for the development of the Florida Water Plan. The Florida Water Plan is required to include the Water Resource Implementation Rule (formerly known as the State Water Policy) and District Water Management Plans (DWMPs).

The Water Resource Implementation Rule (Chapter 62-40, F.A.C.) sets forth goals, objectives and guidance for the development and review of water resource programs, rules and plans. These directives are prescribed in the Water Resources Act (Chapter 373, F.S.), the *Florida Air and Water Pollution Control Act* (Chapter 403, F.S.) and the *State Comprehensive Plan* (Chapter 187, F.S.). These statutes provide the basic authorities, directives and policies for statewide water management, pollution control and environmental protection. The current legal framework for water supply planning is shown in **Figure 2**. The history of water supply planning is included in the *DRAFT Consolidated Water Supply Plan Support Document.*

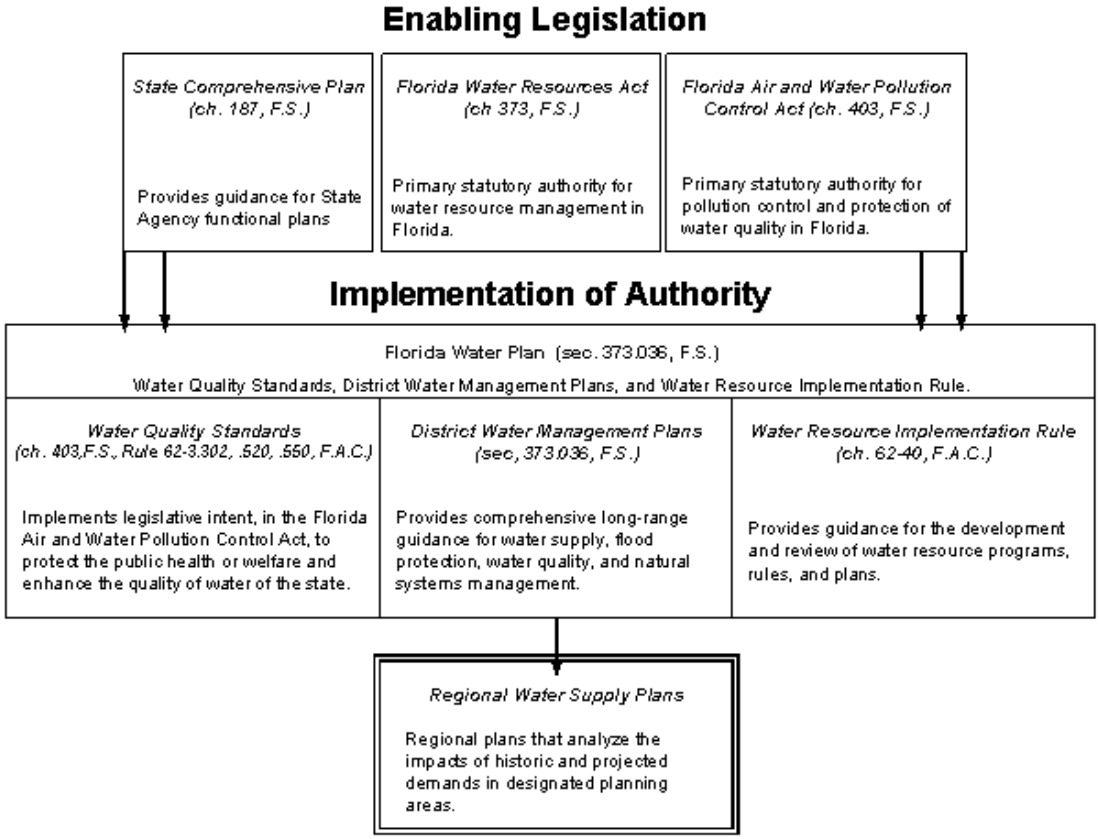


Figure 2. Legal Framework for Water Supply Planning.

The 1997 Legislature adopted more specific legislation concerning the role of the water management districts in water resource and water supply planning and development. The legislative intent was to provide for current and future human and environmental demands for a 20-year planning horizon.

Regional Water Supply Plans

Regional water supply plans provide more detailed, region-specific information than the water supply assessments. Analyses are conducted within each regional water supply plan that evaluates the impacts of projected demands on available water resources and water resource related natural systems. If projected impacts are more severe than a pre-defined threshold, recommendations are made to increase the availability of additional water resources until the impacts are reduced below the threshold.

Each regional water supply plan is based on at least a 20-year future planning horizon and includes, but is not limited to the following components as stated in Subsection 373.0361(1), F.S.:

- A water supply development component.
- A water resource development component.
- A recovery and prevention strategy for addressing attainment and maintenance of MFLs in priority water bodies.
- A funding strategy for water resource development projects that shall be reasonable and sufficient to pay the cost of constructing or implementing all of the listed projects.
- Consideration of how the options addressed serve the public interest or save costs overall by preventing the loss of natural resources or avoiding greater future public expenditures for water resource development or water supply development (unless adopted by rule, these considerations do not constitute final agency action).
- The technical data and information applicable to the planning area that are contained in the DWMP (SFWMD, 2000a) and necessary to support the regional water supply plans.
- The MFLs established for water resources within the planning area.

PLAN GOALS AND OBJECTIVES

The following goal and objectives for this 2004 Update are presented to guide development of the water supply plan to ensure the water needs of this region will be met through 2025. The goal and objectives of the 1998 Plan were used as a starting point. They were reviewed and modified as appropriate.

Overall Water Supply Planning Goal

The overall goal in water supply plans is derived from the *State Comprehensive Plan*:

> Florida shall assure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial and shall maintain the functions of natural systems and the overall present level of surface and groundwater quality. Florida shall improve and restore the quality of waters not presently meeting water quality standards.

Plan Goal

The water resource goal of the state was incorporated into the goal for this Plan:

> Identify sufficient sources of water and funding to meet the needs of all reasonable-beneficial uses within the Upper East Coast Planning Area for the year 2025 during a drought event that has the probability of occurring no more frequently than once every 10 years, while sustaining the water resources and related natural systems.

Plan Objectives

The following regional objectives (no implied priority) were developed to ensure the Upper East Coast Water Supply Plan addresses the specific needs of the planning area:

Water Supply: Identify sufficient sources of water to meet projected 2025 water demands during a 1-in-10 year drought event, without causing harm to natural resources.

Conservation and Alternative Source Development: Increase levels of conservation to increase the efficiency of water use; and, increase the use of alternatives sources to reduce dependency on drought susceptible water sources.

Floridan Aquifer: Encourage development of the Floridan Aquifer as an option to sources that depend on local rainfall for recharge. Establish a monitoring program to collect data to better understand the relationship between water use, water levels and water quality.

Estuarine and Riverine Systems: Protect and enhance the Loxahatchee River, the St. Lucie River and Estuary and the Indian River Lagoon through effective water deliveries and management of the water resources.

Water Resource Protection: Protect wetland systems and the water resources from harm due to water use, including drawdowns and harmful movement of saline water.

Compatibility with Local Governments: Coordinate the UEC Water Supply Plan with the water supply related elements of local government.

Other Regional Planning Efforts: Achieve compatibility with other related regional water resource planning efforts. These include the Indian River Lagoon (IRL) Surface Water Improvement and Management (SWIM) Plan, Comprehensive Everglades Restoration Plan (CERP), CERP IRL – South Project, CERP North Palm Beach County Project Part 1, Lake Okeechobee SWIM Plan, Lower East Coast and Kissimmee Basin Water Supply Plans, IRL National Estuary Program Comprehensive Conservation and Management Plan, St. Johns River Water Management District (SJRWMD) Districtwide Water Supply Assessment and Northern Palm Beach County Comprehensive Water Management Plan.

PLANNING PROCESS

The planning process for development of the 2004 Update included comprehensive public participation, coordination with local governments and other agencies, review of previous planning efforts in the region, documentation of activities that have taken place since approval of the 1998 Plan, development of 2025 demand projections, comparison of the 2025 scenario for the 2004 Update with the 2020 scenario simulated in the 1998 Plan and development of an analysis approach for the 2004 Update. Public participation was ongoing throughout the planning process. The goals and objectives of this Plan were developed by staff and the public, and provide the overall framework for the planning process.

Public Participation

Public participation in development of the 2004 Update was provided through the District's Water Resources Advisory Commission (WRAC). The SFWMD Governing Board established the WRAC in March 2001 as an advisory body to the Governing Board to provide a forum for improving public participation and decision-making on water resource issues affecting south Florida. The WRAC includes members from various interests (e.g., environmental, urban and agricultural) throughout the District. The WRAC meetings were open to the public.

The SFWMD held seven UEC Water Supply Plan WRAC Regional Workshops in the planning area from May 2003 through June 2004 to receive public input in development of this Plan. The workshops were well attended by stakeholders representing a cross-section of user groups in the region including utilities, local government planning departments, various local, state and federal agencies, elected officials, agriculture and the environment. In addition, demand projections were provided to industry experts for review and comment, and some industry experts made presentations during the workshops. Meetings were also held with local government planning departments and utilities to discuss these projections and coordinate land and water planning processes. Presentations were also made to local government elected bodies on the Plan and its conclusions.

Coordination with Adjacent Districts

The UEC Planning Area's northern boundary is the St. Lucie – Indian River County line, which is also the boundary between the SFWMD and the SJRWMD. Coordination with the SJRWMD was ongoing through out the water supply planning process. Representatives of the SJRWMD attended a majority of the regional water supply workshops. Coordination also occurred through Water Planning Coordination Group meetings, where staff from neighboring water management districts and the Florida Department of Environmental Protection (FDEP) discussed methodologies for

demand projections, outlines and schedules for regional water supply plans, conservation and reuse. The objective of these meetings was to achieve consistency in water supply planning among the water management districts.

Relationship to Districtwide Water Supply Assessment

In 1997, water supply planning requirements were incorporated into Chapter 373, F.S. The statutory changes required each water management district to prepare a Districtwide Water Supply Assessment (DWSA) that identify areas that have the potential for demands to exceed available supplies (without causing unacceptable environmental impacts) over a 20-year future time horizon. For each of these areas, the SFWMD is required to prepare regional water supply plans. The SFWMD's *1998 Districtwide Water Supply Assessment* (SFWMD, 1998a) confirmed the District's decision to prepare water supply plans that cumulatively cover the entire SFWMD.

The DWSA demand projections were updated in 2003 and provided the updated water demand assessments for 2000 and projections through 2025 for all categories of water use for this Plan Update. An update to the DWSA was not published. The updated projections are presented in the regional water supply plan for each region. The SFWMD develops regional water supply plans for the four regions within the District.

UEC Boundary Changes

The District made minimum changes to the UEC Planning Area boundary in the 1998 DWSA and the boundary used in the 1998 Plan. Boundary changes were made to more accurately reflect the way analyses were made (by county). This involved transferring small areas of Martin and St. Lucie counties from the Kissimmee Basin to the UEC Planning Area. This reduced the number of counties split between the two planning regions from three to one. As a result, all of Martin and St. Lucie counties are located within the UEC Planning Area.

PLANNING AREA DESCRIPTION

The Upper East Coast is one of four regional planning areas in the SFWMD. The planning area covers 1,230 square miles and includes all of Martin and St. Lucie counties, and a small portion of Okeechobee County (**Figure 3**). The planning area generally reflects the watersheds of the C-23, C-24, C-25 and C-44 canals. This Plan also considers the water needs of the Loxahatchee River and the associated watershed, which lies partially within Martin County. There is a transition in land use within the region from urban in the east to agricultural in the west. The predominant land use has been and is predicted to be agriculture. Citrus is by far the dominant crop in the planning area and occupies over four-fifths of the irrigated agricultural acreage in the region. Interspersed with these land uses are about 200,000 acres of upland forests and wetlands.

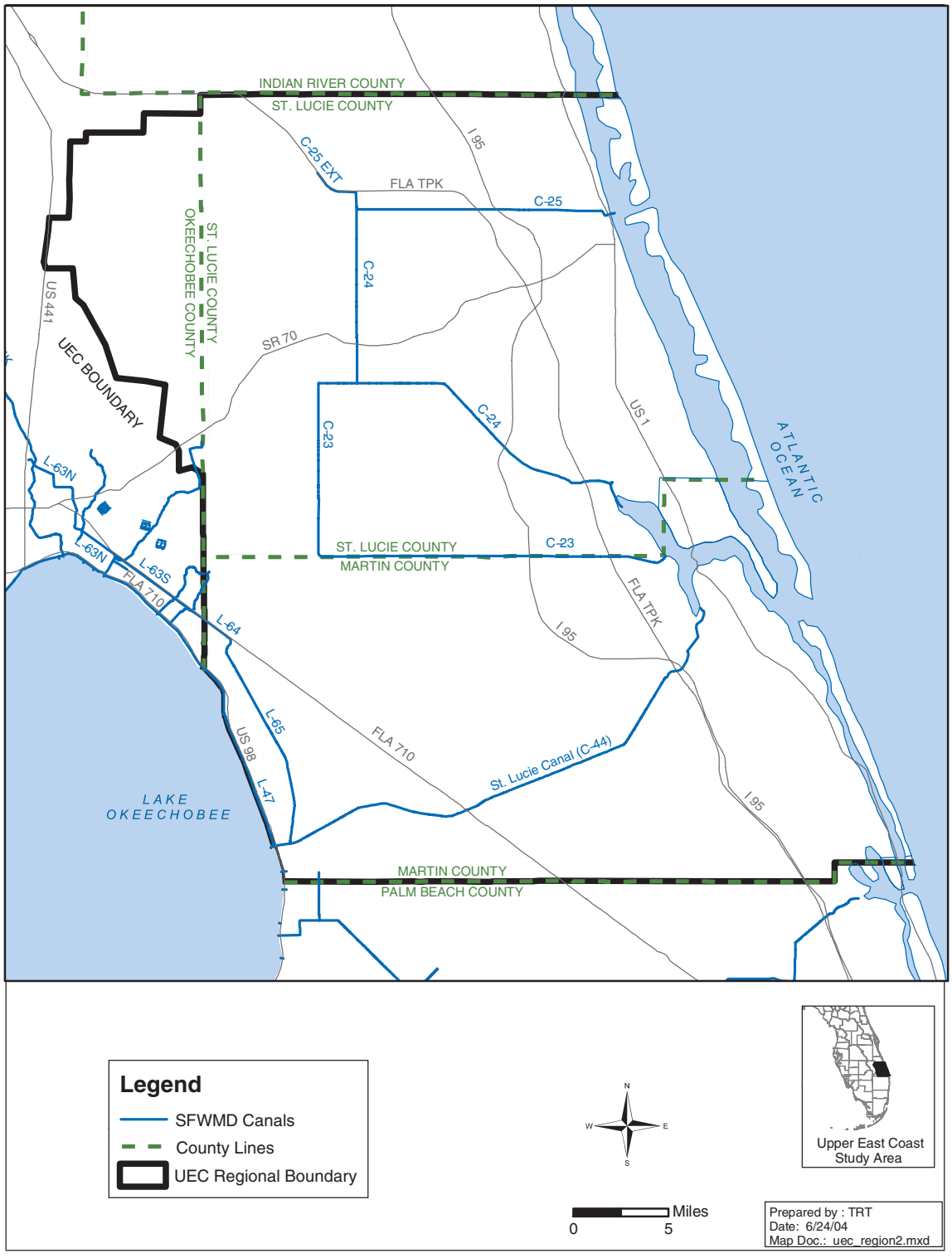


Figure 3. Upper East Coast Planning Area.

The 2000 Census (U.S. Bureau of the Census, 2001) showed St. Lucie County to have 192,695 residents and Martin County to have a population of 126,731. The Okeechobee Area (the portion of the county within the UEC) was assessed as 1,238. Port St. Lucie was the most populous city in the UEC Planning Area, with 90,500 residents in 2000. In 2000, there was approximately 186,000 acres of irrigated agriculture in the planning area.

Water for urban and agricultural uses in the UEC Planning Area comes from three main sources: the Floridan Aquifer System (FAS), the Surficial Aquifer System (SAS) and surface water. Surface water from the C-23, C-24, C-25 and C-44 canals is used primarily for agricultural irrigation, with the FAS used as a backup source during periods of low rainfall. The SAS has been the principal source for public water supply and urban irrigation. Withdrawals from the SAS have been maximized along the coast and alternative water supplies are being developed to meet the growing water needs. These include the FAS as a source of drinking water and reclaimed water for irrigation water.

The SAS and surface water are dependent upon rainfall for recharge. The average annual rainfall in the UEC Planning Area is about 55 inches. Over 70 percent of this occurs during the wet season months, from June through October. In addition to seasonal variation, rainfall varies significantly from year to year with historic annual amounts ranging from 30 inches to over 90 inches in the planning area. Rainfall also varies areally, with rainfall amounts generally decreasing from east to west.

There are four primary drainage canals in the UEC Planning Area that are part of the Central and Southern Florida Flood Control Project. These canals (C-23, C-24, C-25 and C-44) have also become important sources of irrigation water within their respective drainage basins.

The C-44 Canal was constructed as a navigable flood control outlet for Lake Okeechobee. The C-44 is the only one of the four canals that receives inflow from outside its drainage basin. The C-23, C-24 and C-25 canals, by contrast, are solely dependent on rainfall as a source of inflow. As a result of the large demand for this limited surface water supply, there are prohibitions for any new or expanded water supply uses of these three canals.

Major natural systems within the UEC Planning Area consist of inland and coastal resources and include Lake Okeechobee, Indian River Lagoon, St. Lucie River and Estuary, portions of the Loxahatchee River, the Savannas, Pal-Mar, Jonathan Dickinson State Park and DuPuis Reserve.

Dupuis Reserve

ACCOMPLISHMENTS

The 1998 Plan recommendations were organized under five water source options. The water source options and recommendations were developed to resolve water supply issues, which were identified in the analyses conducted in the planning process. These issues included surface water availability, Floridan Aquifer water quality, limits on Surficial Aquifer expansion, discharges to the St. Lucie Estuary and Indian River Lagoon and saltwater intrusion vulnerability.

In moving from issue identification to solution development, several water source options were considered to address the water supply issues identified. Eight water source options were initially identified to consider in the UEC Planning Area. These options make additional water available, either from the same source or other sources (e.g., the Floridan Aquifer) or they reduce demand (e.g., conservation). The eight options are (in no implied priority):

- Surface water storage.
- Aquifer storage and recovery (ASR).
- Floridan Aquifer.
- Surficial Aquifer System wellfield expansion.
- Conservation.
- Wastewater reuse.
- Utility interconnects.
- Ocean water.

Development of each of these options had regional, as well as local responsibilities. The water source options and the responsibilities at the regional and local levels were discussed in Chapter 5 of the 1998 Plan.

The 1998 Plan contained 30 recommendations. These recommendations and associated implementation status are presented in **Table 1**. They are organized by the water source option listed in the aforementioned bullet list. Each recommendation was numbered according to its associated water source option. There were no recommendations developed for SAS wellfield expansion or ocean water.

Table 1. Implementation of 1998 Plan Recommendations.

Recommendation	Progress
Surface Water Storage 1.1 Complete the Indian River Lagoon Restoration Feasibility Study – The primary focus of the Feasibility Study is environmental restoration of the St. Lucie Estuary (SLE) and Indian River Lagoon (IRL).	The final Project Implementation Report (PIR) Public Notice was signed by the U.S. Army Corps of Engineers (USACE) in Atlanta in March 2004. The Plan will be submitted to the USACE Headquarters in Washington, D.C. for final review. The goal is to seek project authorization and funding in the *Water Resources Development Act of 2004 (*WRDA 2004).
1.2 Identify, design and construct other regional attenuation facilities.	The need for additional regional attenuation facilities has not been identified outside of the CERP. Additional storage needs could be identified through adaptive management processes including Restoration Coordination and Verification (RECOVER).
1.3 Support design and construction of the Ten Mile Creek Critical Restoration Project.	Construction of the Ten Mile Creek Critical Restoration Project began in November 2003 and will be completed in 2005.
1.4 Develop and adopt a minimum flow and level for the St. Lucie Estuary.	The MFL for the St. Lucie River and Estuary was established in 2002.
1.5 The District will evaluate increasing conveyance in the C-canals [C-23].	Three of four phases of deposition removal in the C-23 Canal have completed covering over 21 miles. The last section is being survey to determine the amount of deposition to determine if removal is necessary.
Aquifer Storage and Recovery 2.1 Colocation of ASR and Surface Water. 2.2 Water Quality Data for Surface Water ASR. 2.3 Reactivate Demo Project for Lake Okeechobee. 2.4 Rulemaking for Untreated Water ASR. 2.5 Rulemaking for Conflicts of ASR and the Floridan Aquifer. 2.6 Inject Surface Water into Floridan Aquifer. 2.7 Inject Surface Water Along Coast.	Four of these recommendations were addressed in development of the CERP IRL – South Feasibility Study. Aquifer storage and recovery was not identified as a component in the recommended plan. Rules related to ASR were incorporated into the Water Use Basis of Review in 2003. In addition, the District initiated a major study in 2001 to evaluate the fate of microorganisms in the aquifers related to ASR.
Floridan Aquifer System 3.1 The District will remove the Floridan Aquifer from MFL priority list.	The Floridan Aquifer was removed from the MFL priority list in 1997.
3.2 The District will develop and implement a comprehensive regional aquifer monitoring network to collect the necessary information to develop relationships between water use, water quality and water levels.	A comprehensive Floridan Aquifer monitoring well network was established in 2000 in the UEC Planning Area. It built upon two existing networks operated by the SFWMD and the U.S. Department of Agriculture – Natural Resources Conservation Service (USDA–NRCS). The network is described in the appendices of this Plan.

Table 1. Implementation of 1998 Plan Recommendations (Continued).

3.3 The District will develop options for a volunteer or incentive-based Floridan well abandonment program.	Since 1998, over 40 Floridan wells have been decommissioned with funds from a District cost-share program with the USDA–NRCS.
3.4 The District will work with the FDEP and EPA to explore alternative desalination disposal options.	The District participated in a workshop in 1999 with the St. Johns River Water Management District, FDEP and EPA concerning options for disposal of concentrate from desalination treatment facilities. There has been no significant progress made on reclassifying concentrate.
3.5 The District will evaluate Floridan Aquifer recharge areas (in central Florida and outside the planning area) and identify activities, if any that could have a resulting negative effect on the Floridan Aquifer in the UEC Planning Area.	Activities in the Floridan Aquifer recharge areas in central Florida have been studied in the Kissimmee Basin Water Supply Plan. The SFWMD analyses show that activities in central Florida would have minimal impacts, if any, on the Floridan Aquifer in the UEC Planning Area.
Conservation 4.1 The District will promote water conservation for all users of water through, but not limited to, fiscal incentives, such as the Alternative Water Supply Funding Program.	The District provides funding assistance to water users for development of alternative water supplies and water conservation through two cost-share programs: Alternative Water Supply Funding Program. The District has provided about $3.1 million for 19 alternative water supply projects in the UEC Planning Area between 1998 and 2004. These projects produce over 32 million gallons per day (MGD) of additional water supply. Water Savings Incentive Program (WaterSIP). Water SIP was established by the District in 2002 to provide cost-share funding for the implementation of water saving projects that reduce urban water usage. In two years, this program has provided $700,000 for 19 projects Districtwide. No projects in the UEC Planning Area have been submitted for consideration of funding. Citrus Irrigation Conversion Program (District cost-share program with USDA–NRCS): From 1998 through 2002, 2,200 acres of citrus were converted from flood irrigation to microirrigation under this program. This saved 1.34 billion gallons in the Upper East Coast over that five-year period.[a]

a. D. Smith. 2003. U.S. Department of Agriculture, Natural Resources Conservation Service (USDA–NRCS), Fort Pierce, FL.
b. M. Rosen. 2003, Mobile Irrigation Lab Program Manager, South Florida Water Management District, West Palm Beach, FL.

Table 1. Implementation of 1998 Plan Recommendations (Continued).

4.2 Provide cost-share funding for mobile irrigation laboratories.	Two urban mobile irrigation labs (MILs) and one agricultural MIL are operating in the UEC Planning Area. The urban labs are funded by the District and perform urban evaluations in Martin and St. Lucie counties. The USDA–NRCS continues to operate the agricultural lab in Martin, Okeechobee and St. Lucie counties. The efforts of the urban and agricultural MILs are estimated to have resulted in an 8.3-MGD savings from 1998–2002.[b]
Wastewater Reuse 5.1 The District will develop regulatory and fiscal incentives, such as the Alternative Water Supply Funding Program, for reuse in the UEC Planning Area.	Regulatory incentives, including 20-year permits, were addressed in the water use rule revisions in 2003. The Alternative Water Supply Funding Program has funded eight water reuse projects in the UEC Planning Area from 1998–2004. These projects produce almost 7 MGD of additional water supply.
5.2 The District will encourage utilities to evaluate reclaimed water system interconnects to increase reuse in potential problem areas.	The District has continued to encourage reclaimed water interconnects. Martin County Utilities (MCU) is constructing a consolidated reuse system that will result in an interconnected and regionalized reclaimed water distribution system.
5.3 The District will adopt rules implementing the requirements of Section 373.250, F.S. related to wastewater reuse and back-up sources.	Water use rule revisions were completed in 2003.
5.4 The District will provide assistance for reclaimed water projects that involve groundwater recharge and indirect potable reuse, and will assume the lead role for such projects that are of regional significance.	Staff has worked with utilities to identify opportunities for groundwater recharge and indirect potable reuse. However, there has been no interest by the utilities. The utilities in this region are pursuing irrigation based reuse systems.
5.5 The District will discuss with the FDEP, and participate in rulemaking, standards for reclaimed water quality for groundwater recharge, indirect potable reuse projects and wet weather disposal.	The District continues to participate on the Statewide Reuse Coordinating Committee to discuss statewide reuse issues.
Utility Interconnects 6.1 The District will encourage potable water interconnections between utilities for emergency purposes and evaluation of interconnections for water supply purposes.	The District has continued to encourage water interconnects. Martin County Utilities (MCU) is developing a consolidated system, interconnecting their four water distribution systems.

a. D. Smith. 2003. U.S. Department of Agriculture, Natural Resources Conservation Service (USDA–NRCS), Fort Pierce, FL.
b. M. Rosen. 2003, Mobile Irrigation Lab Program Manager, South Florida Water Management District, West Palm Beach, FL.

Table 1. Implementation of 1998 Plan Recommendations (Continued).

Related Implementation Strategies	
7.1 The District will incorporate the assumptions and criteria used in development and findings of the UEC Water Supply Plan into the District's Consumptive Use Permitting Program, including any rulemaking, including: a uniform level of drought; the resource protection criteria used in the 1998 Plan; a cumulative analysis to deal with local conditions and new technologies; and development and adoption of appropriate water shortage triggers for resource protection.	Water use rule revisions were completed in 2003 that addressed this recommendation.
7.2 The District will continue coordination of the UEC Water Supply Plan with local governments/utilities, the SJRWMD and the CERP.	The 1998 UEC Water Supply Plan continues to be coordinated with related planning efforts, local governments/utilities and the SJRWMD.
7.3 Continue the ongoing SFWMD wetland drawdown study.	The District completed its wetland drawdown study that implemented hydrobiological monitoring at various wetland sites throughout the District to determine the effects of groundwater drawdowns on these systems. Several sites in the UEC Planning Area were included in the Study. The results of the Study were used to support water use rule revisions in 2003.
7.4 Wetland mitigation associated with projects in the UEC Planning Area should remain in the region. Additionally, it is recommended that a mitigation bank be established in the UEC Planning Area.	There have been four mitigation banks in the UEC Planning Area permitted since 1998. Three are in St. Lucie County (Treasure Coast, Platt's Creek and Bluefield Ranch), while the other one is in Martin County (RG Reserve).
7.5 The District should fund implementation of the UEC Water Supply Plan.	As shown here, the 1998 UEC Water Supply Plan has been successfully implemented.

CHAPTER 2
Demand Estimates and Projections

Demand estimates for 2000 and projections for 2025 were made for six categories of water use. The category of *Public Water Supply* refers to all potable water supplied by water treatment facilities reporting average pumpages greater than 100,000 gallons per day (GPD) to all types of customers, not just residential. The other five categories of water use are self-supplied. *Commercial and Industrial* refers to self-supplied business operations using 100,000 GPD (0.1 MGD) or more. *Recreational Self-Supply* includes landscape and golf course irrigation demand. The landscape subcategory includes water used for parks, cemeteries and other self-supplied irrigation applications with demands greater than 100,000 GPD. The golf course subcategory includes those operations using groundwater or surface water, but not those using reclaimed water. The *Domestic Self-Supply* category includes only those households whose primary sources of water are private wells. *Thermoelectric Power Generation Self-Supply* water refers to replacement water for losses from cooling water at electrical plants; this does not include facilities using ocean water for cooling. *Agriculture* includes water used to irrigate all crops, and for cattle watering. The water needs of the environment are also explained in this chapter.

For 2000, the total assessed water demand for the Upper East Coast (UEC) Planning Area was approximately 292 million gallons per day (MGD), and this is projected to grow to 337 MGD by 2025 (**Figure 4**).

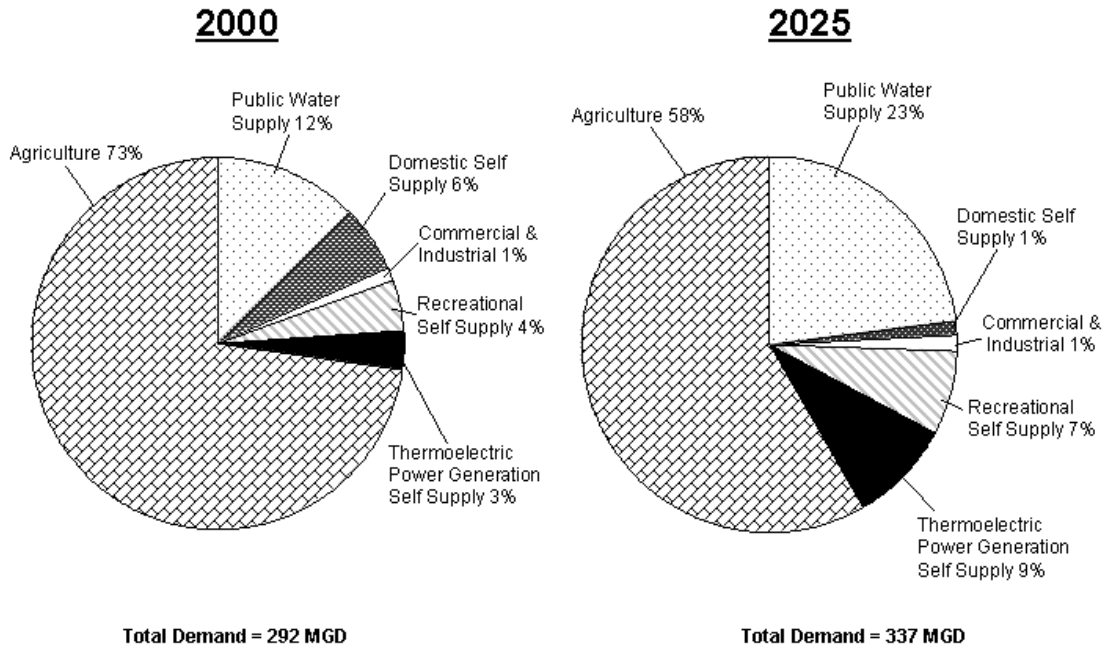


Figure 4. Overall Water Demands for 2000 and 2025 in the UEC Planning Area.

Conservation levels beyond current industry practices were not considered in this phase of the water supply plan, but are dealt with as part of the water source option analysis.

From 2000 to 2025, the total water demand is projected to increase by 15 percent, from 292 to 337 MGD, as shown in **Table 2**. Public water supply has the largest projected increase of 113 percent, while agricultural demand is projected to decline by 7 percent. However, agricultural water demand is projected to remain the single largest category of use. In 2000, agriculture accounted for 73 percent of the total demand, and a slight projected decline in agricultural demands combined with projected increases in urban use results in projected agricultural use declining to 58 percent of the total demand by 2025; this does not include lands coming out of citrus production related to implementation of the Comprehensive Everglades Restoration Plan (CERP). Public water supply demands are projected to increase from 12 percent to 23 percent of the overall water demands.

Table 2. Overall Water Demands for 2000 and 2025 (MGD).

Category	Estimated Demands 2000 (MGD)	Projected Demands 2025 (MGD)	Percent Change 2000–2025
Agriculture[a]	212.8	197.1	-7%
Public Water Supply	36.5	77.8	113%
Domestic Self-Supply	17.0	3.7	-78%
Commercial & Industrial Self-Supply	3.3	4.9	50%
Recreational Self-Supply	12.8	23.8	86%
Thermoelectric Power Generation Self-Supply	9.8	30.0	206%
Total	292.2	337.3	15%

a. Agricultural demand projections do not include approximately 23,000 acres of citrus land coming out of irrigated citrus production with implementation of the CERP.

URBAN WATER DEMAND

Urban water demand includes: 1) public water supply provided by utilities; 2) domestic self-supply; 3) commercial and industrial self-supply; 4) recreational self-supply; and 5) thermoelectric power generation self-supply. Public water supply was the largest component of urban water demand in 2000 (46 percent), followed by domestic self-supply (21 percent), recreational self-supply (16 percent), thermoelectric power generation self-supply (12 percent) and commercial and industrial self-supply (4 percent). Urban water demand in the UEC Planning Area in 2000 was estimated to be approximately 79 MGD and is projected to increase to about 140 MGD in 2025.

The driving force behind urban demand is population. Population numbers for 2000 were taken from the U.S. Bureau of the Census. Population projections for the year 2025 were obtained from the University of Florida Bureau of Economic and Business Research (BEBR, 2002), and are shown in **Table 3**. The total population of the planning area for 2000 was 320,664 and is projected to increase by 52 percent to 486,510 in 2025.

Table 3. Population in the UEC Planning Area, 2000–2025.

County	2000			2025		
	Total	Public Water Supply	Domestic Self-Supply	Total	Public Water Supply	Domestic Self-Supply
St. Lucie County	192,695	129,904	62,791	297,400	290,012	7,388
Martin County	126,731	88,300	38,431	187,500	175,243	12,257
Okeechobee Area	1,238	0	1,238	1,610	0	1,610
Total Planning Area	320,664	218,204	102,460	486,510	465,255	21,255

Source: U.S. Bureau of the Census, 2001 and University of Florida Bureau of Economic and Business Research, 2002.

Public Water Supply and Domestic Self-Supply

The estimated water demand for public water supply (PWS) and domestic self-supply (DSS) users in the UEC Planning Area was 54 MGD in 2000. These water demands are projected to increase by 52 percent from 2000 to 2025 to a total water demand of 82 MGD (**Table 4**). The DSS category includes: residents not living within areas served by utilities; residents living within areas served by utilities, but who are not connected to a utility; and residents served by utilities with historical or projected demands of less than 100,000 GPD (0.1 MGD). About 32 percent of the 2000 population was self-supplied and this is projected to decline to 4 percent by 2025, as self-supplied residents connect to regional utilities, and as future growth is connected to PWS systems. More specific information on utility service area populations and water demands, as well as the methodology used to develop these values is provided in Appendix A.

Table 4. Public Water Supply and Domestic Self-Supplied Demand (MGD).

County	2000		2025	
	Public Water Supply	Domestic Self-Supply	Public Water Supply	Domestic Self-Supply
St. Lucie County	17.7	8.7	42.0	1.0
Martin County	18.8	8.2	35.8	2.5
Okeechobee Area	0.0	0.1	0.0	0.2
Total	36.5	17.0	77.8	3.7

Commercial and Industrial Self-Supply

This category includes self-supplied commercial and industrial demands (**Table 5**). Commercial and industrial demands supplied by public utilities are included with PWS demands. The projection methodology for commercial and industrial self-supply demand is discussed in Appendix A.

Table 5. Commercial and Industrial Self-Supplied Demand (MGD).

County	2000	2025
St. Lucie County	0.1	0.2
Martin County	3.2	4.7
Total	3.3	4.9

Recreational Self-Supply

Recreational demands supplied by PWS utilities are included in the PWS demands. Recreational self-supply demands include demands for landscape and golf course irrigation. Golf course irrigation is the highest recreational water use.

Landscape

Demand projections for this section include irrigated acreage permitted for landscaping and recreation in St. Lucie and Martin counties (**Table 6**), excluding golf courses. In 2000, there were 1,716 acres of irrigated landscape in St. Lucie County, and 1,314 acres in Martin County in the self-supplied, greater than 100,000 GPD category. Projection methodology is discussed in Appendix A.

Table 6. Landscape Self-Supplied Demand (MGD).

County	2000	2025
St. Lucie County	3.2	5.0
Martin County	2.3	3.4
Total	5.5	8.4

Golf Course

Golf Course – St. Lucie County

In 2000, there were 22 golf courses in St. Lucie County (2,497 self-supplied irrigated acres) and 40 golf courses in Martin County (4,104 self-supplied irrigated acres). Golf course demands in the UEC Planning Area are projected to increase from 7.4 MGD in 2000 to 15.6 MGD in 2025 (**Table 7**). Descriptions of the golf courses in St. Lucie and Martin counties, projection methodology, and the self-supplied calculation of irrigation requirements are provided in Appendix A. There are no golf courses in the portion of Okeechobee County within the UEC Planning Area.

Table 7. Golf Course Self-Supplied Demand (MGD).

County	2000	2025
St. Lucie County	3.3	7.0
Martin County	4.1	8.6
Total	7.4	15.6

The sum of the Landscape demands (**Table 6**) and the Golf Course demands (**Table 7**); yield the total recreational self-supplied demands, which are presented in **Table 8**.

Table 8. Recreational Self-Supplied Demand (MGD).

County	2000	2025
St. Lucie County	6.5	12.0
Martin County	6.4	12.0
Total	12.9	24.0

Thermoelectric Power Generation Self-Supply

Thermoelectric power plants may withdraw very large quantities of water for cooling purposes. The vast majority of this water is not consumed, in the sense that the same water may pass through the plant repeatedly, sequentially circulating through a series of ponds. There will, however, be some evaporative losses (mostly related to the heated water being kept in cooling ponds) that must be replaced from an external source beyond rainfall and runoff. This replacement was assessed at 9.8 MGD for 2000 and projected to grow to 30.0 MGD by 2025. This category does not include facilities that use ocean water for cooling.

AGRICULTURAL WATER DEMAND

There are eight categories of agricultural water demand analyzed in this section: 1) citrus; 2) vegetables, melons and berries; 3) field crops (sugarcane); 4) sod; 5) greenhouse/nursery; 6) improved pasture; and 7) miscellaneous (cattle watering). Agricultural water demand was estimated for 2000 to be approximately 213 MGD. Citrus was by far the largest 2000 agricultural water demand (77 percent) and is followed by sugarcane and improved pasture (9 percent each). Vegetables, sod, cut flowers, ornamental nurseries and cattle watering, combined, account for about 5 percent of the total agricultural demand.

Agricultural water demand is forecast to decrease by 7 percent to about 197 MGD in the year 2025. Water demands for citrus irrigation is projected to decrease by 2025, while ornamental nursery demands increase, and other crop demands remain relatively constant. Descriptions of the agricultural acreage in each county, projection methodology and the calculation of irrigation requirements, including data sources, are detailed in Appendix A.

Table 9 shows the historical (2000) and projected (2025) acreages of the different categories of agricultural self-supplied demand in the UEC Planning Area, as well as annual average agricultural irrigation demand by crop. These estimates do not include the irrigated agriculture that may come out of production related to implementation of the CERP (estimated to be approximately 23,000 acres of citrus).

Table 9. Agricultural Water Demand (MGD) and Irrigated Acreage by Crop.

Category	Estimated Demands 2000 (MGD)	Total Irrigated Acreage 2000	Projected Demands 2025 (MGD)	Total Irrigated Acreage 2025	% Change in Demands 2000–2025
Citrus	164.5	149,513	148.1	134,509	-9%
Vegetables	3.6	2,970	3.6	2,970	0%
Sugarcane	19.4	12,478	19.4	12,478	0%
Sod	2.7	960	2.7	960	0%
Greenhouse/Nursery	1.9	942	2.5	1,269	32%
Improved Pasture	18.4	19,000	18.4	19,000	0%
Cattle Watering	2.4	---	2.4	---	0%
Total Planning Area	212.8	185,863	197.1	171,186	-8%

ENVIRONMENTAL WATER SUPPLY

The approach to identifying water supply needs for the environment in this Plan differs from that of urban and agricultural water supply, which are defined based on population and irrigated acreage, respectively. Environmental water supply, primarily wetlands and coastal resources, is provided through resource protection criteria designed to maintain appropriate wetland hydrology and flow regimes, maintaining appropriate water quality in downstream receiving water bodies.

For inland wetland systems, water supply is provided through the use of resource protection criteria designed to prevent harmful drawdowns under wetlands. Maintaining appropriate wetland hydrology (water levels and hydroperiod) is the most critical factor in maintaining a viable wetland ecosystem. Rainfall, along with associated groundwater and surface water inflows, is the primary source of water for the majority of wetlands in the planning area. See Chapter 2 of the *DRAFT Consolidated Water Supply Plan Support Document* and **Chapter 3** of this document for additional information on wetland protection and the water supply needs of inland wetland systems.

For coastal resources, maintenance of appropriate freshwater inflows is essential for a healthy estuarine system. Flow regimes are typically defined in terms of total mean monthly inflows and a suitable range of acceptable minimum and maximum flow rates. Excessive changes in freshwater inflows to the estuary result in imbalances beyond the tolerances of estuarine organisms. The retention of water within upland basins for water supply purposes will provide management of inflows into coastal resources. Flow regimes for coastal resources in the UEC Planning Area will be determined when developing restoration and operation plans associated with construction of proposed storage facilities. See Chapter 2 and Chapter 7 of the *DRAFT Consolidated Water Supply Plan Support Document* and **Chapter 3** of this document for additional information regarding water needs of coastal resources in the planning area.

DEMAND METHODOLOGY

Public Water Supply and Domestic Self-Supply

The urban demand assessment for public water supplied and domestic self-supplied population involved an intensive geographic information system analysis using population data from the U.S. Bureau of the Census and the University of Florida Bureau of Economic and Business Research (BEBR).

For the PWS and DSS assessment, overlaying Census data on utility served area boundaries assessed populations residing within areas served by utilities. The next step involved determining water use rates in the utility served area boundaries using per capita

water use. Per capita water use rates were assessed using the 2000 water withdrawals for each utility reported by the U.S. Geological Survey (USGS) and dividing that number by the 2000 population determined to be in each utility served area. The resulting 2000 per capita water use rates were held constant to project 2025 water demand. Populations in each Census block were projected to grow proportionally with the relevant growth rates specified by the county's Traffic Analysis Zone analysis, up to the county population control total of the BEBR medium population projections (BEBR, 2002). The anticipated 2025 utility served boundaries were then superimposed on the 2025 population data, assigning projected populations to utilities, and then each utility's 2000 per capita rate was applied to yield projected demands for utilities.

The current plan relied on DSS data from the 1998 Plan for overlay with 2000 Census data. The previous plan had access to 1990 Census data that included "source of water" on the Census long-form questionnaire. This item was removed from the 2000 Census long-form questionnaire. The current plan, therefore, used the DSS data from the previous plan, where the same utilities existed. Where new utilities were added to the assessment, the 1990 Census data were overlaid onto the 2000 utility area boundaries for an approximation of self-supplied population. Population in small utilities with pumpages greater than the 100,000 GPD PWS threshold of the 2004 Update and less than the 500,000 GPD threshold of the 1998 Plan shifted from the DSS category in the 1998 Plan to the PWS category in the 2004 Update.

Self-Supplied Categories of Use

The remaining categories of water use are self-supplied and include commercial and industrial, recreational, thermoelectric and agricultural. The methodology for commercial and industrial remains the same as in the 1998 Plan. The 2000 water demands were as reported by the USGS, and projections were made using the population growth rate.

The recreational and agricultural self-supply demand calculations did have a fundamental change in methodology. The 1998 Plan used a modified Blaney-Criddle model to estimate supplemental requirements for irrigation, while the 2004 Update is using the Agricultural Field Scale Irrigation Requirement Simulation (AFSIRS) model to assess irrigation demands. Differences between the models follow.

The agricultural demand assessment involved establishing acreages through collecting data from the Florida Agricultural Statistics Service and the Institute of Food and Agricultural Sciences (IFAS). Following the establishment of acreages by crop types, acreage projections were developed using a mix of statistical and industry feedback information; agricultural water demands were assessed based on those acreage projections. The IFAS extension agents from St. Lucie, Martin and Okeechobee counties reviewed historical (2000) and projected (2025) agricultural acreage information.

CHANGES FROM THE 1998 PLAN

There were several changes made in the demand assessment and projection methodology used in the 1998 Plan for the 2004 Update. These are summarized as follows:

Census blocks used instead of Census block groups. The population analysis conducted in this 2004 Update used census blocks; whereas block groups were used for the 1998 Plan. A Census block is the smallest Census geographic area, normally bounded by streets and other prominent physical features. A Census block has a higher resolution than a group of blocks (Census block group), therefore, use of blocks rather than block groups provide a higher level of precision.

BEBR medium population projections used instead of county comprehensive plan projections. In the development of the 1998 Plan, the original projection horizon was 2010, and county population projection control totals were taken from the county comprehensive plans. In 1997, as plan development progressed, Chapter 373, F.S. was amended to require that water supply plans include (among other things) a 20-year planning horizon. Based on this, the planning horizon of the 1998 Plan was changed to 2020. The population projection sources (comprehensive plans) did not go beyond 2010; however, it was observed, that the county comprehensive plan population projections for 2010 approximated the BEBR 2020 medium population projections—so the analysis stood. For this 2004 Update, the BEBR medium projections for 2025 (BEBR, 2002) were used as population control totals for each county.

A decreased water use threshold for PWS utilities from 500,000 to 100,000 gallons per day. This had the effect of increasing the number of PWS utilities analyzed, from 15 in the 1998 Plan to 19 in the 2004 Update.

Supplemental irrigation needs determined using the AFSIRS model versus a modified Blaney-Criddle model. Both of these models estimate evapotranspiration (ET) in order to derive supplemental irrigation requirements for agricultural crops and outdoor irrigation. However, in south Florida, the Blaney-Criddle model tends to overestimate ET, which is the driving component of supplemental irrigation. As a result, the Blaney-Criddle model has the potential to overestimate supplemental irrigation requirements. To address this, District staff began utilizing the Agricultural Field Scale Irrigation Requirement Simulation (AFSIRS) model as the regional water supply plans were updated. The AFSIRS model yields supplemental irrigation requirements that better reflect historic use patterns, and are generally lower than the modified Blaney-Criddle model on an annual basis.

COMPARISON WITH 1998 PLAN PROJECTIONS

This section includes a comparison of the population and water demands between the 1998 Plan and the 2004 Update. Overall water use demand projections decreased from the 1998 Plan projections by 40 percent (**Table 10**). The 2004 Update included higher projections for 2025 for public water supply, commercial and industrial self-supply and thermoelectric power generation self-supply (which was not addressed in the 1998 Plan).

Table 10. Comparison of Population and Water Demands Projections in 1998 Plan versus 2004 Update.

	1998 UECWSP for 2020	2004 UECWSP Update for 2025	% Change 1998 Plan (2020) vs. 2004 Update (2025)
Population	445,925	486,510	9%
Total Water Use (MGD)	565.4	337.3	- 40%
Public Water Supply (MGD)	64.4	77.8	21%
Domestic Self-Supply (MGD)	18.8	3.7	- 80%
Commercial & Industrial Self-Supply (MGD)	4.3	4.9	14%
Recreational Self-Supply (MGD)	38.1	23.8	- 38%
Thermoelectric Power Generation Self-Supply (MGD)	Not Addressed	30.0	
Agriculture Self-Supply (MGD)	439.8	197.1	- 55%

Table 10 shows a comparison of the level of demands that were analyzed in the 1998 Plan for a 2020 projection horizon, versus the demands projected in the 2004 Update for a 2025 projection horizon. The demand numbers differ for the following reasons:

- The irrigation model used in the 1998 Plan was a modified Blaney-Criddle model, whereas the AFSIRS model is used for the 2004 Update. Use of that version of the Blaney-Criddle model generally results in a higher per acre irrigation than AFSIRS. For example, the Blaney-Criddle model gives average annual irrigation demands for citrus in the UEC (on typical soil types) ranging from 18 to 25 inches, whereas the comparable AFSIRS range is 13 to 16 inches.
- The projection for irrigated agricultural acreage in the 1998 Plan anticipated a significant increase in citrus acreage (the dominant crop in the region), whereas the 2004 Update anticipates a modest decline (not including current citrus lands that may be used for the CERP).

- The decrease in domestic self-supplied demands is due to the lowering of the threshold dividing the PWS and DSS categories (meaning that four smaller utilities are included in the PWS category) in the 2004 Update, that were previously in the DSS category of the 1998 Plan. Additionally, it is anticipated that self-supplied users within utility served areas will connect to regional utilities by 2025.

Uncertainties Associated with Demand Projections

Demand projections are based on the extrapolation of trends and circumstances that change over time. For example, observed and projected growth in citrus acreage during the preparation of the 1998 Plan has since reversed into a decline. There have been some acreage increases in ornamental nursery, but not of the same magnitude as the reduction in citrus acreage. Trend changes, such as this are incorporated in the five-year updates to the Plan.

CHAPTER 3
Resource Analysis

Several methods and sources were used and consulted during the analysis phase of the developing this Plan including:

- Review of the analysis and results from the 1998 UEC Water Supply Plan.
- Review of consumptive use permitting activities and related data that have occurred since the acceptance of the 1998 UEC Water Supply Plan.
- Implementation of the 1998 UEC Water Supply Plan.
- Review and input from the public.
- Data and results from the CERP Indian River Lagoon – South Project.

The purpose of this chapter is to summarize the analysis that was used to support this 2004 Plan Update. This analysis was used to identify potential water supply related issues (potential problems) that may occur in developing historically used water sources to meet year 2025 projected water demands in the Upper East Coast (UEC) Planning Area. Potential issues as a result of this analysis are described in **Chapter 4** of this document. The process and information used for issue identification are described along with the results. The results are summarized in the form of a list of issues that this Plan needs to address and resolve.

Water source options, potential implementation and strategies to resolve these issues are discussed in **Chapter 5** (Meeting and Managing Future Water Demands). For each water source option, a definition, summary of the public workshop discussion, estimated costs, quantity of water anticipated to be made available from that option, as well as implementation strategies to facilitate development of that option are listed. In addition, regional recommendations are described and costed (total and annualized) by task, designated to a funding source and consigned to the entity/agency responsible for its implementation, in **Chapter 6**.

CHAPTER 373 RESOURCE PROTECTION TOOLS AND LEVEL OF CERTAINTY

Before discussing planning area specifics, it is important to understand the relationship between the different levels of harm referred to in statutes and various SFWMD resource protection programs. The overall purpose of Chapter 373 of the Florida Statutes (F.S.) is to ensure the sustainability of water resources of the state (Section 373.016, F.S.). To carry out this responsibility, Chapter 373 provides the SFWMD with several tools, with varying levels of resource protection standards. Protection programs include the SFWMD's surface water management and consumptive use permitting regulatory programs, minimum flows and levels (MFLs) and the SFWMD's Water Shortage Program. Determination of the role of each of these and the protection that they offer are discussed in Chapter 4 of the *DRAFT Consolidated Water Supply Plan Support Document*.

1998 UEC WATER SUPPLY PLAN

The SFWMD's Governing Board approved the first *Upper East Coast Water Supply Plan* in February 1998 (1998 UEC Water Supply Plan or 1998 Plan). The 1998 Plan had a 2020-planning horizon. An advisory committee was established to provide public input throughout development of the 1998 Plan. The 1998 Plan incorporated regional groundwater modeling as part of its analysis. The demand projections, assumptions and resource protection criteria used in that analysis were reviewed and compared to current information. It was determined that the conclusions of the 1998 Plan are applicable with the current planning horizon of 2025.

Staff and the public recognized the findings and conclusions of the 1998 Plan as still representative of the issues in meeting the UEC Planning Area 2025 projected water demands; and, that they should be considered in the development of the *2004 Upper East Coast Water Supply Plan Update* (2004 Update), in combination with other methods as described. It was concluded that the modeling associated with 1998 Plan is congruent with the 2025 scenario for the 2004 Plan Update.

1998 UEC Water Supply Plan Level of Certainty

The 1998 UEC Water Supply Plan incorporated a 1-in-10 level of certainty for all users, including natural systems. The 1-in-10 level of certainty was based on a twelve-month cumulative drought rainfall event, which statistically occurs once every 10 years. This certainty level was simulated in models for St. Lucie and Martin counties and is consistent with the level of certainty goal contained in the statutory requirements. The methodology used in determining the 1-in-10 year drought event in the 1998 Plan is described in that Plan's Appendix C, and a similar discussion of methodology is provided

in Appendix D of this 2004 Update. The demand projections and resource protection criteria incorporated the 1-in-10 level of certainty.

1998 UEC Water Supply Plan Demands

The water demand projections in the 1998 UEC Water Supply Plan were compared with projections developed for the 2025 planning horizon in the 2004 Update. The 1998 Plan incorporated a planning horizon of 2020. Population projections in the 1998 Plan were based on population projections contained in local government comprehensive plans. The 2004 Update uses the 2025 medium range population projections, as published by the University of Florida Bureau of Economic and Business Research (BEBR, 2002). The 2025 projections have been compared to recent updates of local government comprehensive plans, where available, and have been found to be similar. Local governments and utilities have also reviewed them.

In both plans, irrigated acreage was based on historical growth patterns. Irrigation demands in the 1998 Plan were determined using the modified Blaney-Criddle method as described in the *Basis of Review for Consumptive Use Permitting* (SFWMD, 1997) using a 1-in-10 year drought event. In the 2004 Update, the Agricultural Field Scale Irrigation Requirement Simulation (AFSIRS) model was used. Appendix G of the 1998 Plan and Appendix A of this 2004 Update contain additional information regarding the projection and demand methodologies used in each plan.

The results of this comparison concluded that the total average water demand projections in the 1998 Plan for 2020 are almost twice as high as those projected for 2025 in the 2004 Update. The total average water demands projected for 2020 in the 1998 Plan were 565 MGD; whereas, the total average water demands projected for 2025 in the 2004 Update are 277 MGD. This reduction in total demand is attributed primarily to a lower estimate for irrigated agricultural acreage; the 1998 Plan anticipated a significant increase in citrus acreage, whereas the 2004 Update, based on trends since 1998, anticipates a modest decline. With the exception of the public water supply and commercial and industrial self-supply categories, all water uses in the 1998 Plan had higher projections for 2020 than the 2004 Update has for 2025 as indicated in **Chapter 2** of this document.

1998 UEC Water Supply Plan Resource Protection Criteria

Resource protection criteria in the 1998 UEC Water Supply Plan were designed to prevent harm to the resources up to a 1-in-10 year drought event. For drought conditions greater than a 1-in-10 event, it may be necessary to decrease water withdrawals to avoid causing significant and serious harm to the resource. Water shortage triggers or water levels, at which phased restrictions are declared, can be used to curtail withdrawals by water use types. These restrictions avoid water levels declining to and below a level where serious harm to the resource could potentially occur. The framework of water use permitting, reservations, minimum flows and levels and water shortage practices are

further explained in Chapter 4 of the *DRAFT Consolidated Water Supply Plan Support Document*.

Two resource protection criteria were used in the 1998 Plan: wetland protection criterion and Floridan Aquifer protection criterion. These criteria were intended to be equivalent to the existing water use permitting guidelines. For the 1998 Plan, the criteria were defined in terms of water levels, duration, frequency of drawdowns and a 1-in-10 year drought event in order to assess the potential impacts (harm) of cumulative water use on the environment and groundwater resources using the groundwater modeling tools. Vulnerability mapping was used to identify areas with the greatest potential for saltwater intrusion.

In the planning context, the resource protection criteria are guidelines to identify areas where there is the potential for cumulative water use withdrawals to cause harm to wetlands and groundwater resources. Areas where simulations indicate the resource protection criteria were exceeded during the selected level of certainty are areas where the water resource may not be sufficient to support the projected demand under the given constraints.

Wetland Protection Criterion

The wetland protection criterion was defined in the 1998 UEC Water Supply Plan as follows: Groundwater level drawdowns induced by cumulative pumping withdrawals in areas that are classified as a wetland should not exceed 1.0 foot at the edge of the wetland for more than one month during a 12-month drought condition that occurs as frequently as once every 10 years. The wetland coverage used in the 1998 Plan was developed using information from the 1984 National Wetlands Inventory (NWI). Using 1990 and 1991 satellite images and aerial photographs, the SFWMD updated the NWI data.

In 2003, the SFWMD's Governing Board approved a substantial change to wetland impact evaluation criteria contained in the Basis of Review for Water Use Permit Applications within the SFWMD (Basis of Review). This criterion is used to determine whether or not a permit applicant satisfies the conditions for issuance of a water use permit. Essentially, applicants must demonstrate that their proposed use will not cause harm to wetlands. The standards define three categories of wetlands from natural lakes, deep ponds and cypress strands that are permanently flooded throughout the year, except in cases of extreme drought (Category 1); to seasonally inundated wetlands including cypress domes, emergent marshes, cypress strands, mixed hardwood swamps or shrub swamps and exhibit standing water conditions throughout most of the year (Category 2); to temporarily flooded and saturated wetlands including wet prairies and shallow emergent marshes, as well as seepage slopes, bayheads, hydric hammocks and hydric flatwoods (Category 3). Most of the wetlands in the UEC Planning Area are Category 2 wetlands.

To demonstrate that no harm will occur to wetlands and other surface waters, the applicant must provide reasonable assurances that the narrative standard for Category 1, 2 and 3 wetlands are met. For Category 2 wetlands, the criteria states that the narrative standard is met by complying with a numeric threshold, unless it is deemed by the SFWMD to be inapplicable due to site specific considerations. The numeric threshold states that the water use shall not be considered harmful when the modeled drawdown resulting from cumulative withdrawals in the unconfined aquifer beneath all portions of the wetland is less than 1.0 foot. The standards require that water use withdrawals be modeled based on a maximum monthly allocation simulated for 90 days without recharge, for situations where an analytic simulation is utilized. This is sometimes referred to as the "90 day no recharge" standard. In the 1998 Plan, it was demonstrated that the wetland protection criterion based on a 1-in-10 year drought was consistent with the "90 day no recharge" standard. For more complex systems, calibrated numeric system simulation models may need to be used. In such instances, the model run must use a series of steps with various rainfall and demands, including a 12-month period of 1-in-10 year drought conditions. Given the underlying parallels between the 1998 Plan wetland protection criterion and the criterion that is incorporated into the Basis of Review, the SFWMD's planning and permitting criterion for wetland protection was determined to be consistent.

Floridan Aquifer Protection Criterion

The Floridan Aquifer protection criterion was defined in the 1998 UEC Water Supply Plan as follows: Groundwater level drawdowns induced by water use withdrawals should not cause water levels in the Floridan Aquifer to fall below land surface any time during a 12-month drought condition that occurs as frequently as once every 10 years.

The upper Floridan Aquifer is an artesian aquifer in the UEC Planning Area. The water quality in formations below the upper Floridan Aquifer is of lower quality (salinity is higher). If the water level in the upper Floridan Aquifer is allowed to decline below acceptable levels, upconing of this underlying lower quality water could occur at an unacceptable rate, causing water quality degradation in the upper Floridan Aquifer. This could eventually lower the water quality in the upper Floridan to a level unsuitable for current users. This protection criterion was established to protect the quality and sustainability of the upper portion of the Floridan Aquifer (upper Floridan Aquifer, generally 800 feet below land surface in the UEC Planning Area), and to avoid impacts to existing users.

The SFWMD's Water Use Permitting Program rules relating to aquifer protection have recently been updated and continue prohibiting pumps on all Floridan wells in Martin and St. Lucie counties that increase water withdrawals greater than would occur naturally. This prohibition is related to the concern of potential upconing of higher salinity water and to avoid impacts to existing legal users. Impacts include the potential decline in water quality and a loss in head or water levels reducing the water available for use. Presently, there is insufficient data to conclusively define the relationship between water use, water levels and water quality. Also, the naturally occurring flow of the

Floridan Aquifer has been sufficient to meet the needs of the region's users. As such, water levels in the Floridan cannot decline below land surface. Therefore, the Floridan Aquifer protection criterion used in this Plan is equivalent to the intent of the existing Consumptive Use Permitting (CUP) Program. This criterion relates to the use of the Floridan Aquifer as a water source, but does not address the use of the Floridan Aquifer for aquifer storage and recovery (ASR) purposes.

Summary of 1998 UEC Water Supply Plan Analytical Tools

Analytical tools used in the 1998 Plan analysis included surface water budgets, numerical groundwater models and vulnerability mapping. Surface water budgets were used to approximate surface water availability in each of the major surface water basins in order to quantify the demands that could not be satisfied by surface water. The groundwater models were used to identify potential impacts of water use on the environment and groundwater resources. Vulnerability mapping was used to identify areas where there is the potential for future saltwater intrusion in the Surficial Aquifer System. A process diagram of the analytical tools used in the UEC Water Supply Plan is located in **Figure 5**.

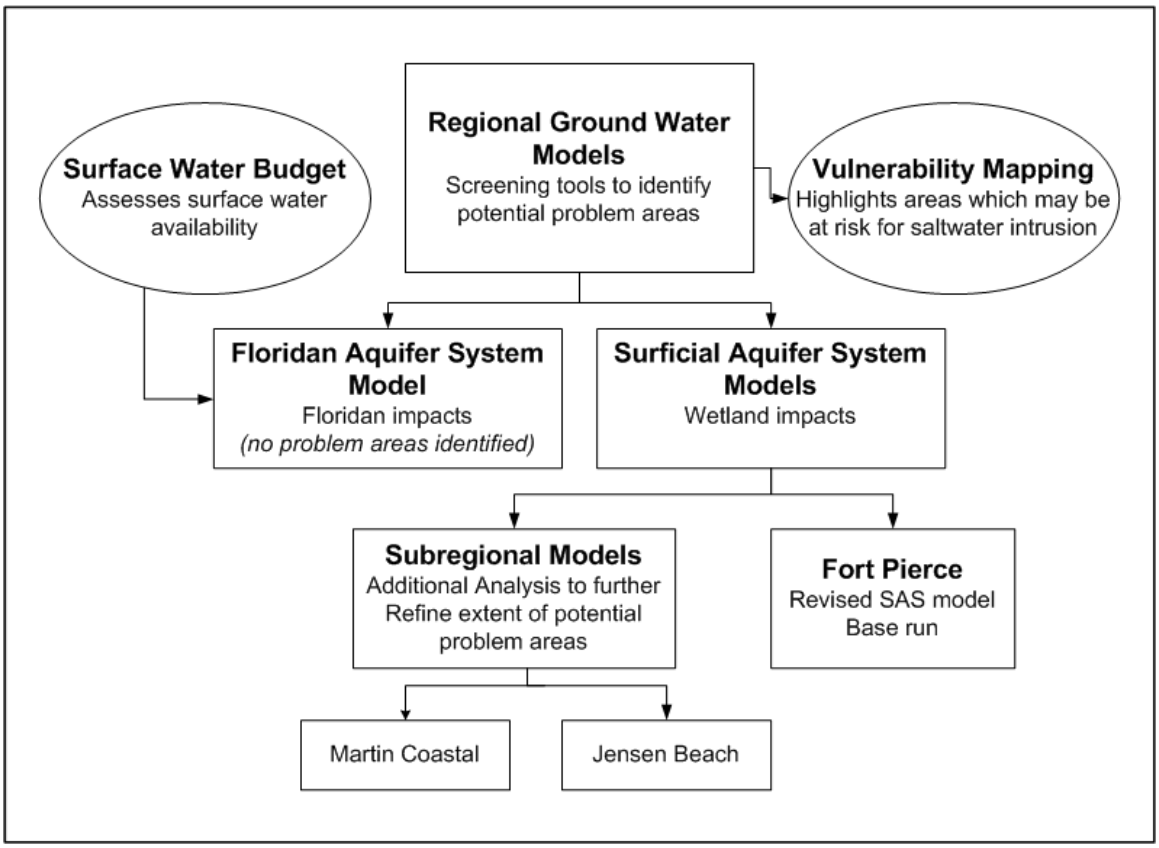


Figure 5. 1998 UEC Water Supply Plan Process Diagram and Analytical Tools.

Surface Water Budgets

Surface water budgets were used to assess surface water availability for water supply in each of the major surface water basins in the UEC Planning Area (C-23, C-24, C-25, North Fork St. Lucie River, Tidal St. Lucie), except the C-44 Basin. The surface water budgets indicate whether there is a surplus or deficit of surface water in each of the major canal basins for the rainfall event chosen. A deficit of surface water would indicate there is insufficient surface water to meet demands. For a given surface water basin, the budget considers the inflows and outflows that affect surface water storage. If inflows exceed outflows, then surface water is sufficient to meet the surface water demand. Unmet surface water needs were distributed to available groundwater sources, primarily the Floridan Aquifer.

As minimum flows and levels had not yet been established, the surface water budgets did not include minimum flows to the St. Lucie Estuary and Indian River Lagoon. A discussion of minimum flows and levels is provided later in this chapter. In addition, there are numerous combinations of potential solutions to meet the minimum flow, which were evaluated in the CERP Indian River Lagoon – South Project.

Groundwater Models

Groundwater models used in the development of the 1998 UEC Water Supply Plan included regional and subregional models. Regional groundwater models were used as screening tools to identify areas where water use, based on historical water sources and existing and proposed withdrawal facilities, has the potential of causing harm to the environment or aquifer during a 1-in-10 year drought condition. In locations where there were concentrated areas of potential impacts, more detailed analyses were conducted.

Based on the regional modeling results, three Surficial Aquifer areas in the UEC Planning Area were identified for additional analysis: 1) the Jensen Beach Area; 2) the Martin Coastal Area; and 3) the Fort Pierce Area. For the Jensen Beach and Martin Coastal areas, finer resolution subregional “zoom” groundwater models were used to conduct the additional analysis. The Fort Pierce Area was examined in more detail using the regional SAS model with refined inputs. **Figure 6** indicates the areas encompassed by the regional groundwater models and the areas that required additional analysis.

Both the regional and subregional groundwater models used the U.S. Geological Survey (USGS) modular three-dimensional finite difference groundwater flow model, commonly known as MODFLOW. The area encompassed by the model is divided into cells by a model grid (defined by a system of rows and columns). The groundwater models generate two principal types of output, computed water levels, which result from the conditions simulated, and water budgets for each active cell. The water budget shows the inflows and outflows for each of the cells. More detailed information on these models is available in the *1998 UEC Water Supply Plan Support Document* and *Appendices*.

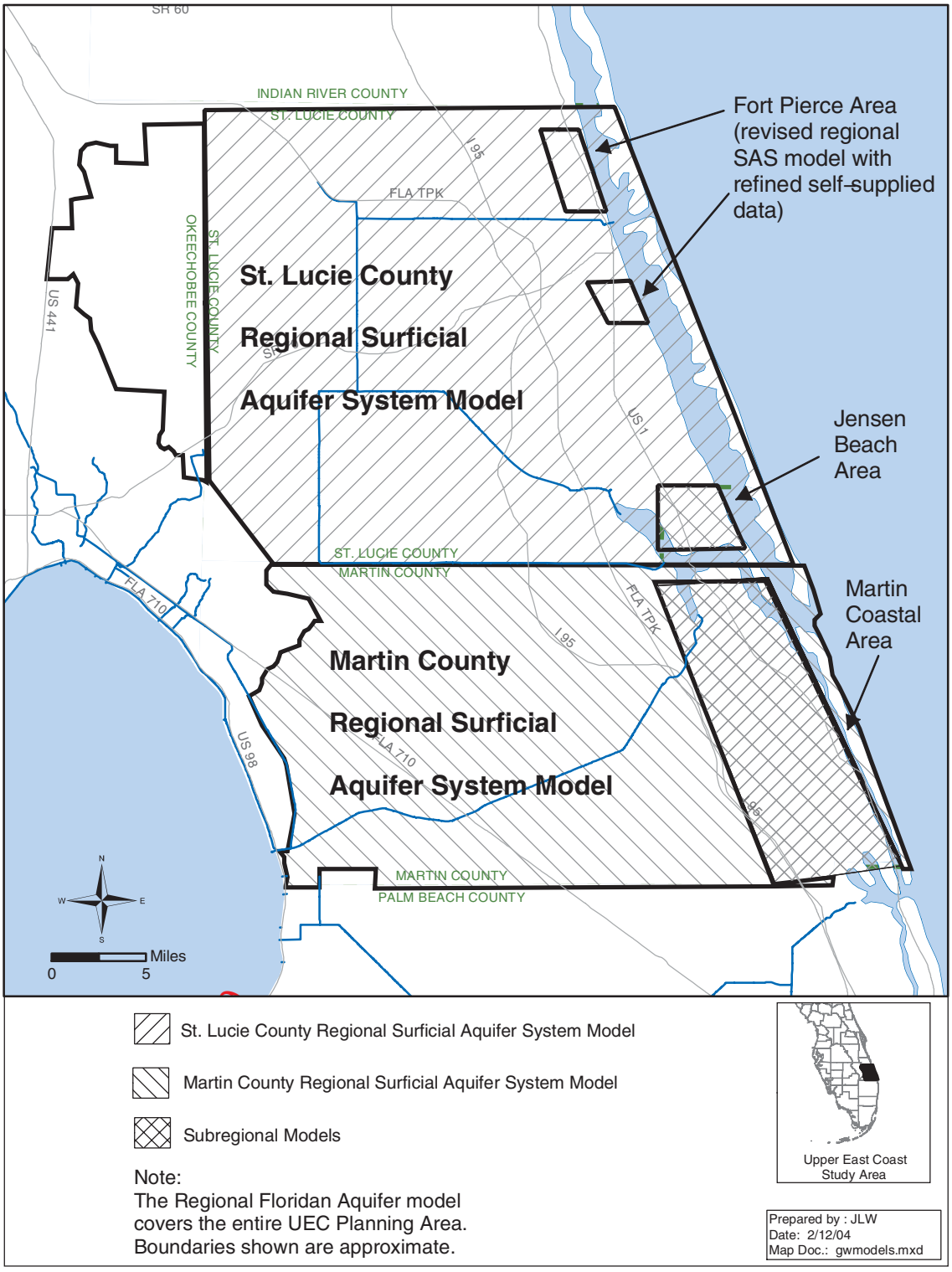


Figure 6. Regional Groundwater Modeling and Subregional Areas.

All the groundwater models were peer-reviewed for their appropriateness and reasonableness. The reviewers concluded the modeling was acceptable, the post-calibration modeling activities were reasonable, and that the overall groundwater modeling effort was appropriate for development of this water supply plan.

Regional Groundwater Models

Three regional groundwater models were used to simulate the potential impacts of water use in the UEC Planning Area: 1) the Martin County Surficial Aquifer System (SAS) Model; 2) the St. Lucie County SAS Model; and, 3) the Floridan Aquifer System (FAS) Model, which encompasses the entire UEC Planning Area. The SAS models are comprised of 2,000-by-2,000-feet cells, while the FAS model is comprised of 1-by-1-mile cells.

These regional models were developed by District staff and documented in peer-reviewed technical publications prior to their use in the UEC Water Supply Plan effort. The regional models were updated to reflect 1990 and future water use demands.

Subregional Groundwater Models

Aside from the regional models, two finer resolution subregional SAS models were used for the Jensen Beach Area and Martin Coastal Area to determine if the potential impacts were an artifact of the scale of the regional models or water use. The ability of the groundwater models to reflect the actual ground location of a withdrawal is a function of the cell size or scale used in the model. All withdrawals (wells) that fall within the boundaries of a cell are viewed as coming from the center of that cell, regardless of their specific location. Because of this, as cell sizes are decreased, withdrawals are placed closer to their actual position. The same holds true for the position of wetlands. Consequently, by using the finer scale models, the models more closely represent actual conditions.

The Jensen Beach Area subregional SAS model (Jensen Beach model) was an existing model developed by District staff and documented in a peer-reviewed technical publication (SFWMD, 1991b) and the model's data sets were updated for this planning effort. The Jensen Beach model encompasses the Jensen Beach peninsula in Martin County and is comprised of 240-by-240-feet cells. Approximately 69 Jensen Beach model cells fit into one regional model cell.

The Martin Coastal Area subregional SAS model (Martin Coastal model) was developed during the planning process. The Martin Coastal model encompasses the area from the St. Lucie River south to the Loxahatchee River, and from the Atlantic Ocean west to the Florida turnpike, and is comprised of 500-by-500-feet cells. Approximately 16 Martin Coastal model cells fit into one regional model cell. This model is further described in Appendix J of the 1998 Plan.

Vulnerability Mapping

Vulnerability mapping is a technique used to identify potential problem areas, especially in water resource investigations, by weighting key factors that can cause the problem. It was used in the 1998 UEC Water Supply Plan to evaluate the potential for saltwater intrusion. The factors used in this evaluation were: water levels, proximity to salt water and historic changes in chloride concentrations. Several of these factors were outputs from the regional SAS models. Vulnerability mapping for this application highlights areas that have the highest potential for saltwater intrusion relative to the rest of the region. It does not determine areas that have or will have saltwater intrusion.

The inland movement of salt water is a major resource concern in the coastal areas of the UEC Planning Area and can significantly affect water availability in areas adjacent to saline water bodies. When water is withdrawn from the Surficial Aquifer at a rate that exceeds its recharge capacity, the amount of freshwater head available to impede the migration of salt water is reduced, and saltwater intrusion becomes likely. Saltwater intrusion was identified in Hobe Sound, resulting in several wells being taken out of service.

Historically, the SFWMD's CUP Program has required water users to maintain a minimum of 1.0 foot of freshwater head between their wellfields and saline water as a guideline for the prevention of saltwater intrusion, among others. This guideline, in combination with a saltwater intrusion monitoring program, has been largely successful in preventing saltwater intrusion in the UEC Planning Area. Much of this effort has been carried out on a permit-by-permit basis. The approach taken in the water supply plan is intended to provide a comprehensive view of the potential for saltwater intrusion within the region. By identifying those areas most vulnerable to saltwater intrusion, the plan provides users and regulators with a foundation to take a strong proactive approach in managing saltwater intrusion.

Summary of 1998 UEC Water Supply Plan Modeling and Results

The results of the 1998 UEC Water Supply Plan indicated that historically used sources of water, primarily the SAS in the urban coastal areas, are not adequate to meet the growing needs of the UEC Planning Area during a 1-in-10 year drought condition. Potential impacts on wetlands, as well as the potential for saltwater intrusion, increase using estimated future demand levels. However, with diversification of supply sources (e.g., Floridan Aquifer, reclaimed water, etc.), the analysis indicated the existing and future water demands could be met with minimal potential impacts.

The results of the surface water budget analysis verified that the surface water availability during a 1-in-10 year drought condition under the existing canal and storage network is not adequate to support the water supply demands on them. However, supplementing these surface water supplies with groundwater sources, primarily the Floridan Aquifer, was shown to be sufficient to meet the existing and future demands.

Considering a worst-case scenario, existing and future public water supply demands were transferred to the FAS for one of the model simulations. This is in addition to the users already projected to be using the Floridan Aquifer to meet future demands. In an extreme case, if the utilities choose to use the Floridan Aquifer to meet future demands, the Floridan would most likely only supplement, not replace, their existing SAS withdrawals. As a result, actual Floridan withdrawals are expected to be less than evaluated. The results of this analysis indicate there would be no resource protection criterion exceedances if all projected public water supplies met the entire demand with Floridan Aquifer water.

The 1998 Plan concluded that future public water supply demands could be met with a combination of SAS water and FAS water without causing harm to the resources during a 1-in-10 year drought condition. Urban landscape irrigation demands could be met with a combination of SAS water and reclaimed water. Some further development of the SAS can be accomplished in these areas at the local level through modifications to wellfield configurations and pumping regimes with respect to locations of wetlands and salt water. Additional withdrawals from the SAS in these coastal areas will have to be evaluated on a project-by-project basis.

For agriculture, primarily citrus, it was concluded that surface water, supplemented with Floridan Aquifer water during extended periods of low rainfall, is sufficient to meet the projected needs during a 1-in-10 year drought. Construction of storage reservoirs associated with the CERP Indian River Lagoon – South Project is expected to enhance surface water availability. The CERP will determine quantities available for the natural systems, as well as human uses.

It was agreed that freshwater discharges (minimums and maximums) are affecting the health of the St. Lucie Estuary and the Indian River Lagoon, as well as being lost to tide. The CERP Indian River Lagoon – South Project will address freshwater discharges to the St. Lucie Estuary and increase surface water availability for water use. The Ten Mile Creek project, initiated in 2003, will address freshwater flows in the Ten Mile Creek Basin.

Several water resource options, and combinations of options, were evaluated to determine their potential effectiveness in meeting a portion of the projected demands and reducing potential exceedances. These source options included use of the FAS to meet public water supply demands, increased use of reclaimed water and increasing agricultural efficiency. Analysis of the Floridan Aquifer indicated the Floridan Aquifer could support the additional demands. The analysis found reducing demands on the SAS through the use of the Floridan system and reclaimed water in the coastal portions of the UEC Planning Area was very effective at reducing potential exceedances of the wetland protection and the potential for saltwater intrusion. Maximizing the use of the resources should incorporate more efficient use of water by increasing urban and agricultural water conservation.

For consistency between the 1998 UEC Water Supply Plan and the Water Use Permitting Program, it was recommended that the resource protection criteria and assumptions used in the 1998 Plan be incorporated into the SFWMD's Basis of Review for consumptive use permits. Additional research was also recommended to better understand the potential impacts to natural systems and to develop water shortage management strategies tied to the District's CUP Program.

1998 UEC Water Supply Plan Conclusions and Recommendations

The 1998 UEC Water Supply Plan concluded that historically used sources of water, primarily fresh groundwater sources, are not sufficient to meet the projected demands through the planning horizon. The 1998 Plan recommended new sources of water be explored and used to reduce the potential for harm to wetlands and the water resources, including the FAS, increased use of reclaimed water, increased water conservation and research to meet the projected demands. The 1998 Plan also recommended more efficient use of water by increasing urban and agricultural water conservation, and developing cost-sharing partnerships. The 1998 Plan analysis concluded that implementation of the above will significantly reduce the number of potential problems. To ensure the water needs of this region will be met over the next 20 years and beyond, the Plan contained 31 water resource development recommendations and 19 water supply suggestions.

1998 UEC Water Supply Plan Implementation

The recommendations in the 1998 UEC Water Supply Plan are being realized. The following are summaries of the implementation of some of the 1998 Plan recommendation areas.

Floridan Use

Most coastal public water supply utilities have begun transitioning to the Floridan Aquifer in addition to continued use by the citrus industry. The utilities in the UEC Planning Area that use, or are developing the Floridan Aquifer for future demands, include South Martin Regional, Martin County North, Martin County Tropical Farms, Port St. Lucie and Fort Pierce Utilities Authority.

Table 11 shows that use of the Floridan Aquifer is increasing by public water supply utilities in both Martin and St. Lucie counties. In 2000, the use of the Floridan Aquifer by utilities accounted for 20 percent of the total utilities withdrawal in the UEC Planning Area. This is an increase from the 1998 usage of 16 percent of the total. This trend is anticipated to continue as most of the utilities in the region plan to use the Floridan Aquifer in the future. In some areas of the region, utilities have decreased Surficial Aquifer withdrawals with development of the Floridan Aquifer.

Table 11. Public Water Supply Water Sources and Use (MGD) 1998–2000.

	1998	1999	2000
Floridan Aquifer			
Total	5.09	6.57	8.48
% of Total	16%	18%	20%
Surficial Aquifer			
Total	27.28	30.52	34.72
% of Total	84%	82%	80%
Total Use	32.37	37.09	43.20

Source: USGS, 2001

Reclaimed Water

The use of reclaimed water in the planning area in 2002 has increased to over 9.3 MGD (FDEP, 2003). The volume of reclaimed water that is used for a beneficial purpose has almost doubled since 1994 in the region. Most new large irrigation needs are being met with reclaimed water where it is available. This trend is projected to continue with the projects underway, or proposed by utilities in the region. Some local governments are also developing mandatory reuse zones that will require new developments to use reclaimed water as part of their development orders.

SFWMD Funding Programs

The SFWMD provides funding assistance to water users for development of alternative water supplies and water conservation through two cost-share programs, the Alternative Water Supply Funding Program and the Water Savings Incentive Program.

Alternative Water Supply Funding Program. The SFWMD has continued funding of alternative water supply projects through the Alternative Water Supply Funding Program. The SFWMD has provided about $3.1 million for 21 alternative water supply projects in the UEC Planning Area between 1998 and 2004. These included 12 projects related to development of the Floridan Aquifer and reverse osmosis treatment, seven water reuse projects and two stormwater reuse projects. These projects produce over 32 MGD of additional water supply.

Water Savings Incentive Program. The Water Savings Incentive Program (WaterSIP) was established by the SFWMD in Fiscal Year (FY) 2002 to provide cost-share funding for the implementation of water saving projects that reduce urban water usage. The WaterSIP focuses on non-capital projects, such as the installation of automatic shutoff devices for irrigation systems and plumbing retrofits. In two years, this program has provided $700,000 for 19 projects Districtwide. No projects in the UEC Planning Area were submitted for consideration of funding.

Mobile Irrigation Labs

The SFWMD co-funds two urban Mobile Irrigation Labs (MILs) in the UEC Planning Area to complement an existing agricultural lab. The urban MILs provide homeowners, condominium associations, golf courses and public buildings and parks with on-site analyses, system evaluations and water quality evaluations. The Martin and St. Lucie labs were established in 1998 and 1999, respectively, as a result of recommendations in the 1998 Plan. Each urban MIL completes approximately 140 evaluations per year, with a potential water savings of 50 to 60 million gallons of water per year (about .30 MGD) and an associated reduction in lawn chemicals and fertilizers leaving sites as runoff. There is one agricultural lab in the region funded by U.S. Department of Agriculture – Natural Resources Conservation Service (USDA–NRCS) that serves both St. Lucie and Martin counties. The agricultural lab performed 31 evaluations in FY 2002 and saved about 3.30 MGD.

Citrus Irrigation Conversion

Conversion of flood-irrigated citrus to microirrigation has continued since the 1998 Plan. In the 1998 Plan, it was estimated that 70 percent of the citrus in the region was using microirrigation. Today, information indicates this number has increased to over 80 percent. Flood irrigation has an efficiency of 50 percent, while microirrigation has an efficiency of 85 percent.

Citrus Grove

Floridan Aquifer Monitoring Network

As a result of the 1998 UEC Water Supply Plan, Floridan Aquifer monitoring programs in the UEC Planning Area were reviewed and combined into a comprehensive monitoring network. The District established a comprehensive monitoring network to collect data on water quality, water levels and water use in the Floridan Aquifer to gain a better understanding of the relationship between these three components important to planning. The comprehensive Floridan Aquifer monitoring well network consists of 31 monitoring locations distributed across the UEC Planning Area. There are 12 District locations (14 monitoring wells) that are monitored for water levels and water quality. The remaining 19 locations (52 monitoring wells) are monitored and sampled for water levels, water quality and water use under contract with the St. Lucie Soil and Water Conservation District. Data collection to determine trends and relationships is ongoing. A report summarizing the design and implementation of the network along with some of the initial findings are included in Appendix E of this 2004 Update.

The SFWMD also co-funded a study with the USGS to evaluate potential water quality changes and the distribution of salinity in the Floridan Aquifer. The final report

from this study is scheduled for release in mid-2004. The aim of the study was to identify potential sources of high salinity and possible flow mechanisms or pathways of groundwater to wells, and describe areas with a high potential of increased salinity. The study found that heads in the aquifer in central and northern St. Lucie County and Okeechobee County had declined substantially within recent years (2 to 4 feet in the past 15 years, 15 to 20 feet since predevelopment times). The head declines coincide with areas of intense agricultural use. These inland areas also have some structural deformations in the rock that could present exceptional pathways for groundwater flow. An area of elevated chloride concentration exists inland trending northwest through north-central Martin County and western St. Lucie County. The preliminary findings of the investigation indicate that the highest potential for upward or lateral movement of the saltwater interface is in the inland areas of St. Lucie County and Okeechobee County because of large declines in hydraulic head, areas of structural deformation and areas of higher salinity.

Wetland Drawdown Study

The SFWMD completed its wetland drawdown study as recommended in the 1998 Plan. The District began formulating a research plan to support development of wetland drawdown criteria in 1995. The purpose of this study was to implement hydrobiological monitoring at various wetland sites throughout the SFWMD to determine the effects of groundwater drawdowns on these systems. Twenty sites in four study areas were established and instrumented in 1997, including several in the UEC Planning Area. Additional sites were added in 1999. Data collection and analysis has been conducted to determine the relationship between variations in hydrology and wetland functions. These data were used to support development of wetland protection criteria in the SFWMD's Basis of Review for Water Use Permit Applications.

Rulemaking

The 1998 Plan contained recommendations to incorporate certain aspects of that plan, such as the resource protection criteria, level of certainty, special designations and permit durations into the Basis of Review for Water Use Permit Applications. The SFWMD has accomplished this through adoption of rule amendments in 2003. Specifically, an exhaustive series of rulemaking efforts was completed in September 2003 and resulted in amendments to Chapters 40E-1, 40E-2, 40E-5, 40E-8, 40E-20, 40E-21, Florida Administrative Code (F.A.C.) and the Basis of Review for Water Use Permit Applications within the SFWMD. Many important criteria affecting water use permitting were amended through these rulemaking efforts. Among the most significant changes were the amendments to permit duration, permit renewal, wetland protection, supplemental irrigation requirements, saltwater intrusion, aquifer storage and recovery and model evaluations criteria. Adoption of these rule changes is particularly important as the irrigation permit expiration and renewal process begins. Irrigation class water use permits within the UEC Planning Area began the renewal process in fall of 2003. The UEC Planning Area is the first region within the SFWMD to undergo the irrigation permit expiration and renewal process. The renewal process for the UEC Planning Area

should be completed by October 2004. The newly adopted criteria listed previously will apply to all applications for new and renewals of irrigation use class permits. The preceding rules, among others, can be found on the District's website available from http://www.sfwmd.gov/org/wsd/wateruse/wu_index.html.

Surface Water Storage

Regional surface water storage is being accomplished through three Everglades Restoration projects in the region: the CERP Indian River Lagoon – South Project, Ten Mile Creek Critical Restoration Project and CERP North Palm Beach County Part 1 Project. These projects, when implemented, will: 1) restore the Indian River Lagoon, St. Lucie Estuary and Loxahatchee River to a healthier state, and 2) provide water to agricultural users, after environmental needs have been met. These projects are being cost-shared between the SFWMD and the U.S. Army Corps of Engineers.

CERP Indian River Lagoon – South Project. The purpose of the Indian River Lagoon – South Project is to improve surface water management in the C-23, C-24, C-25 and C-44 basins for habitat improvement in the St. Lucie River/Estuary and the Indian River Lagoon. The Final Indian River Lagoon – South Project Implementation Report (PIR) Public Notice was signed by the USACE in Atlanta in March 2004. The PIR will be submitted to the USACE Headquarters in Washington, D.C. for final review. Approvals are being sought to incorporate the Indian River Lagoon – South Project in the *Water Resource Development Act of 2004 (*WRDA 2004). Construction could be initiated as early as 2006 and it would take six years to complete.

Indian River Lagoon

The recommended plan in the CERP Indian River Lagoon – South PIR provides over 135,000 acre-feet of storage via four reservoirs covering 12,610 acres. In addition, four stormwater treatment areas are proposed to reduce phosphorus and nitrogen. These treatment areas encompass 8,731 acres, and will provide 35,000 acre-feet of storage. Additionally, 92,130 acres of natural storage and treatment areas will provide over 30,000 acre-feet of storage. The project is expected to increase water availability by 26,300 acre-feet per year (23.48 MGD), which will result in a decrease in Floridan Aquifer usage for agriculture.

The recommended plan also incorporates the removal of 5,500 cubic yards of muck and the creation of 90 acres of artificial habitat. Integrated as a component

of the plan, the restoration of the North Fork floodplain includes reconnection of historic oxbows and acquisition of over 3,000 acres of floodplain.

Ten Mile Creek Critical Restoration Project. Construction of the Ten Mile Creek Restoration Project was initiated in November 2003. The project involves construction of a 550-acre reservoir (maximum depth of 10 feet) and a 110-acre stormwater treatment area (maximum depth of 4 feet). This project is located immediately west of the Varn (a.k.a. Gordy Road) Structure in St. Lucie County and will provide storage and treatment of storm water from the Ten Mile Creek Basin, the largest subbasin discharging to the North Fork of the St. Luce River. The Ten Mile Creek Critical Restoration Project could potentially make over 5 MGD of additional water available to agricultural users. The construction will take approximately two years to complete and will cost approximately $26 million.

CERP North Palm Beach County Part 1 Project and Northern Palm Beach County Comprehensive Water Management Plan. The South Florida Water Management District Governing Board accepted the Northern Palm Beach County Comprehensive Water Management Plan in May 2002.

The District has purchased approximately 44,800 acre-feet of storage for the L-8 Reservoir in the southern L-8 Basin. Analysis is being undertaken through the CERP North Palm Beach County Part 1 Project, modeling initiatives to determine how much more storage will be needed in the future. Construction of the G-160 Loxahatchee Slough Structure in northeastern Palm Beach County was completed in January 2004. This $2.1 million spillway structure will provide essential freshwater flows to the Northwest Fork of the Loxahatchee River during the dry season and will also maintain a more natural hydroperiod within the slough. Construction of the G-161 Northlake Boulevard Structure began in 2004.

MINIMUM FLOWS AND LEVELS

Since publication of the 1998 Plan, minimum flows and levels (MFLs) have been established for two water resources in the UEC Planning Area: the St. Lucie River and Estuary and the Northwest Fork of the Loxahatchee River. The establishment process for each of these included compilation and analysis of existing information, scientific peer review, significant public participation and rulemaking. Minimum flow and levels are established by the SFWMD in Chapter 40E-8, F.A.C., Minimum Flows and Levels. Establishment of minimum flows and levels for the Loxahatchee River tributaries (Cypress Creek, Hobe Grove Ditch and Kitching Creek) is scheduled for 2007.

St. Lucie River and Estuary

St. Lucie Inlet

The St. Lucie River and Estuary watershed are located in Martin and St. Lucie counties. It includes the North and South Forks of the St. Lucie River, several major drainage and irrigation canals, the surrounding watershed and the estuary. The watershed covers approximately 780 square miles, while the microtidal estuary covers about 9.2 square miles. The River's headwaters lie between the lands west of Fort Pierce in St. Lucie County to near the north boundary of Jonathan Dickinson State Park in Martin County. Several creeks and canals that flow into either the North Fork or South Fork of the St. Lucie River, before entering the Indian River Lagoon near the St. Lucie Inlet, drain the natural watershed. This system is of particular importance because it lies at the confluence of two major transportation waterways. It is located adjacent to the Indian River Lagoon (part of the National Estuary Program), and provides an outlet for discharge of excess water from Lake Okeechobee.

Excess Discharges to the St. Lucie River and Estuary

For the St. Lucie River and Estuary, extended periods of large volume, freshwater flows also impact the resource. Methods to reduce the volume and frequency of these releases therefore need to be considered. Various projects are proposed as part of the CERP Indian River Lagoon – South Project to increase storage, redistribute flows, provide additional water for irrigation and reduce the amount of excess runoff discharged to the Estuary. Projects within CERP and adjustments to the Lake Okeechobee regulation schedule will provide a means to reduce the amount of excess water discharged to the coast from Lake Okeechobee. Setting a minimum flow is viewed as a starting point to define minimum water needs necessary to protect water resources against significant harm.

Minimum Flow and Level for the St. Lucie River and Estuary

The SFWMD's Governing Board established a minimum flow and level for the St. Lucie River and Estuary in 2002. The minimum flow criteria for the St. Lucie River and Estuary are linked to the concept of protecting valued ecosystem components (VEC) from significant harm. The VEC components identified for the St. Lucie River and Estuary are the assemblage of organisms inhabiting the low salinity, oligohaline zone. The minimum flow and level criteria for the St. Lucie River and Estuary were based on the determination that significant harm occurs to the oligohaline zone when net freshwater flows (sum of surface and groundwater inflows minus evaporation) to the

estuary are at or below zero for a period of two consecutive months for two or more years in succession. The *Technical Documentation to Support Development of Minimum Flows and Levels for the St. Lucie River and Estuary* is available on the District's website at www.sfwmd.gov/org/wsd/mfl/index.html.

Based on this, a MFL violation occurs in the St. Lucie Estuary when mean monthly flows to the St. Lucie Estuary fall below 28 cubic feet per second from the Gordy Road Structure to the North Fork of the St. Lucie River for two consecutive months during a 365-day period, for two consecutive years.

St. Lucie River and Estuary MFL Prevention Strategy

Although the river and estuary presently receive an adequate supply of fresh water, and are expected to continue to do so as the CERP Plan is implemented, a prevention strategy may be required to protect this resource. The ability to better manage water in the watershed may also make it possible to capture and retain water from the watershed for allocation to other users (e.g., urban and agricultural water supply). Prevention strategy components for the North and South Forks to not cause significant harm to the St. Lucie River and Estuary are:

- Discharges from the North Fork will be managed within the operational protocols of the Ten Mile Creek Project scheduled to be completed by 2004. Flow targets will be consistent with the CERP performance requirements for the Indian River Lagoon.
- A research and monitoring strategy for the North and South Forks of the St. Lucie River will be developed and implemented in coordination with the Upper East Coast Water Supply Plan Update.

Northwest Fork of the Loxahatchee River

The SFWMD's Governing Board established a minimum flow and level for the Northwest Fork of the Loxahatchee River in 2002. The Loxahatchee River and Estuary watershed is located in Martin and Palm Beach counties. It includes the Northwest, Southwest and North Forks of the Loxahatchee River, a major drainage canal (C-18), the surrounding watershed and the estuary. The Northwest Fork was designated as Florida's first Wild and Scenic River in 1985. It is located at the southern end of the Indian River Lagoon (part of the National Estuary Program), and includes a state park and an aquatic preserve.

Minimum Flow and Level for Northwest Fork of the Loxahatchee River

The MFL criteria for the Northwest Fork of the Loxahatchee River were developed to protect the remaining floodplain swamp community and downstream estuarine resources from significant harm. Due to the lack of recent flow or biological data from the North Fork, the inability to regulate flow from the North Fork and the

highly altered nature of the Southwest Fork, these two arms of the Loxahatchee Estuary were not considered for MFL establishment at this time.

The minimum flow criteria for the Northwest Fork were linked to the concept of protecting VEC from significant harm. The VEC identified for the Northwest Fork is the Loxahatchee River's freshwater floodplain swamp. An assemblage of six freshwater tree species and associated vegetation community parameters were identified that characterizes the VEC. The Loxahatchee River National Wild and Scenic River Management Plan identified the floodplain swamp and its associated cypress forest as a resource of outstanding value that needs to be protected. Since cypress trees themselves appear to tolerate a wide range of salinity conditions and are slow to show a response to salinity stress, researchers at the SFWMD identified six species of freshwater swamp trees that, as a group, appear to be a more sensitive indicator of adverse salinity conditions. Protection of these species will assure that major constituents of the freshwater floodplain swamp community are also protected from significant harm. The *Technical Documentation to Support Development of Minimum Flows and Levels for the Loxahatchee River* is available on the District's website at www.sfwmd.gov/org/wsd/mfl/index.html.

Analysis of recent historical flow data indicated that an enhanced freshwater regime is necessary to prevent significant harm to the water resources and ecology of the Northwest Fork of the Loxahatchee River, pursuant to Sections 373.042 and 373.0421, F.S. By establishing the MFL, along with implementation of the associated recovery strategy, it is the interim goal of the District to provide sufficient freshwater flows to create at river mile 9.2 the freshwater conditions found at River Mile 10.2. A MFL violation occurs within the Northwest Fork of the Loxahatchee River when an exceedance happens more than once in a six-year period. A MFL exceedance occurs within the Northwest Fork of the Loxahatchee River when:

- Flows over Lainhart Dam decline below 35 cubic feet per second (cfs) for more than 20 consecutive days; or
- The average daily salinity concentration expressed as a 20-day rolling average exceeds two parts per thousand at river mile 9.2.

In addition to this MFL, which is intended to achieve partial enhancement of the Northwest Fork of the Loxahatchee River to prevent significant harm, restoration of the Loxahatchee River beyond the MFL will be addressed pursuant to Rule 40E-8.421(6), F.A.C. and other applicable provisions of state law. This MFL will be reviewed within two years of adoption and revised, if necessary, to ensure consistency with the restoration goal and plan identified pursuant to Rule 40E-8.421, F.A.C. or other applicable provisions of state law.

Loxahatchee River MFL Recovery Strategy


Loxahatchee River

The Northwest Fork of the Loxahatchee River is currently not meeting the MFL and requires implementation of a recovery strategy to achieve the MFL as soon as practicable, consistent with Section 373.0421, F.S. The recovery strategy consists of projects contained within the following approved plans: the Lower East Coast Regional Water Supply Plan (LEC Plan), CERP and the Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP). Four phases of recovery are identified in the MFL Technical Document completed in November 2002, which are projected to increase flows to meet the MFL for the Northwest Fork of the Loxahatchee River. As part of the recovery strategy, consumptive use permitting and water shortage requirements in Chapters 40E-2 and 40E-21, F.A.C., shall apply to consumptive use direct and indirect withdrawals from surface and groundwater sources from the Northwest Fork of the Loxahatchee River, and those areas directly tributary to the Northwest Fork.

In addition to implementing this MFL recovery strategy, the SFWMD has committed to restore freshwater flows to the Northwest Fork of the Loxahatchee River above the MFL through Chapter 373, F.S., and the CERP and its associated authorities. The SFWMD will continue to partner with the Florida Department of Environmental Protection (FDEP) in establishing a practical restoration goal and plan for the Loxahatchee River watershed. Recognizing that natural seasonal fluctuations in water flows are necessary to ensure that the functions of the Loxahatchee River are protected, this restoration goal and plan will include a more complete set of seasonally managed flow criteria for the river that are driven primarily by natural rainfall and runoff patterns within the watershed.

The SFWMD will continue to operate the G-92 Structure and associated structures to provide approximately 50 cfs or more over Lainhart Dam to the Northwest Fork of the Loxahatchee River, when the District determines that water supplies are available. It is the intent of the SFWMD to continue the current operational protocols of the G-92 Structure so as not to reduce the historical high, average and low flows as estimated over the 30-year period of rainfall record used as the basis for the MFL for the Northwest Fork of the Loxahatchee River. It is the District's intent to implement, along with other partners, projects to meet the practical restoration goal. Projects contained in CERP, the Lower East Coast Regional Water Supply Plan and the Northern Palm Beach County Comprehensive Water Management Plan will provide increased storage and conveyance within the basin with a goal of providing more water for restoration of the Northwest Fork of the Loxahatchee River. These projects include the G-160 (Loxahatchee Slough) and the G-161 (Northlake Boulevard) structures on the C-18 Canal, M Canal widening and 48,000 acre-feet of storage in the southern L-8 Basin.

To protect water made available for the recovery and restoration of the Loxahatchee River through implementation of these associated projects, the SFWMD intends to adopt water reservations, a resource tool, for the Loxahatchee River, pursuant to Subsection 373.223(4), F.S., on a project-by-project basis, over the next 20 years. In addition, the SFWMD intends to adopt an initial reservation to protect existing water used for protection of fish and wildlife, consistent with the practical restoration goal identified for the Loxahatchee River in 2004. Future reservations related to the Loxahatchee River will be consistent with the reservations being developed for restoration of the Everglades under CERP, and will reflect the needs of the natural system through a range of hydrologic conditions. These water reservations are intended to prevent the future allocation to consumptive uses of the fresh water needed for restoration of the Loxahatchee River. The reservations will be implemented through the District's CUP Program, operational protocols, water shortage rules and other appropriate provisions in Chapter 373, F.S.

As reservations are adopted to restore the Loxahatchee River beyond the level of protection achieved by the present MFL, the SFWMD shall revise the MFL and associated prevention and recovery strategy, as appropriate, under Sections 373.042 and 373.0421, F.S., to be consistent with the reservation.

ASSESSMENT OF THE 1998 UEC WATER SUPPLY PLAN

Taking into consideration the information and knowledge gained in developing the 1998 Plan, and the intelligence gained since its approval, it was concluded that the 1998 Plan analysis represents a very conservative scenario and is applicable to the 2025-planning horizon. This conclusion is based on several considerations:

- The projected water demands in the 2004 Update are considerably less than those projected in the 1998 Plan.
- Some of the potential problems that were identified on a regional scale in the 1998 Plan associated with 1990 withdrawals were not identified as issues or have been resolved on a local scale through the SFWMD's CUP Program.
- Water users have diversified their supply sources and reduced their reliance on the Surficial Aquifer. Most coastal utilities are utilizing the Floridan Aquifer to meet their future needs; reclaimed water use in the area has increased significantly and offsets use of groundwater; and conversion of flood irrigation to microirrigation has continued. Most of the recommendations in the 1998 have been implemented.
- The 1998 Plan analysis indicated that with diversification of supply sources, through development and expansion of alternative sources, exceedances were eliminated. Since the 1998 modeling and identification of these potential problem areas, additional work has been conducted related to these areas. Some of the factors examined

included projected demands, current land use, CUP experience, field inspection and the SFWMD's wetland drawdown study.

- The increased demand on the Floridan was simulated—all existing and future public water supply demands were transferred to the Floridan Aquifer for one of the model simulations. This is an extreme case in that if utilities choose to use the Floridan Aquifer to meet future demands, the Floridan would most likely only supplement, not replace, their existing SAS withdrawals. As a result, Floridan withdrawals are actually expected to be less than evaluated. The results of the 1998 Plan analyses indicated there would be no resource protection criterion exceedances if all utilities met their entire projected demand with Floridan Aquifer water.
- Projected 2025 irrigated agricultural acreage is approximately 19 percent less than those projected and simulated in the 1998 Plan. Irrigated agricultural acreage in the region is projected to decrease slightly from 2000 levels.
- Several applications for consumptive use permits in the potential problem areas have been approved since the 1998 Plan. Several of these projects required modification to wellfield locations and pumping regimes with respect to wetlands prior to approval. In other areas, aerial photography was reviewed over several decades and did not indicate changes in the size or vegetation of these systems. In addition, information collected as part of the SFWMD's wetland drawdown study suggests that seasonally inundated wetlands (a majority of the wetlands in the UEC Planning Area) are more sensitive to drawdowns during the wet season, rather than the dry season. The 1998 Plan analysis evaluated drawdowns based on a 12-month 1-in-10 year drought condition, and many potential problems were triggered on drawdowns that occurred during the dry season.
- The demand projections, assumptions and resource protection criteria used in the 1998 Plan analysis were reviewed and compared to current (2003) information and it was determined that the conclusions of the 1998 Plan are applicable today with the current planning horizon of 2025.

District staff and the public recognized that the findings and conclusions of the 1998 UEC Water Supply Plan are still representative of the issues involved in meeting the UEC Planning Area 2025 projected water demands. These findings will be considered in the development of the 2004 UEC Water Supply Plan Update. It was concluded that the analyses in the 1998 Plan is congruent with the 2025 scenario for the 2004 Plan.

CHAPTER 4
Issue Identification

INTRODUCTION

This chapter discusses water supply related issues associated with meeting the 2025 projected water supply needs of the Upper East Coast (UEC) Planning Area. There are many activities currently underway that are addressing these issues, and several others proposed in this Plan. These activities and recommendations will be discussed in **Chapters 5** and **6**.

Several water supply issues were identified in the 2004 Update based on the analysis described in **Chapter 3**, if increased reliance on historically used sources of water were to continue from 1990 demand levels in the UEC Planning Area. The analysis indicated that the Surficial Aquifer in the coastal areas and surface water in the western portions of the planning area would not be adequate to meet the growing needs of the UEC Planning Area during a 1-in-10 year drought condition. Potential impacts on wetlands, as well as the potential for saltwater intrusion, increased using projected demand levels. A more detailed discussion of these follows. However, these problems would not occur in reality; a water use permit would not authorize withdrawals from the Surficial Aquifer if it was determined that withdrawals would cause harm to the resources. In fact, in some areas of the planning area, the use of the Surficial Aquifer has decreased from 1990 levels.

There are also significant riverine and estuarine systems in the planning area. Notably, the St. Lucie River and Estuary, Indian River Lagoon and the Loxahatchee River have unique supply issues. Freshwater discharges from the local watersheds to the St. Lucie River and Estuary and the Indian River Lagoon are problematic in maintaining a healthy estuarine system. The timing and volume of these discharges may have important water supply implications. In addition, large freshwater releases from Lake Okeechobee via the C-44 Canal have a dramatic effect on water quality, including salinity and health of the estuarine system. The Loxahatchee River has been significantly impacted by the creation and maintenance of the Jupiter Inlet, which has contributed to the displacement of freshwater wetland communities by estuarine species. In addition, construction of the C-18 Canal and installation of drainage projects for agricultural and urban development have lowered water tables and reduced the amount of fresh water available to the Loxahatchee River, which have significantly altered natural flow patterns. Efforts are underway in both of these systems' watersheds to address the freshwater flow regimes. The District has initiated rulemaking for the Northwest Fork of

the Loxahatchee River reservation and will begin the same process for the initial reservation for the St. Lucie River and southern Indian River Lagoon in 2004.

UEC WATER SUPPLY ISSUES

Following is a summary of water supply issues in the UEC Planning Area, as well as a map generalizing the aerial extent of some of these depicted in **Figure 7**. **Figure 7** is a compilation of Figures 7, 9 and 10 from the 1998 Plan. Each of these issues is discussed in greater detail following the list.

- Increased withdrawals from the Surficial Aquifer System are limited due to potential impacts on wetlands, as well as the increased potential for saltwater intrusion.
- Surface water availability in the C-23, C-24 and C-25 canals is not sufficient to meet existing and projected agricultural demands.
- Freshwater discharges (minimums and maximums) are affecting the health of the St. Lucie River and Estuary, southern Indian River Lagoon and the Northwest Fork of the Loxahatchee River.

These issues are generally the same as those issues identified in the 1998 Plan. The 1998 Plan identified several strategies, including development of alternative water supplies, to avoid these potential problems. As presented in **Chapter 3**, implementation of recommendations in the 1998 Plan is well underway, including increasing conservation efforts, the use of alternative water supplies and surface water storage and management.

Increased Withdrawals from Surficial Aquifer System Limited

As noted previously, the analyses conducted for the 1998 Plan indicated that the Surficial Aquifer could not support the projected urban water demands much beyond 1990 demand levels, primarily public water supply and landscape irrigation demands (recreational self-supply). Expansion of Surficial Aquifer withdrawals continues to be limited due to potential impacts to wetlands, as well as the increased potential for saltwater intrusion. The Surficial Aquifer is the primary source of water for public water supply and urban landscape irrigation.

Public Water Supply

The analyses concluded that public water supply could not continue to rely solely on the Surficial Aquifer to meet future demands. However, the analyses concluded that future public water supply demands could be met with a combination of Surficial Aquifer water and Floridan Aquifer water without causing harm to the water resources during a 1-in-10 year drought condition. One of the model simulations completed for the 1998 Plan considered a scenario wherein all the 2020 public water supply demands (existing

and projected—64 MGD) were transferred to the Floridan Aquifer. This is in addition to meeting the supplemental water needs (125 MGD) of agricultural users during a 1-in-10 year drought event.

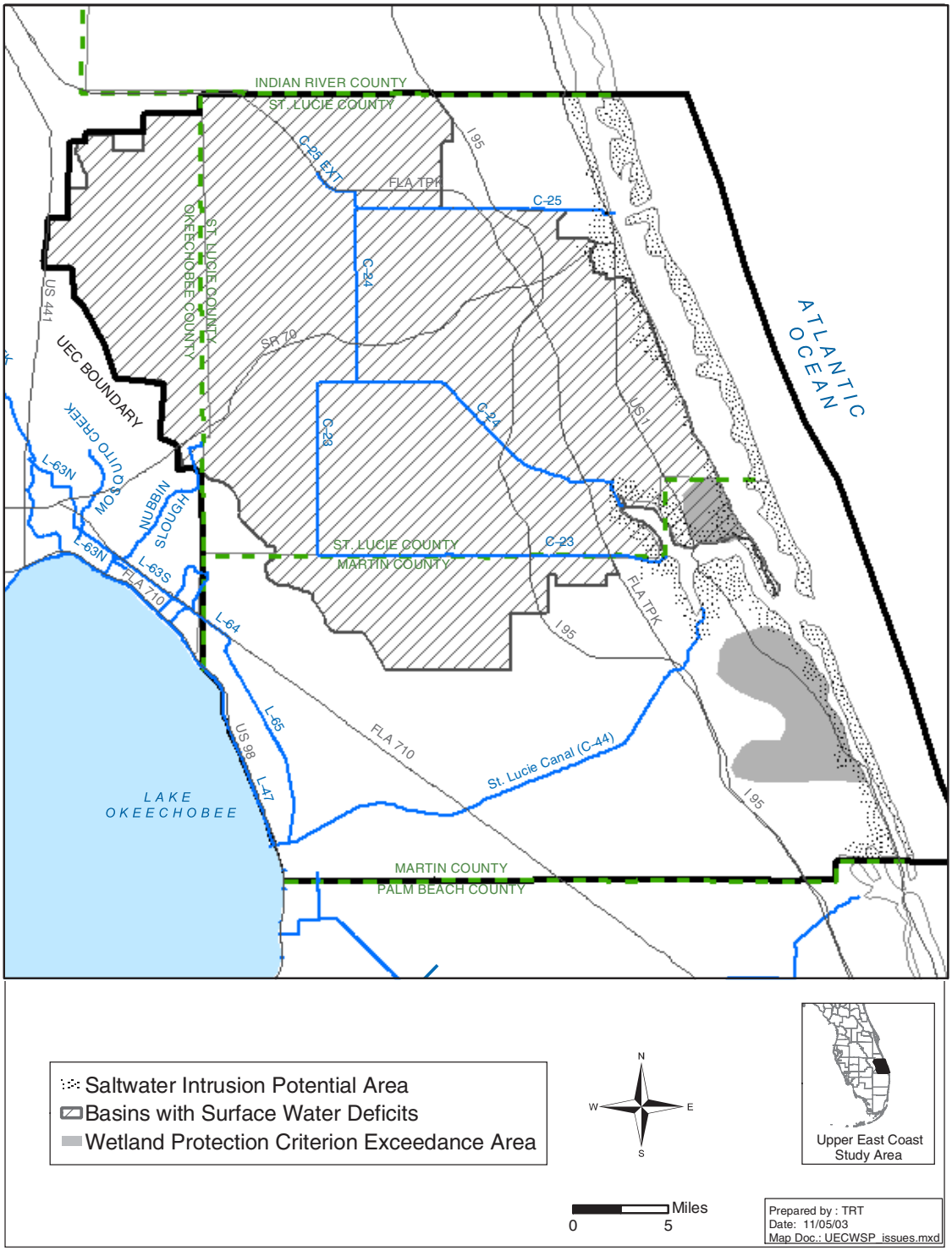


Figure 7. 1998 Upper East Coast Water Supply Plan 2020 Generalized Base Case Potential Supply Issues.

Landscape Irrigation

The analyses concluded that landscape irrigation (recreational self-supply water use category) could not continue to rely solely on the Surficial Aquifer to meet future demands. However, it was also concluded from the analyses that these demands could be met with a combination of Surficial Aquifer water and reclaimed water. Additional localized development of the Surficial Aquifer could be accomplished through modifications to wellfield configurations and pumping regimes with respect to locations of wetlands and salt water. Additional withdrawals from the Surficial Aquifer in these coastal areas will require evaluation on a project-by-project basis. Increases in the use of reclaimed water are expected as the region continues to develop.

Surface Water Availability in the C-23, C-24 and C-25 Canals

The results of the surface water budget analysis in the 1998 Plan verified that the surface water availability during a 1-in-10 year drought condition under the existing canal and storage network is not adequate in the C-23, C-24 and C-25 canals to support existing or projected agricultural water supply demands. However, the historical practice of supplementing surface water supplies with groundwater sources during dry periods, primarily the Floridan Aquifer, was shown to meet existing and future demands. Recent changes in economic conditions within the citrus industry prompted reassessment of the moderate increases in irrigated agricultural acreage projections in the 1998 Plan. Little, if any, growth from 2000 agricultural demand levels is expected.

Construction of storage reservoirs associated with the CERP Indian River Lagoon – South Project will enhance surface water availability, further assuring the needs of the agricultural community, as well as reducing the need for discharges to the estuarine systems.

Freshwater Discharges to Coastal Resources

Existing freshwater flow regimes (minimums and maximums) are affecting the health of the St. Lucie River and Estuary, southern Indian River Lagoon and the Northwest Fork of the Loxahatchee River. Minimum flows and levels have been approved for each of these including development of prevention and recovery strategies, where appropriate. Efforts are underway to create storage in each of these watersheds to better control freshwater discharges and create flow regimes (and salinities) to better support these systems.

St. Lucie River, Roosevelt Bridge

Most of the freshwater inflows to these coastal resources are rainfall driven due to the lack of adequate storage in the watersheds to these systems. Development in the watersheds has reduced historical natural storage areas. This reduction in storage has affected both the timing and volume of inflows. As a result, these systems receive significant inflows in a short period of time during rain events, and very little inflow during dry periods.

As discussed in **Chapter 3**, minimum flows and levels (MFLs) have been established for two natural systems in the UEC Planning Area: the St. Lucie River and Estuary and the Northwest Fork of the Loxahatchee River. Minimum flows and levels for the Loxahatchee River tributaries (Cypress Creek, Hobe Grove Ditch, Kitching Creek and the Loxahatchee Slough) are scheduled to be established in 2007. There are significant efforts underway to create storage in these watersheds and development of rainfall-driven schedules to make meaningful and beneficial water deliveries address maximum flows to these systems.

St. Lucie River and Estuary

Establishing a minimum flow and level alone is not sufficient to maintain a sustainable resource during the broad range of water conditions occurring in the managed system. For the St. Lucie River and Estuary, extended periods of large volume, freshwater flows also impact the resource. Setting a minimum flow is viewed as a starting point to define minimum water needs necessary to protect water resources from significant harm. Within the watershed, the timing and volume of freshwater flows to the St. Lucie River and Estuary have been dramatically changed from historical conditions with land development and canal construction.

The St. Lucie Estuary watershed covers an area of approximately 775 square miles. Three of its major drainage basins are now linked to the estuary by the C-23, C-24 and C-44 canals. The canals convey stormwater runoff from within these basins to the St. Lucie River and Estuary. In addition, the C-44 Canal conveys flood control discharges from Lake Okeechobee to the South Fork of the St. Lucie River. The C-25 Canal and watershed are located in northern St. Lucie County and runoff carried by the canal is discharged directly to the Indian River Lagoon near Fort Pierce Inlet.

North Fork St. Lucie River

The combination of these drainage modifications with land use intensification in the St. Lucie Estuary watershed has dramatically increased wet-season flows to the estuary and significantly reduced dry-season inflows. The reduction of the dry season base flows to the estuary impacts habitats and organisms dependent on brackish or freshwater areas during their life cycle. High volume stormwater discharges produce rapid fluctuations of

salinity, as well as sedimentation. The increase in nutrient and sediment loading has contributed to the build-up of fine-grained, nutrient-rich muck in the estuary. The resultant change in aquatic communities within the estuary consists of more pollutant tolerant benthic organisms and decreases in seagrass and oyster communities.

Construction of storage in the watershed is necessary to capture water during periods of rainfall to reduce peak discharges and maintain salinities within an acceptable range. Implementation of the CERP Indian River Lagoon – South and the Ten Mile Creek projects will provide needed storage to reduce maximum discharges from the watershed to the St. Lucie River and Estuary.

The Project Implementation Report (PIR) for the CERP Indian River Lagoon – South Project presently indicates the District will adopt initial reservations of existing water for the protection of fish and wildlife for the St. Lucie River and southern Indian River Lagoon. The process for adopting these reservations is expected to begin in 2004 and is anticipated to occur over an approximate two-year period.

Additionally, and prior to execution of the Project Cooperation Agreement (PCA), the District will reserve water made available by the CERP Indian River Lagoon – South Project for protection of fish and wildlife. Presently, staff expects execution of the PCA to occur in approximately 2006.

Northwest Fork of Loxahatchee River

The Loxahatchee River has been significantly impacted by the creation and maintenance of the Jupiter Inlet, which has contributed to the displacement of freshwater wetland communities by estuarine species. In addition, construction of the C-18 Canal and installation of drainage projects for agricultural and urban development have lowered water tables and reduced the amount of fresh water available to the Loxahatchee River, which has significantly altered natural flow patterns.

The minimum flow and level for the Northwest Fork of the Loxahatchee River was developed to protect the remaining floodplain swamp community and downstream estuarine resources from significant harm. A restoration plan is being developed. The restoration plan will address the flow regime to the river using a watershed approach. Restoration will include development of goals and targets; construction of the CERP components in northern Palm Beach County and southern Martin County, establishment of minimum flows and levels for contributing tributaries to the river and water reservations. The SFWMD Governing Board authorized initiation of rule development in April 2004 for an initial reservation for the Northwest Fork of the Loxahatchee River. The CERP based project component water reservations will follow construction of the project, and overall water reservations will follow completion of all activities. Establishment of minimum flows and levels for the Loxahatchee River tributaries (Cypress Creek, Hobe Grove Ditch, Kitching Creek and the Loxahatchee Slough) are scheduled for 2007.

The SFWMD Governing Board accepted the Northern Palm Beach County Comprehensive Water Management Plan in May 2002. The plan proposed 48,000 acre-feet of storage conceptually located in the L-8 Basin (L-8 Reservoir). The District has purchased approximately 44,800 acre-feet of storage in the L-8 Reservoir. Construction of the G-160 Loxahatchee Slough Spillway Structure in northeastern Palm Beach County was completed in January 2004, which will provide essential freshwater flows to the Northwest Fork of the Loxahatchee River during the dry season and will also maintain a more natural hydroperiod within the slough.

In addition to these regional efforts, Martin County is involved in several projects to enhance water quality and expand wildlife habitat. These projects include Tropic Vista and Little Club, Pal-Mar/Cypress Creek/Hobe Grove, Cypress Creek, Pal-Mar East and Kitching Creek Restoration. These projects are described in **Chapter 5** of this document in the Surface Water section.

Chapter 5 presents water source options that were considered in this Plan including implementation strategies. **Chapter 6** contains recommendations for implementation of these strategies.

CHAPTER 5
Meeting and Managing Future Water Demands (2000–2025)

In moving from issue identification/analysis to solution development, several water source options were considered to address the water supply issues identified in **Chapter 4**. Eight water source options were initially identified for consideration in the Upper East Coast (UEC) Planning Area to meet existing and future demands. These options either make additional water available from historically used sources or other sources, such as the Floridan Aquifer, or provide improved management of the sources, such as, conservation. The options considered were (no implied priority):

- Aquifer storage and recovery
- Conservation
- Floridan Aquifer
- Reclaimed Water
- Reservoirs
- Seawater
- Surface water
- Surficial Aquifer

Development of each of these options could be the responsibility of regional and/or local entities.

In this chapter, water resource development and water supply development are defined as applied to implementation of the recommendations of this Plan. Presented are the opportunities and roles of each of the source options in meeting the urban, agricultural and environmental water needs on a regional scale. Each water source option is defined and summarized, providing information on estimated costs to develop that option, the quantity of water potentially available from that option and potential implementation strategies. This information is based mostly on the topics that were discussed at the public workshops. The implementation strategies provide the basis for the recommendations in **Chapter 6**.

WATER SUPPLY DEVELOPMENT AND WATER RESOURCE DEVELOPMENT

Chapter 373 of the Florida Statutes (F.S.) requires that water supply plans include a list or menu of water source options for water supply development for local water users to choose from. Each water source option listed should provide the estimated amount of water available for use, along with estimated costs, potential sources of funding and a list of water supply development projects that meet applicable funding criteria. In addition,

water supply plans must also include a listing of water resource development projects that support water supply development. Each water resource development project listed should provide an estimate of the amount of water to become available as a result of that recommendation, a timetable, funding and entities responsible for implementation. The estimated amount of water potentially available and the costs to develop that source from a regional perspective are provided in this chapter. Specific recommendations to develop that source option, costs associated with implementation, a timetable, an estimated amount that would be made for use, the entity responsible for implementation and potential funding sources for each recommendation are contained in **Chapters 6** of this Plan.

Section 373.019, F.S. defines water resource development and water supply development as follows:

> "Water resource development" means the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and groundwater recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities.

and,

> "Water supply development" means the planning, design, construction, operation and maintenance of public or private facilities for water collection, production, treatment, transmission, or distribution for sale, resale, or end use.

For the purposes of this Plan, it was concluded that the District is responsible for water resource development to attain the maximum reasonable-beneficial use of water; to assure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial; and to maintain the functions of natural systems. Local users have primary responsibility for water supply development; choosing water source development options that best meet their individual needs. For an option to be a water resource development project, it should:

- Address more than one resource issue.
- Address a variety of use classes (e.g., environment, public water supply).
- Protect/enhance resource availability for allocation.
- Move water from water surplus areas to deficit areas.
- Apply technology on a regional basis.

For an option to be a water supply development project, it should provide:

- Localized implementation of technology.
- Delivery of resource to consumer.

OPPORTUNITIES AND ROLES

Stakeholders and District staff reviewed the water source options to assess the potential for meeting the water supply needs of the UEC Planning Area. The results are presented in **Table 12**. The table indicates the ability of each option to meet the identified need, except for inland environmental needs. For inland environmental needs, the response shows the ability of that option to reduce demands from the Surficial Aquifer, potentially enhancing nearby natural systems.

The relative ability of each source option in this table was based on regional volumes (supply and demand), and does not universally reflect the publics' sense of importance of that option. For example, significant emphasis was placed on the importance of increased conservation to promote more efficient use of water, although from a regional perspective, the volume of water that could be made available through conservation is low to medium compared to other water source options and the overall need. At the local level, the potential of each option may change based on the specific needs of that local situation. From a volume perspective, options that can significantly (and relatively) make more water available would be scored high. Elements of conservation are incorporated with the use of each of these options.

In **Table 12**, an entry of high (H) indicates the option, based on volume, has a high potential to address the associated category's water supply needs. A medium (M) entry indicates the option has a medium potential, and a low entry means there is low potential to address water supply needs. The high, medium and low entries are relative to one another.

These options are menu items that local water users should consider in meeting their individual water needs. In many cases, several options will be used to meet demands depending on the specific situation.

Table 12. Potential of Water Source Options in Meeting 2025 UEC Water Supply Needs.

Water Source Option	UEC Water Supply Needs					
	Public Water Supply	Recreational Self-Supply	Agriculture	Thermoelectric Power Generation	Freshwater Needs of Estuarine Systems	Inland Environ-mental Needs[c]
Aquifer Storage and Recovery	L	L	L	L	L[d]	L
Conservation[a]	L/M	L	L	L	N/A	L
Floridan Aquifer System	H	L	M	H	N/A	H
Reclaimed Water	L	M	L	H	N/A	H
Reservoirs	L	L	M	H	H	L
Seawater[b]	L	L	L	H	N/A	L
Surface Water	L	L	H	L	H	L
Surficial Aquifer System	M	M	L	L	N/A	L

L=Low; M=Medium; H=High; N/A=Not Applicable

a. Generally cost-effective and although does not yield volumes comparable to other options, is considered highly effective in contributing to long-term, climate-proof resources.
b. Potentially large volume could be made available, but determined not cost-effective at this time.
c. Ability of option to reduce demands from SAS, potentially enhancing nearby natural systems.
d. ASR was not identified as a component in the CERP Indian River Lagoon – South Project.

WATER SOURCE OPTIONS AND STRATEGIES

Each water source option is discussed to identify its potential for use in the UEC Planning Area. For each water source option, the following information is presented: definition and discussion, estimated costs to develop that option, the quantity of water potentially available from that option and potential implementation strategies.

Aquifer Storage and Recovery (ASR)

Aquifer storage and recovery (ASR) is the underground storage of injected water into an acceptable aquifer (typically the Floridan Aquifer System in south Florida) during times when water is available, and the later recovery of this water during high demand periods. The aquifer acts as an underground reservoir for the injected water, reducing water loss to evaporation.

In 2002, there were five ASR wells in the District with operations permits using treated drinking water or partially treated surface water. There were 15 ASR wells under operational testing, and over ten wells under construction. There are no ASR facilities in the UEC Planning Area. In addition to these utility uses, the District, in cooperation with

the U.S. Army Corps of Engineers (USACE), is pursuing regional ASR systems as part of the Comprehensive Everglades Restoration Plan (CERP). Almost 400 ASR wells are planned around Lake Okeechobee and other significant sources of water, such as major canals.

Treated Water ASR

Treated water ASR involves using potable water as the injection water. Since potable water meets drinking water standards, this type of ASR application is more easily permitted. There are many examples in Florida of utilities using treated water ASR, including several in the SFWMD. These include Collier County, Miami-Dade County, Lee County and the City of Boynton Beach Utilities.

Raw Water or Partially Treated ASR

Raw water or partially treated ASR involves using groundwater from freshwater aquifers or surface water. Some treatment may be necessary prior to injection to meet the appropriate standards. Raw water or partially treated ASR is usually discussed in combination with surface water storage, such as a reservoir or canal system. The reservoir or canal system captures excess surface water and provides sufficient volumes of water for the ASR injection cycle. In lieu of withdrawing surface water directly from a surface water body, potential projects may involve installation of vertical and/or horizontal wells, and use of the soil matrix between the water body and well intake for filtration, sometimes referred to as bank filtration. This type of ASR could be used as a supplemental source to reclaimed water for irrigation use.

Reclaimed Water ASR

Reclaimed water ASR involves using reclaimed water as the injection water. Several communities in Florida are interested in reclaimed water ASR and are investigating the feasibility of such a system. In 2002, two utilities in the Tampa Area initiated operational testing of ASR systems using reclaimed water. Some modification to treatment systems or installation of additional treatment components may be necessary to meet applicable standards. There are no reclaimed water ASR wells in the SFWMD.

ASR Wellhead

Fate of Microorganisms in Aquifers Study

The SFWMD, in conjunction with others, is conducting a Fate of Microorganisms Study to evaluate the fate of coliform bacteria and other biological constituents (e.g., bacteria, viruses, protozoa) during storage through ASR wells in brackish aquifers. Limited available data suggests that natural bacterial, geochemical and physical processes that occur underground around an ASR may cause rapid die-off of pathogenic microorganisms, particularly in brackish aquifers prevalent in much of the District. Current Florida Department of Environmental Protection (FDEP) interpretations of the Underground Injection Control (UIC) regulations necessitate treatment to drinking water standards to eliminate coliform bacteria in recharge water. If a reasonable case could be made through testing and monitoring that sufficient treatment occurs naturally in the aquifer within a zone around the well, then recharge pretreatment and associated costs could possibly be reduced. Therefore, efforts to confirm and document such underground natural processes are needed to provide a firm foundation for legislative or regulatory actions that would help to achieve these potential cost savings without jeopardizing groundwater quality or public health. A risk-based comparison of potential benefits may then be performed, including consideration of the cost savings to Florida taxpayers and water consumers, and also any potential risks associated with proposed reduction in pretreatment requirements.

The study is being conducted in a phased approach to further investigate the pathogen die-off phenomenon reported via subsurface storage. During Phase I, a literature search was conducted to document existing literature regarding the fate of coliform bacteria and other biological constituents during subsurface storage. Also during Phase I, laboratory experiments were conducted by investigating the effects of varying temperature and salinity values on pathogenic microorganisms. With the recent completion of Phase I in 2004 having generally positive results, the SFWMD is considering conducting in-situ testing in Phase II of the study with a technique known as diffusion chambers. Diffusion chambers allow water to pass through, but the seeded pathogenic microorganisms are retained within the chamber. Therefore, the chambers can be lowered into a well and the effects of subsurface conditions (i.e., aquifer water quality, geochemistry, native microorganisms, pressure, etc.) can be evaluated, while still protecting public health. Should these tests prove successful, a risk-based strategy could be conducted in the future via Phase III to store non-disinfected water in the subsurface. The District is awaiting approval from regulatory agencies regarding the proposed Phase II work. Once approved, a detailed scope of work would need to be developed before Phase II work could commence.

Aquifer Storage and Recovery – Estimated Costs

Estimated costs for an ASR system depend on the type of the ASR system. Estimated costs for a 2-MGD potable water ASR system and a 5-MGD surface water ASR system are provided in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Document*. A 2-MGD drinking water ASR system has an estimated total

construction cost of $990,000 and an annual operations and maintenance cost of $83,300. This equates to a cost of about $0.44 per 1,000 gallons. A 5-MGD surface water ASR system with microfiltration has an estimated total construction cost of $6.54 million and an annual operations and maintenance cost of $364,781. This equates to a cost of about $1.05 per 1,000 gallons.

The potable water cost information assumes the ASR well will be located at the water treatment plant site and have a 70 percent recovery rate. The surface water ASR cost information assumes the ASR facilities will be located at a remote site with microfiltration treatment of the water being injected, and a 70 percent recovery rate.

Aquifer Storage and Recovery – Quantity of Water Potentially Available

The volume of water that could be made available through ASR wells depends upon several local factors, such as well yield, water availability, variability in water supply and variability in demand. Without additional information, it is not possible to accurately estimate the quantity of water that could be available through ASR. Typical storage volumes for individual wells range from 10 to 500 million gallons per cycle or 31 to 1,535 acre-feet (Pyne, 1995). Where appropriate, multiple ASR wells could be operated as a wellfield, with the capacity determined from the recharge and/or recovery periods. The storage time is usually seasonal, but could be used long-term or for emergency events. The volume of water that could be made available by any specific user must be determined through the District's Consumptive Use Permit (CUP) Program.

Aquifer Storage and Recovery – Implementation Strategies

The following is a potential strategy developed in cooperation with the public that will be considered in the development of plan recommendations regarding ASR:

- Utilities should explore ASR, among other options, to extend the use of current resources in order to meet future demands, including addressing peaks in demands or in availability of resources. Aquifer storage and recovery could be used to extend water supplies during peak demand periods.

Conservation

The overall water conservation goal of the state is to prevent and reduce wasteful, uneconomical, impractical or unreasonable use of water resources, pursuant to Section 62-40.412, of the Florida Administrative Code (F.A.C.). As an alternative to the development of new water supply, water conservation programs can provide additional water from traditional sources, usually at a lower cost. The least-expensive water is the water that utilities have already developed.

In this section, conservation refers to long-term reductions that generally result from implementation of water saving technologies, such as ultralow flow plumbing,

irrigation rain sensors and water pricing strategies that encourage efficient water use. This is in contrast to short-term water conservation measures and cutbacks made by users during water shortage situations.

The 1998 UEC Water Supply Plan (1998 Plan) concluded that historically used sources of water, primarily fresh groundwater sources, are not sufficient to meet the projected demands through the planning horizon. The 1998 Plan recommended new sources of water be explored and used, including the Floridan Aquifer System (FAS). Increased use of reclaimed water and increased water conservation and research was recommended to meet the projected demands and to reduce the potential for harm to wetlands and water resources. The Plan also recommended more efficient use of water by increasing urban and agricultural water conservation and developing cost-sharing partnerships. Since 1998, the District has supported mobile irrigation labs in the planning area and has educated the region's water users through water conservation outreach and education programs provided by the SFMWD Martin/St. Lucie Service Center.

Conservation is vitally important for the fast-growing UEC Planning Area. Population in the region is projected to increase by about 50 percent from 2000 to 2025. More and more, water conservation is being regarded as an important component in integrated water resource management. In addition to offsetting demands on traditional water resources and reducing impact on natural systems by developing alternative water supplies, such as desalination, ASR and reclaimed water for reuse, water conservation or demand reduction, has become a factor in managing water resources. Measures to use water more efficiently can be less expensive than projects to increase supply and have other important advantages, such as reducing stress on natural systems. Water saved can be used to meet new needs, in effect expanding current water supplies and protecting the environment. In addition to environmental benefits and augmenting water supplies, water conservation projects are often easier to implement than supply projects due to uncomplicated permitting, lower costs and acceptance by the public.

Evaluating Conservation in the Water Supply Planning Process

Statewide, in concert with the FDEP, water management districts agreed to conduct evaluations of water conservation in the water supply planning process. Water conservation is regarded as a potential source of supply, and as such, estimates of supply are performed through evaluation of data and potential best management practices. These evaluations include an assessment of water conservation opportunities in the planning area and potential measures for improving water use efficiency, assessment of the measures determined to be the most feasible and programs to implement the alternative(s). Recommendations include funding sources, responsible parties and timetables. Potential for water conservation measures can be found in each of the following sectors:

1. Agricultural Irrigation
2. Landscape Irrigation
3. Water Pricing
4. Industrial/Commercial/Institutional
5. Indoor Water Use
6. General Policy Considerations

This process, including the sectors, is an outgrowth of the Florida Water Conservation Initiative completed in 2002. This state initiative was spurred by Florida's rapidly growing population and recent experience of one of the worst droughts in state history. The initiative developed and ranked a series of conservation recommendations. The information presented in this conservation section is organized based on the previously stated sectors. The state water conservation initiative is explained in greater detail next.

A Statewide Effort: Florida's Water Conservation Initiative

In response to growing water demands, water supply problems and one of the worst droughts in Florida's history, the FDEP led a statewide Water Conservation Initiative (WCI) to find ways to improve efficiency in all categories of water use. Hundreds of stakeholders participated in the WCI, which addressed all water use classes, and subsequently offered alternatives to save water. Fifty-one cost-efficient alternatives were published in the document entitled *The Florida Water Conservation Initiative* (FDEP, 2002a). A full list of the 51 alternatives may be found in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Document*. In addition to policy and regulatory measures, the following six alternatives were the highest-ranked of the WCI alternatives:

Agricultural Irrigation presents many opportunities for improved efficiency. Key among these are cost-share programs to implement irrigation best management practices, increased use of mobile irrigation labs to evaluate irrigation efficiency, improvements in the recovery and recycling of irrigation water and greater use of reclaimed water for irrigation.

Landscape Irrigation for watering lawns, ornamental plants and golf courses can be significantly reduced through more efficient irrigation system design, installation and operation, and by reducing the amount of landscaping that requires intensive irrigation.

Water Pricing or rate structures, informative utility billing and other techniques can send appropriate price signals to encourage water users to conserve water.

Industrial, Commercial and Institutional users can improve water use efficiency through certification programs for businesses that implement industry-specific best

management practices, and through water use audits, improved equipment design and installation and greater use of reclaimed water.

Indoor Water Use is a growing water use sector. The greatest potential for conserving water in this sector is through increasing the number of Florida homes and businesses that use water-efficient toilets, clothes washers, showerheads, faucets and dishwashers.

Reuse of Reclaimed Water can be used more efficiently through pricing and metering. Metering of reclaimed water use and implementation of volume-based rates for reclaimed water is a major strategy contained in the *Water Reuse for Florida – Strategies for Effective Use of Reclaimed Water Report* to promote efficient use of reclaimed water (Reuse Coordinating Committee, 2003).

A comprehensive, statewide water conservation effort has been initiated to implement the recommendations of the WCI including incorporation of conservation into the water supply planning, regulatory and utility facilities planning processes. The public water supply recommendations of the WCI are being pursued through an agreement among key water supply partners in the state.

Comprehensive Water Conservation Program

To best implement the recommendations of the WCI concerning public water supply, a Joint Statement of Commitment was developed. The agreement outlines the responsibilities of the state, through FDEP, in overseeing a statewide comprehensive water conservation program, as well as the roles of the water management district and utilities. The overarching goal of the entire effort is to produce a statewide program consisting of measurable, accountable and goal-based conservation activities appropriate for each utility's user profile.

The "Joint Statement of Commitment for the Development and Implementation of a Statewide Comprehensive Water Conservation Program for Public Water Supply" (JSOC) is a written agreement by key water supply partners in Florida to collaborate on measures to improve water use efficiency. A copy of the "Joint Statement of Commitment" may be obtained from the Florida Department of Environmental Protection Office of Water Policy available from: http://www.dep.state.fl.us/water/waterpolicy.

Improved water conservation will benefit all water users, both economically and environmentally, and will also help to ensure the sustainability of Florida's water resources. Allowing public water supply utilities the flexibility to tailor cost-effective, goal-based, accountable and measurable water conservation programs to reflect individual circumstances will result in greater water use efficiency.

The signatories of the Joint Statement are the Florida Department of Environmental Protection; the South Florida Water Management District; the St. Johns River Water Management District; the Southwest Florida Water Management District;

the Northwest Florida Water Management District; the Suwannee River Water Management District; the Florida Public Service Commission; the Utility Council of the American Water Works Association, Florida Section; the Utility Council of the Florida Water Environment Association; and the Florida Rural Water Association.

Based on the principles of the Joint Statement, the signatories are now developing a work plan with specific tasks, interim milestones, completion dates, cost estimates and assignments of responsibilities. The work plan is to be completed by February 2005 and will include recommendations for:

- Developing standardized definitions and performance measures for water conservation data collection and analysis.
- Establishing a clearinghouse for water conservation that will provide an integrated statewide database, technical assistance capabilities and continual assessment of the effectiveness of water conservation programs and practices.
- Developing and implementing a standardized water conservation planning process for utilities.
- Developing and maintaining a Florida-specific water conservation guidance document.
- Implementing pilot applications of various elements of the program, or the entire program, through cooperative agreements with volunteer utilities.

2004 Legislation

During the finalization of this Plan, legislation was passed incorporating and codifying the development of the statewide water conservation program for public water supply. The bill provides goals that must be addressed as part of the program, encouraging conservation by utilities. One important part of the program requires development of a water conservation guidance manual designed to assist utilities as they implement their specific water conservation plans to satisfy water management district requirements for consumptive use permits. Other aspects of this legislation address guidelines for Xeriscape™ landscaping and development of a model ordinance to be used statewide to increase landscape irrigation efficiency. In addition, the new legislation allows water management districts to require the use of reclaimed water, if feasible, and to encourage metering of newly implemented reuse projects, enabling utilities to charge for actual volumes used. The requirements in this legislation will be addressed during the implementation of this Plan.

Assessing Water Conservation Opportunities in the UEC Planning Area

The initial assessment of water conservation opportunities in the planning area began with staff considering all 51 recommendations of the WCI. The second step of the assessment was to determine the highest-ranked most applicable and implementable

alternatives. Alternatives that may have been ranked highly by the WCI, but were outside the scope of this water supply plan or the District's authority to require, assist or fund, were not analyzed. For example, high-efficiency kitchen appliances are activities more suited to implementation by utilities and local governments. The complete evaluation of all of the WCI recommendations can be found in Appendix E. The initial assessment considered the six water conservation sectors outlined previously in this section.

Agricultural Irrigation. Agricultural irrigation is the largest water use category in the UEC Planning Area. There are several potential water conservation opportunities in agricultural conservation, including irrigation system conversion, water table management and other best management practices. The existing agricultural mobile irrigation laboratory plays an important role in facilitating more efficient use of water within agriculture.

Landscape Irrigation. Landscape Irrigation includes statewide standards for landscape irrigation and includes the development and adoption of standards, with inspections, and is the responsibility of the state, under the Florida Building Code. Educational and outreach programs on water efficient landscaping are conducted by the Cooperative Extension Services of the University of Florida, Institute of Food and Agricultural Sciences (IFAS).

Xeriscape™

The District is a funding partner of IFAS research for determining water needs of woody ornamental plants. This research, started in 2003, will provide important data for establishing water shortage restrictions and for establishing water budget recommendations, as cited in the Florida WCI Report. In addition, House Bill 293 (2004 Legislature) will require a statewide program to develop and implement Xeriscape™ landscape irrigation standards for design, installation and operation. The District will participate in this process and work with local governments to adopt a consistent ordinance, which will ensure efficiency in urban irrigation systems.

Water Pricing. Water conservation rate structures have been required by SFWMD rule since 1993. The District's consumptive use permitting process for water utilities requires water conservation-based rates. Recent water conservation legislation (HB293) precludes water management districts from setting rates. All the planning region's utilities employ a conservation-based rate structure in their pricing. A statewide study funded by Florida's water management districts was initiated in 2003 to evaluate the effectiveness of the rate structures currently employed by utilities. In addition to analyzing the impact of conservation-based water pricing on revenues, the study will analyze the effect of these rate structures

on water use; participating utility customers will be surveyed. The study is scheduled for completion in 2005.

Industrial/Commercial/Institutional. Industrial/Commercial/Institutional water use in the UEC Planning Area represents a minor portion of the overall demand, and in the initial assessment, was not considered significant enough to warrant detailed evaluation.

Indoor Water Use. Indoor water use accounts for a major portion of demands on public water supply. Plumbing retrofit programs were one of the WCI's highest-ranked alternatives and were recommended in the 1998 Plan. This alternative is assessed in detail in the Indoor Water Use section of this chapter, using specific data for each county in the UEC Planning Area.

General Policy Considerations. The role of education and outreach programs and the effect of cooperative funding programs, such as mobile irrigation labs and other agricultural irrigation programs were reviewed to assess the potential for water conservation in the UEC Planning Area. The District's permit requirements were also considered for conservation and technology-based conservation cost-shares for projects that increase water efficiency.

Education and Outreach. Each of the sectors of water use has necessary outreach and education components. Although quantification of a specific amount of water saved as a result of an outreach and education effort is not as readily measured, as with water saving devices or technology, outreach and education are crucial to any successful conservation program.

Comprehensive outreach and education programs usually involve three steps: awareness, education and adoption of action. *Awareness* is the process of conveying to users an awareness of their behavior (i.e., water use), and communicating the importance of conserving the resource. The next step, *education*, consists of providing appropriate information to users to enable them to understand that taking an action or embracing a concept will result in water savings and/or other benefits. The last step, *action*, results when the user is aware and educated and is actively seeking a solution to conserve. This final step prepares users for technology-based alternatives.

Successful outreach and education efforts usually consist of cooperation between many agencies and organizations. For example, outreach through school education can provide the basis of long-range acceptance and action of the conservation message by future generations. Public water supply utilities can play an important role through their customer service and billing processes. The District and the other participating state agencies have consistently provided assistance to the wide range of water users through outreach and education programs.

Mobile Irrigation Laboratories. Mobile Irrigation Laboratories (MILS), specialized labs on wheels, provide recommendations to improve irrigation systems, and are discussed in greater detail later in this chapter. Irrigation labs are excellent examples of cooperative funding partnerships, often involving federal, state and local entities, which also provide education and outreach.

Agricultural Irrigation Cost-Sharing Programs. Cost-Share Incentive was a highly ranked alternative by the WCI stakeholders. Traditionally, agricultural cost-share incentives have been funded through state and federal agencies (e.g., Florida Department of Agriculture and Consumer Services and the U.S. Department of Agriculture – Natural Resources Conservation Service). Example programs include agricultural irrigation system retrofits employing efficient technologies.

Water Savings Incentive Program (WaterSIP). The SFWMD provides cost-share funding for programs that employ devices to increase water savings. The Water Savings Incentive Program (WaterSIP) was established in Fiscal Year (FY) 2002 to provide funding for projects that conserve water. The WaterSIP focuses on projects that are not capital improvements, such as installing automatic shutoff devices for irrigation systems and plumbing retrofits. To date, the WaterSIP has committed a total of $700,000 in cooperative funding for 19 projects. The program is Districtwide, and will save hundreds of thousands of gallons of water each day. For example, the eight projects funded in FY 2003, once installed, will save an estimated 171 million gallons per year (MGY). Projects are identified for funding through a Request for Proposals solicitation and project selection process. In addition to public water suppliers, other entities wishing to cost-share in water saving programs are eligible, such as homeowner's associations and public/private partnerships. There have not been any WaterSIP proposals submitted in the UEC Planning Area through FY 2004, although several regional proposals are currently being recommended for funding in the FY 2005 budget.

Projects that are identified through the evaluation of water conservation alternatives that present the best opportunity for water savings for the UEC Planning Area will likely score higher in the proposal criteria for the WaterSIP. The District also provides cost-share funding for utilities and local government outreach and education activities. The SFWMD's Regional Service Centers provide coordination and education for outreach projects for the general public or specific use sectors.

The WaterSIP is separate from Chapter 40E-2, F.A.C. and the *Basis of Review for Water Use Permit Applications,* which is currently under rulemaking to support goal-based water conservation programs for utilities. Under the proposed rule, a utility would submit a comprehensive water conservation program plan, which commits to conservation measures that may be partially

funded under the criteria guidelines of both the WCI and WaterSIP.

Regulatory Measures. The SFWMD water use permitting rule amendments adopted in January 1993 require specific water conservation elements for public water supply utilities (and associated local governments), commercial/industrial users, landscape and golf course users and agricultural users. The requirements are summarized in **Table 13**. These requirements must be addressed to obtain individual water use permits. For more information on regulatory water conservation measures, please refer to the *DRAFT Consolidated Water Supply Plan Support Document* (SFWMD, 2004b).

Consumptive use permitting requires a leak detection and repair program for any utility with more than 10 percent unaccounted for water.

In addition, 2003 revisions to the *Basis of Review for Water Use Permit Applications* requires all permittees with a maximum monthly allocation of greater than 3.0 million gallons in the UEC Planning Area to monitor and report withdrawal quantities from each withdrawal facility or point of diversion upon renewal of their water use permit. Proper accounting for water use is essential to establish reasonable-beneficial use of the resource, which is in the interest of the public. In addition, proper accounting of various water uses enables the District to better estimate water use and to implement water shortage plans. At this time, many of the irrigation permits in the planning area are going through a renewal process, which should be completely by the end of 2004. A better understanding of actual water use will also assist in identifying potential water conservation opportunities.

Rulemaking efforts are underway at the District to consider goal-based conservation as a permit condition. In 2002, workshops were held in the UEC Planning Area, as well as others, concerning revisions to Chapter 40E-2, F.A.C., and the *Basis of Review for Water Use Permit Applications* to require goal-based conservation programs developed by individual water utilities. Goal-based conservation allows utilities to achieve a water management district agreed-upon conservation goal, such as a reduction in per capita or overall reduction in pumpage, using any method from a suite of methods the utility chooses, to satisfy consumptive use permitting conservation requirements. These programs would be in addition to the existing requirements discussed in the next section.

Table 13. Regulatory Conservation Measures.

Public Water Supply Utilities	Commercial/ Industrial Users	Landscape/ Golf Course Users	Agricultural Users
1. Adopt irrigation hours ordinance 2. Adopt Xeriscape™ landscape ordinance 3. Adopt ultralow volume fixtures ordinance 4. Adopt rain sensor device ordinance 5. Adoption water conservation-based rate structure 6. Implement leak detection and repair program 7. Implement water conservation public education program 8. Analyze feasibility of reclaimed water	9. Audit water use 10. Implement cost-effective conservation measures 11. Implement employee conservation awareness program 12. Develop an implementation plan 13. Analyze feasibility of reclaimed water	14. Use Xeriscape™ for new and modified projects 15. Install rain sensor devices or switches 16. Irrigate between 4 p.m. and 10 a.m. only 17. Analyze feasibility of reclaimed water	18. Use microirrigation for new and existing systems 19. Analyze feasibility of reclaimed water

Detailed Evaluation of the Most Feasible Alternatives – UEC Water Supply Plan

As stated earlier, the 1998 UEC Water Supply Plan recommended plumbing retrofits for both interior plumbing fixtures and rain sensors for automatic landscape irrigation systems; continuation/expansion of the MIL Program; and voluntary conversion of agricultural seepage irrigation systems to microirrigation in the UEC Planning Area. Based on consensus from stakeholders and the analysis associated with this Plan, it was concluded that the 1998 Plan recommendations remain valid and should continue to be implemented.

As previously mentioned, the recommended options were selected from the WCI list of potential conservation measures. These are the methods best suited to the scope of the regional water supply plan. Options with the greatest potential water savings were identified; relevant information was assembled, such as laws, ordinances and District rules, and age of housing stock in the UEC Planning Area were considered and analyzed. An analysis of potential conservation water savings was performed. Funding mechanisms for the recommended alternatives are also discussed in this section.

Agriculture Irrigation Conservation

Citrus is the dominant crop in the UEC Planning Area. Over 80 percent of the citrus acreage in the planning area is now using low-volume technology or microirrigation as compared to 71 percent in 1998, the remaining acreage uses flood irrigation. Much of the acreage currently using flood irrigation is located in Chapter 298 Districts (Chapter 298, F.S.) where several growers use a method of rain harvesting which recycles water after each use and moves it from one citrus grove to another. Conversion of citrus acreage now using flood irrigation to microirrigation will continue to increase water savings

From a local perspective, additional water harvesting can be achieved from on-site stormwater management systems that capture rainfall for irrigation use. From a regional perspective, the CERP Indian River Lagoon – South Project incorporates regional scale reservoirs in the UEC Planning Area to capture rainfall from the regional canal system that would otherwise flow into the St. Lucie River and Indian River Lagoon Estuary. The primary purpose of the regional reservoirs is to attenuate discharges from the regional canal system to reduce water quality impacts to the estuary. A secondary benefit of the regional reservoirs is increased surface water availability in the planning area.

Citrus Groves in UEC

Since 1992, the U.S. Department of Agriculture – Natural Resources Conservation Service (USDA–NRCS) and the Indian River Lagoon Mobile Irrigation Lab have been promoting water conservation through conversion of flood irrigation systems to low-volume technology. The USDA–NRCS has facilitated these conversions by cost-sharing, using the Environmental Quality Improvement Program (EQIP). In 2003, over 80 percent of citrus acreage in the region has been converted.

In 2004, the District responded to a request from IFAS to become a funding participant in the Florida Automated Weather Network (FAWN). This network of weather stations provides real-time and historical data to water users (agricultural, as well as urban landscape) for making informed irrigation decisions.

Agricultural Best Management Practices (BMPs)

The Best Management Practices (BMP) Program was developed to help farmers improve water quality. The BMP programs are voluntary, developed in cooperation with specific agricultural commodity groups. The commodity groups that presently have BMP programs in place or under development are Cattle, Citrus (Indian River area and Ridge

area), Green Industries (landscape, nurseries and golf courses), Horses, Silviculture (forestry) and Vegetables.

The statewide BMP Program is authorized by Section 403.067, F.S. and the specific authority for the Indian River Citrus BMP Program in Rule 5M-2, F.A.C. Section 403.021, F.S, mandates SFWMD involvement in the BMP Program.

The Indian River Area Citrus BMP is the most significant program in the UEC Planning Area. Examples of BMPs for the Indian River Area Citrus include scheduling of irrigation and drainage, monitoring of soil moisture and water table management. There has been a high level of enrollment in the voluntary program in the UEC Planning Area. **Table 14** shows the percentage of citrus acres enrolled in the program by county.

Table 14. Percent of Citrus Acreage Enrolled in the Indian River BMP Program in the UEC Planning Area.

County	Potential Acres[a]	Enrolled Acres	Percent Enrolled
Martin	44,746	33,576	75%
Okeechobee[b]	12,170	9,349	77%
St. Lucie	98,889	93,272	94%
Total	155,805	136,196	87%

Source: Florida Department of Agriculture and Consumer Services (FDACS) Notice of Intents Status Reports, 2003.
a. Florida Agricultural Statistics Service data.
b. Includes all of Okeechobee County.

One of the major incentives to join the program is a cost-sharing arrangement with Florida Department of Agriculture and Consumer Services (FDACS) on implementation costs.

Several state, federal and local agencies are involved in the program. The BMP program is administered by FDACS. The FDEP sets allowable pollution limits called Total Maximum Daily Loads (TMDLs) for nutrients. Resource Conservation and Development Corporations and Soil and Water Conservation Districts provide local support for BMP programs. The University of Florida IFAS evaluates individual grove owners' BMP compliance and has written the *Water Quality/Quantity BMPs for Indian River Area Citrus Groves*. The USDA–NRCS provides technical assistance and some additional cost-sharing for the program. The SFWMD provides financial and technical assistance for the program startup.

Mobile Irrigation Lab Program

The Mobile Irrigation Lab (MIL) Program began in south Florida in 1989 with an agricultural lab on the Lower West Coast. The mission of the labs is to demonstrate and educate agricultural and urban water users on how to irrigate efficiently. There are currently nine labs operating in 11 of the 16 counties within the SFWMD boundaries.

Funding is a multi-agency partnership between federal, state, regional and local levels of government. The agencies currently funding MILs are the USDA–NRCS, the SFWMD and the SFWMD's Big Cypress Basin Board, various Soil and Water Conservation Districts, the FDACS and various county and local governments. Over the past four years, recommendations for improvements to irrigation systems have yielded average annual potential water savings of 3.35 billion gallons per year. Plans to start additional labs within the District's boundaries are underway.

In the UEC Planning Area, there are two urban labs, one in St. Lucie County and one in Martin County. There is also an agricultural lab that provides evaluations in both St. Lucie and Martin counties. The St. Lucie County urban lab has been in operation since 2000. The urban lab in Martin County has been in operation since 1998. Together, these urban labs have saved about 370 MGY since their inception. The agricultural lab has performed evaluations since 1992; since 1998, the lab has saved 2,367 MGY.

Urban Water Conservation

Utilities in the UEC Planning Area have promoted water conservation through traditional methods, such as public outreach and customer information. The utilities in this region have implemented CUP Program water conservation requirements as previously described, resulting in implementation of water conservation programs and adopted conservation ordinances.

Several utilities have conducted small-scale retrofit projects. In this Plan, a more detailed analysis of supplementary water conservation practices/projects will be discussed to offer recommendations to expand efforts of the region's water suppliers.

The approach to evaluating the best conservation measures for the UEC Planning Area was an iterative one. The evaluation process entailed identifying characteristics of the planning area, such as age of housing stock, that would likely determine the type or respective age of technology of indoor plumbing devices, and characterizing use patterns by service area and per capita trends (**Table 15**).

Table 15. Examples of How Alternatives are Evaluated.

Planning Area Housing Characteristic	Best Opportunity	Conservation Measure
Indoor - older housing with inefficient indoor plumbing fixtures	Retrofits	Plumbing (e.g., toilets, showerheads, etc.)
Outdoor - irrigation systems that do not respond to rainfall	Retrofits	Rain shut-off switches
New development	Local ordinances/ codes/regulatory measures	Varies from code enforcement to landscape technology, such as Xeriscape™

Indoor Water Use

Two significant changes occurred in plumbing standards in 1983 and 1994, which affected residential water use. In 1983, Chapter 553, F.S., was modified, lowering the maximum allowable flow rates for water fixtures in new construction to a maximum use of 3.5 gallons per flush for toilets and a flow rate of 3.0 gallons per minute (GPM) for showerheads. Prior to this state legislation, the typical volume of water for toilet flushing was 6.0 gallons and showerhead flow was 6.0 GPM.

In 1994, new plumbing standards for water use were implemented under the Federal Energy Policy Act of 1992, setting national plumbing code standards of 1.6 gallon per flush for toilets, 2.5 GPM for showerheads and 2.0 GPM for faucets.

Methodology

In order to determine urban areas with the greatest potential for retrofits in the UEC Planning Area, a housing stock analysis was performed using age of housing as a determinate of the age and water use characteristics of plumbing fixtures. County property assessors parcel data for Martin and St. Lucie counties provided the number and age of residential units.

To determine housing with greater potential for indoor retrofits, age of the residential units was compared to years when the plumbing code changed as described previously (pre-1984, 1984–1994, 1994–2000). **Table 16** shows the number of units and percentages of housing in each group for Martin and St. Lucie counties.

Table 16. Age of Housing Stock in Martin and St. Lucie Counties (Indoor Retrofit).

County	Housing Stock			
	Pre-1984	1985-1994	Post-1994	Total
Martin	25,435 59%	14,250 33%	3,717 8%	43,402
St. Lucie	30,844 49%	24,474 39%	7,561 12%	62,879
Totals	56,279 53%	38,724 36%	11,278 11%	106,281

Costs and Savings

Utilities that would benefit most from plumbing fixture retrofits are those with significant housing in the pre-1984 age category, and thus, have the most potential for indoor water savings.

In Martin County, ten of 16 utilities had a majority of housing stock in their service areas that was older than 1984. For the remaining six utilities, the majority of housing stock in their service areas was older than 1994. In St. Lucie County, four of nine

utilities had a majority of housing stock older than 1984. A complete listing of housing stock by age and utility service area can be found in Appendix E.

Water savings derived from retrofitting pre-1984 housing to current standards is 4.4 gallons per flush for toilets, and 3.5 GPM for showerheads. Toilets are estimated to be flushed five times a day, with ten minutes per shower as a standard estimate. According to the 2000 U.S. Census, number of persons-per-household was 2.23 in Martin County and 2.47 in St. Lucie County.

Therefore, annual savings from retrofitting one unit from the pre-1984 technology to current standards would be 32,000 gallons for each retrofitted showerhead and 20,075 gallons for each retrofitted toilet.

For the purposes of this approach, it is assumed that a retrofit program would include 75 percent of the pre-1984 housing stock. This percentage is typically used as an estimate of expected coverage in an urban retrofit program, as some retrofits have already been done, some units are vacant or on the market, or for other reasons will not be part of the program. Using the county housing age data in **Tables 16** and **17**, and assuming the 75 percent retrofit, the total potential annual savings of a showerhead retrofit is 1.7 MGD for Martin County and 2.0 MGD for St. Lucie County for a total of 3.70 MGD for the planning area.

Similarly, using the housing age data in **Tables 16** and **17**, and assuming the 75 percent retrofit, total annual savings of a toilet retrofit for Martin County is 1.0 MGD and 1.3 MGD for St. Lucie County, for a total potential savings of 2.3 MGD for the planning area.

Total annual savings for both toilet and showerhead retrofit is 2.7 MGD for Martin County and 3.3 MGD for St. Lucie County for a total potential savings of 6.0 MGD. This estimate assumes one retrofit of each device per housing unit.

Costs for toilet retrofits are $200 per retrofit, and $20 per showerhead, as described in the *DRAFT Consolidated Water Supply Plan Support Document*. Water conservation cost-efficiency is expressed in 1,000 gallons of water saved annually. Toilet retrofits cost $.25 per 1,000 gallons of water saved, and showerhead retrofits cost $.06 per 1,000 gallons of water saved.

Whenever indoor water use is reduced, there is also a reduction in wastewater. Wastewater flows have been estimated to be as much as 50 percent of residential water use. Impacts to wastewater treatment facilities and the need for expansion and disposal can be reduced if water use is reduced.

Landscape Irrigation

Methodology


Rain Sensor

For this evaluation, water savings derived from installation of rain sensors for housing stock built prior to 1992 is estimated. Based on the county housing age data in **Tables 16** and **17**, and assuming 75 percent of the housing units are retrofitted, a total savings of 5.0 MGD was estimated for the planning area (2.1 MGD for Martin County and 2.9 MGD for St. Lucie County).

Installing rain sensors in irrigation systems of housing units constructed prior to the 1991 Xeriscape™ Landscaping law would result in the greatest savings. For those systems using reclaimed water, additional efficiencies can be realized using metering. Data for **Table 17** were obtained from county property assessors parcel data as previously described. A complete listing of housing stock by age and utility service area can be found in Appendix E.

Table 17. Age of Housing Stock in Martin and St. Lucie Counties (Rain Sensor).

County	Housing Stock		
	Pre 1992	Post 1992	Total
Martin	37,920 87%	5,482 13%	43,402
St. Lucie	52,540 84%	10,339 16%	62,879
Total	90,460 85%	15,821 15%	106,281

To determine housing with the greatest potential for outdoor retrofits, age of the housing unit was compared to the law related to rain sensor changes (pre-1992 and post-1992). The percentages of units constructed in the two time periods are described for each county. A 1987 SFWMD Survey of Water Use indicated that 70 percent of all residential irrigation in the District is done by in ground automatic irrigation systems, which are required to have a rain sensor as reflected in the law.

Costs and Savings

Rain sensors can provide a significant reduction in water use for nominal cost. The cost is estimated to average $68 per rain sensor including installation, and can save 27,000 gallons per year. This equates to a cost of $0.25 per 1,000 gallons. The useful life

of a rain sensor is estimated to be 10 years. Areas benefiting the most from a rain sensor retrofit program would be pre-1994 housing units with in-ground irrigation systems.

Urban Mobile Irrigation Labs

In the UEC Planning Area, there are two urban labs, one in St. Lucie and one in Martin County. Mobile irrigation lab personnel evaluate the effectiveness of irrigation systems and then make recommendations on how the system can be made more efficient. The result is savings in water, energy, time and money for the user.

Conservation – Quantity of Water Potentially Available

Table 18 highlights three examples of public water supply utility characteristics, and a culling of the best-fit water conservation measures recommended for each utility area characteristic.

The estimated amount of water that could potentially be conserved in the planning area is 10.7 MGD for urban use within the 20-year planning horizon as a result of retrofit conservation measures. Achieving this savings is highly dependent on cooperating utilities. The District will continue to provide WaterSIP funding and increased technical assistance and outreach. Savings may vary from year to year as programs are implemented.

The District will actively engage in devising programs for retrofits. For example, the City of Stuart, expecting build-out during the planning horizon, may employ conservation along with reuse to continue use of the Surficial Aquifer System as their water source. The District has dedicated outreach specialists and intergovernmental representatives to assist utilities, local governments and water users to achieve the goals of this Plan.

Table 18. Recommended Measures for Conservation for Planning Region.

Housing Stock Characteristic	Conservation Measure	Water Savings per Retrofit Device	Cost per Device	Cost per 1,000 gallons	Planning Area Savings Based on Retrofit of 75% of Characteristic Housing Stock
Housing Built Before 1984	Showerhead retrofit	3.5 gallons/minute	$20	$.06/1,000	3.5 MGD
	Toilet retrofit	4.4 gallons per flush	$200	$.25/1,000	2.2 MGD
Pre-1992 Outdoor Irrigation Systems Without Rain Sensors	Rain sensor installation	74 gallons/day	$68	$.25/1,000	5.0 MGD
Planning Area Savings					10.7 MGD

Table 19 provides a general list of recommended conservation measures that would be effective in different types of utility service areas based on the population growth rate, housing stock and potential for growth.

Table 19. Utility Characteristics and Conservation Methods.

Type of Utility	Characteristics of Utilities	Utility Specific Recommendations
Large Growth Potential	Considerable existing housing stock of intermediate to old age, significant land available for new development	Indoor retrofits, Xeriscape™ ordinance, irrigation hours ordinance, outreach and education
Moderate Growth Potential	Existing housing stock intermediate in age, moderate potential for development – limited by boundaries of other utility service areas and natural areas	Indoor retrofits, Xeriscape™ ordinance, irrigation hours ordinance, promote Mobile Irrigation Lab, outreach and education
Limited Growth Potential	Housing stock is older, service area is near build-out, very limited potential for growth	Indoor retrofits, rain sensor installation, promote Mobile Irrigation Lab, outreach and education

Outreach and education efforts in the planning area include annual conservation workshops held at the service center to showcase the District's funding programs for conservation and alternative water supplies, funding support for annual WaterFest events, support of Florida Yards and Neighborhoods and MIL educational efforts.

The District's WaterSIP is tailored to assist the community to partially fund projects, such as large-scale retrofits, as recommended by this Plan.

Conservation – Implementation Strategies

The following are potential strategies for water conservation, which were developed in cooperation with the public that will be considered in developing plan recommendations regarding conservation.

- Landscape irrigation water conservation has the potential for significant water savings, and has the potential to reduce Surficial Aquifer System resource issues. This may be accomplished by expanding mobile irrigation lab activity in the planning area, and may involve local government funding partnerships to increase lab services, especially in newer urban communities.
- Local governments should consider developing ordinances to address water-conserving landscape installation for new construction to maximize water savings in initial design and operation of both residential and commercial sites.
- Implement cost-effective indoor and outdoor retrofits in the UEC Planning Area based on the preceding analyses.
- Complete water conservation rulemaking for Chapter 40E-2, F.A.C., and the *Basis of Review for Water Use Permit Applications*, emphasizing goal-based conservation programs for public water suppliers and major water users.
- Fund projects through the Water Savings Incentive Grant Program, including public/private partnerships, which further the preceding recommendations.
- Expand outreach and education through funding, public/private partnerships, the media, professional organizations and users.

Floridan Aquifer System

The upper Floridan Aquifer is the principal source of supply to users of the Floridan Aquifer System (FAS) in the planning area. The top of the FAS lies approximately -300 feet National Geodetic Vertical Datum (NGVD) in the northwest corner of the planning area, then dips to the southeast to more than -900 feet NGVD in southeast Martin County. For most of the planning area, the Floridan Aquifer is artesian; the wells flow naturally at land surface without the need for a pump. Water in the FAS is brackish in the UEC Planning Area. Additional information on the hydrogeology of the FAS in the UEC Planning Area is provided in the *DRAFT Consolidated Water Supply Plan Support Document*.

The upper Floridan Aquifer is used extensively by citrus growers in the UEC Planning Area, primarily as a supplemental irrigation source when surface water availability is limited and as a primary source in areas where no surface water is available. Water from the Floridan is generally blended with surface water or water from the Surficial Aquifer to reduce potential problems associated with salinity. Excess salinity of irrigation water can result in decreased citrus production/yield, reduction in root growth, and can be fatal to specific root stocks (Syvertsen *et al.*, 1989). Construction of storage reservoirs associated with the CERP Indian River Lagoon – South Project will enhance surface water availability and should reduce the use of the Floridan Aquifer by the citrus industry.

Most coastal utilities in the region, including Fort Pierce Utilities Authority, Port St. Lucie, Martin County Utilities, South Martin Regional Utility, Plantation Utilities and Sailfish Point currently use water from the Floridan Aquifer as a source of drinking water. A number of smaller private coastal facilities use water from the Floridan Aquifer as a primary source for potable water. Water from the Floridan Aquifer is nonpotable throughout the planning area and requires desalination or blending prior to potable use. Utilities in the UEC Planning Area use reverse osmosis treatment to provide potable quality water. Water from the Floridan Aquifer accounted for 20 percent of total utility withdrawals in the UEC Planning Area in 2000 as shown in **Figure 8**. This is an increase from the 1998 usage, where Floridan Aquifer water accounted for 16 percent of the total utility withdrawal. Most of the utilities in the UEC Planning Area intend to use water from the Floridan Aquifer to meet increases in potable water demand.

The 1998 Plan analysis indicated the Floridan Aquifer has the potential of supplying sufficient water to meet all public water supply demands through the planning horizon, while meeting the supplemental water needs of agricultural users during a 1-in-10 year drought event without exceeding the resource protection criteria.

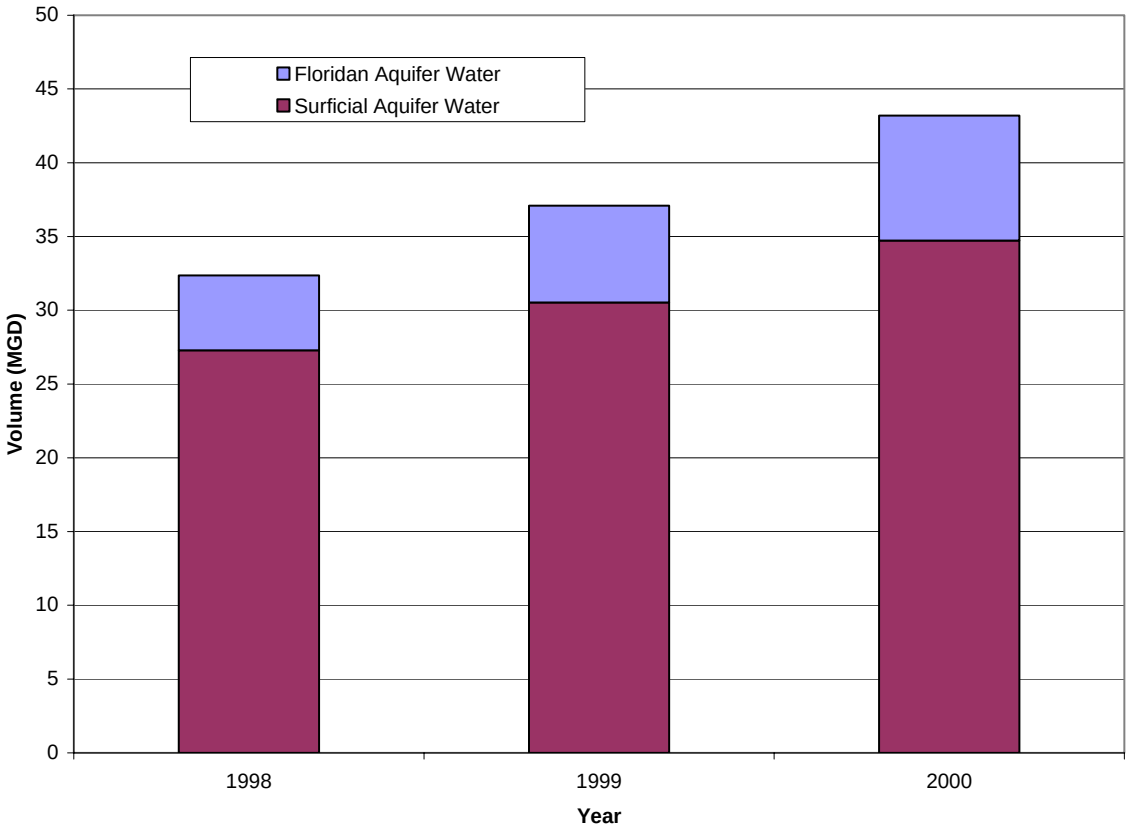


Figure 8. Public Water Utilities Potable Water Sources (1998–2000).

Floridan Aquifer Monitoring Program

The relationship between water levels, water quality and water use needs to be better understood. A comprehensive Floridan Aquifer monitoring well network was established to monitor the effects of sustained withdrawals on the aquifer pursuant to the recommendations in the 1998 Plan. The purpose of the Floridan Aquifer monitoring network is to provide water level, water quality and water use data in high use areas (e.g., citrus groves) to determine statistical trends and relationships between the three data sets. Understanding these relationships will aid in the allocation of water from the Floridan Aquifer, and planning for long-term water supply in the region.

Monitoring began in 1999 at many of the locations in the monitoring well network. Four public water supply sites are being added to the network in 2004. A detailed summary of the network and data collected to date is provided in Appendix E. Additional data are needed to reach conclusions on the relationship between water levels, water quality and water use. Continued monitoring of this network is recommended. It is also recommended that public water supply wells be incorporated into the network.

The SFWMD also co-funded a study with the U.S. Geological Survey (USGS) to evaluate potential water quality changes and the distribution of salinity in the Floridan Aquifer. The final report from this study is scheduled for release in mid-2004. The aim of

the study was to identify potential sources of high salinity and potential flow mechanisms or pathways of groundwater to wells, and describe areas with a high potential for increases in salinity. The preliminary results found that water levels in the Floridan Aquifer in central and northern St. Lucie and Okeechobee counties have declined within recent years (2 to 4 feet in the past 15 years, 15 to 20 feet since predevelopment times). The head declines coincide with areas of agricultural use. These inland areas also have some structural deformations in the rock that could present exceptional pathways for groundwater flow. An area of elevated chloride concentration exists inland trending northwest through north-central Martin County and western St. Lucie County. The preliminary findings of the investigation indicate that the highest potential for upward or lateral movement of the saltwater interface is in the inland areas of St. Lucie and Okeechobee counties because of large declines in hydraulic head, areas of structural deformation and areas of higher salinity.

Development of a density-dependent solute transport groundwater model, including hydrogeologic investigations, is being proposed to conduct water quality predictive analysis for the next update to this Plan.

Floridan Well Inventory

It is estimated that there are several thousand wells that penetrate the Floridan Aquifer in the UEC Planning Area. Most of these are for agricultural water supply and were drilled decades ago. There have been several initiatives over the past 15 years to inventory these wells; to provide assistance to well owners to install operable wellheads on free flowing wells, and to decommission wells that are no longer used or are in a state of disrepair. Some of these past inventories have been titled “Abandoned Floridan Well Inventory;” however, many of the wells in the inventories are permitted as active withdrawal sources through the District’s CUP Program. Under a consumptive use permit, withdrawal facilities must be maintained in good operating condition.

Because many of these wells were drilled decades ago, there is concern about their condition. Well casings, typically made of steel in older wells, could be corroded below the ground surface and wellheads could also be corroded. In addition, many of these wells are short-cased. The wells do not have a casing for the entire depth of the well into the Floridan Aquifer, such that the wells could be open to the Floridan Aquifer and also to the base of the Surficial Aquifer. Since the Floridan Aquifer is under greater hydrostatic pressure than the Surficial Aquifer, water could be flowing from the saline Floridan Aquifer to the fresh Surficial Aquifer through the well bores. There is also concern about the fate of these Floridan wells as agricultural use is converted to urban use. These wells should be properly decommissioned prior to conversion of the land to residential use.

The renewal of all individual and major general water use irrigation permits within the UEC Planning Area began in 2003. The renewal process in the UEC Planning Area is staggered by basin, with the last basin expiring on October 30, 2004. The renewal process consists of review and reissue of irrigation permits in accordance with current

District rules. Many of the irrigation permits in the UEC Planning Area were last issued in the 1980s. As part of the current renewal process, the District will update the existing Floridan well inventory. Wells that are no longer operational or active will have to be rehabilitated or properly decommissioned.

To ensure Floridan wells are identified and addressed in land formerly used for citrus production and planned for urban use development, there have been discussions of using the District's Environmental Resource Permitting (ERP) Program and/or CUP Program to notify developers of the presence of Floridan Aquifer wells. An environmental resource permit must be obtained before beginning any activity that could affect wetlands, alter surface water flows or contribute to water pollution, which includes urban development of most lands. If the proposed development is going to have associated self-supplied water use, a consumptive use permit will have to be obtained. As part of the processing of either of these two types of permits, the Floridan well inventory would be used to identify the existence of Floridan wells. Floridan wells not proposed for future use would have to be properly decommissioned. This process will also increase public awareness of Floridan wells.

Decommissioning Assistance for Floridan Wells

There was considerable discussion at the public participation workshops of programs to assist landowners in decommissioning Floridan wells that are no longer in use. There were several programs that provided technical assistance and cost-share funds for decommissioning Floridan wells in the past. Decommissioning (sometimes referred to as well plugging or abandonment) generally consists of filling the entire well with grout. Past funding and technical assistance has been provided by the District, the USDA–NRCS Environmental Quality Incentive Program (EQIP) administered through the St. Lucie Soil and Water Conservation District. In the UEC Planning Area, over 400 wells have been decommissioned or rehabilitated by these programs over the past 15 years, including all known free-flowing wells.

In the future, these agencies should continue to provide technical assistance, which includes assisting new land owners in locating Floridan wells on their property through the District's well inventory, thereby increasing public awareness. One option discussed as a regional approach toward decommissioning Floridan wells was the possibility of the citrus industry pursuing a state appropriation for funding assistance.

Effects of Floridan Aquifer Use on Surficial Aquifer

The 1998 Plan reviewed monitoring data and other related information regarding impacts of Floridan water use on the quality of the water in the Surficial Aquifer System. The data indicated the existence of elevated total dissolved solids concentrations in the Surficial Aquifer in western and central St. Lucie County. However, this was generally limited to areas in the aquifer less than 50 feet below land surface. There are some residential self-supply wells in these areas, but they are generally greater than 50 feet

deep. Based on this information, it was recommended that no further activity was needed. No additional data was reviewed for this Plan.

Future Modeling and Analysis

Much of the Floridan Aquifer predictive modeling and analysis completed to date in the UEC Planning Area has focused on water levels in the aquifer. A comprehensive Floridan Aquifer monitoring well network has been established to collect information on water use, water levels and water quality. It is recommended that a density dependent (water quality) model be developed and used in the next five-year update to conduct predictive analysis on water quality in the Floridan Aquifer.

Floridan Aquifer – Estimated Costs

The costs related to development of the FAS for water supply are provided in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Document*. For potable water use, desalination treatment is required, such as reverse osmosis (RO). Drilling of a Floridan Aquifer well is a function diameter and depth. Cost for a 1,000-foot well depth is estimated to range from $150,000 for a 10-inch diameter cased well to $320,000 for a 24-inch diameter cased well. The water that can be withdrawn from an individual well is very site specific and varies within the UEC Planning Area. Current regulations for the region prohibit the withdrawal of water from a Floridan Aquifer well with a pump. Floridan Aquifer wells in the UEC Planning Area provide water by natural artesian flow. Production from Floridan Aquifer wells can be limited by several factors, including geology of the area, the rate of recharge and water movement in the aquifer, potentiometric head, well diameter and other existing legal users in the area. Typical production rates from Floridan Aquifer wells in the UEC Planning Area can range from 1 to 2 MGD.

For much of the UEC Planning Area, the Floridan Aquifer is artesian and flows at land surface without the need for pumps. In most agricultural uses of the Floridan, pumps are not used. For public water supply, pumps are needed to transfer water from the Floridan wells to the treatment facility. Pumping costs vary depending on the volume of water needed. For example, the construction cost for a 1-MGD pumping system is estimated to cost about $72,000 with an annual operation and maintenance cost of $28,000. Whereas, the construction cost for a 5-MGD pumping system is estimated to cost about $132,000 with an annual operation and maintenance cost of $104,000. Site-specific costs associated with RO can vary significantly as a result of source water quality; concentrate disposal requirements, land costs and use of existing water treatment plant infrastructure.

There are additional costs for water treatment for potable uses. As stated previously, since water from the Floridan Aquifer is brackish, desalination treatment is required prior to potable use. All utilities that use the Floridan Aquifer in the UEC Planning Area use RO for treatment and most use deep well injection for concentrate disposal. Treatment cost information is provided in Chapter 5 of the *DRAFT*

Consolidated Water Supply Plan Support Document. Estimated cost of reverse osmosis treatment with concentrate disposal via deep well injection including operation and maintenance is $2.15 per 1,000 gallons for a 3-MGD facility to about $1.84 per 1,000 gallons for a 10-MGD facility.

Floridan Aquifer – Quantity of Water Potentially Available

The analysis in the 1998 Plan indicated that the Floridan Aquifer has the potential of supplying, at a minimum, a sufficient volume of water to meet at least 64 MGD of the public water supply demands (2020 public water supply projections in 1998 Plan), while meeting the supplemental water needs (125 MGD) of agricultural users during a 1-in-10 year drought event. The results of the modeling in the 1998 Plan indicate that there would be no resource protection criterion exceedances. To ensure that the resource is managed properly, the volume of water that could be withdrawn by any specific user must be determined through the District's CUP Program. The analysis did not address water quality degradation (increasing salinity) in the FAS because of increased, long-term withdrawals.

In the UEC Planning Area, the Floridan Aquifer has historically been used regularly by agricultural users, and to a lesser extent, by public water supply users. Out of the limited number of Floridan wells that have historic water quality records, some have showed increases in salinity. The 1998 Plan modeling did not include a water quality component as sufficient data did not and currently does not exist. However, the modeling indicated that water levels are not projected to decline below land surface over the planning horizon, and the experience in the UEC Planning Area suggests this should not result in significant changes in water quality. As stated previously, continued data gathering from the comprehensive Floridan Aquifer monitoring well network for water use, water quality and water levels is recommended. Data from this initiative could be used in modeling of water quality, as well as water levels, for the next update of this Plan.

Floridan Aquifer – Implementation Strategies

The following are potential strategies developed in cooperation with the public that will be considered in the development of plan recommendations regarding the Floridan Aquifer:

- Continue to collect data from the comprehensive regional Floridan Aquifer monitoring well network to better understand the relationship between water quality, water levels and water usage.
- Develop a density dependent solute transport groundwater model for next UEC Plan Update for predictive analysis purposes.
- Implement a Floridan Aquifer exploratory well program to gather additional hydrogeologic data to support development of a Floridan Aquifer density dependent groundwater model.

- Conduct Floridan Aquifer tracer tests to better understand flow paths in the Floridan Aquifer.
- Refine the Floridan well inventory, increase public awareness of presence of Floridan wells when land is converted from agricultural use to urban use and support local initiatives to decommission wells that are no longer used.
- Provide technical support of local initiatives in pursuit of decommissioning Floridan Aquifer wells.

Reclaimed Water

Reclaimed water is wastewater that has received at least secondary treatment and is reused after flowing out of a wastewater treatment plant (Chapter 62-610, F.A.C.). Water reuse is the deliberate application of reclaimed water for a beneficial purpose, in compliance with the FDEP and water management district rules. Potential uses of reclaimed water include landscape irrigation (e.g., medians, residential lots and golf courses), agricultural irrigation, groundwater recharge via percolation ponds, industrial uses, environmental enhancement and fire protection.

In addition to the more common use of reclaimed water, Chapter 62-610, F.A.C. also addresses the use of high-quality reclaimed water for groundwater recharge using injection wells and for indirect potable use.

The State of Florida encourages and promotes the use of reclaimed water. The Water Resource Implementation Rule (Chapter 62-40 F.A.C.) requires the FDEP and water management districts to advocate and direct the reuse of reclaimed water as an integral part of water management programs, rules and plans. The District requires all applicants for water use permits to use reclaimed water unless the applicant can demonstrate that it is not feasible to do so.

2003 Statewide Reuse Strategy Report

The *Water Reuse for Florida – Strategies for Effective Use of Reclaimed Water* report resulted from a joint venture between the Reuse Coordinating Committee and the Water Conservation Initiative's Water Reuse Work Group (Reuse Coordinating Committee, 2003). This report identifies strategies for increasing the efficiency and effectiveness of the use of reclaimed water in Florida, as directed by the *Florida Water Plan* (FDEP, 2002b) and as part of Phase II of the *Florida Water Conservation Initiative* (FDEP, 2002a). In addition to presenting background information on water reuse, a summary of Florida's Water Reuse Program, and development of water reuse in Florida, the report details 16 major, interrelated strategies for ensuring efficient and effective use of reclaimed water. Some of the strategies are:

- Encourage metering and volume-based rate structures
- Implement viable funding programs

- Facilitate seasonal reclaimed water storage
- Encourage use of reclaimed in lieu of other water sources
- Link reuse to regional water supply planning
- Encourage use of supplemental water supplies
- Encourage reuse system interconnects

The report provides a roadmap for the State's Water Reuse Program into the 21st Century. The *2003 Water Reuse for Florida* report (Reuse Coordinating Committee, 2003) is available from: http://www.floridadep.org/water/reuse/news.htm.

Existing Reuse in UEC Planning Area

Reuse System Pumps

The use of reclaimed water in the UEC Planning Area has played a vital role in meeting a portion of current demands for irrigation water. The volume of reclaimed water that is used for a beneficial purpose has increased almost 70 percent from 1994 to 2003 as shown in **Figure 9**. Over this period, the volume of reclaimed water reused has varied from year to year depending on the addition of new users and rainfall.

In 2003, there were 28 wastewater treatment facilities in the UEC Planning Area with a capacity of 0.10 MGD or greater. The largest of these is the Fort Pierce Utilities Authority with a capacity of 10 MGD. Specific information on each facility and its location is provided in Appendix B. These facilities had a total capacity of over 34 MGD and treated over 20 MGD in 2003. There are three methods of treated wastewater management used in the UEC Planning Area: reuse, deep well injection and surface water discharge via ocean discharge.

Twenty-seven of the facilities used reuse for all or a portion of their disposal. About 40 percent (8.10 MGD) of the wastewater treated in the planning area in 2003 was reused for a beneficial purpose with over 5.43 MGD used for irrigation. In 2002, reclaimed water was used for irrigation of over 5,400 residential lots, 20 golf courses, three parks, five schools and a citrus grove (FDEP, 2003). About 2.20 MGD was used for groundwater recharge and the remainder was used for industrial and toilet flushing purposes. The results of the analysis indicates that current reuse in the UEC Planning Area, primarily irrigation of golf courses, has contributed to reduced potential resource impacts.

A few of the reuse systems in the planning area are limited at this time because the reclaimed water supply is fully committed or utilized during certain times of the year.

However, these utilities have surplus reclaimed water at other times of the year. To overcome shortfalls and maximize the use of reclaimed water, some utilities have developed supplemental supplies, such as storm water and groundwater. St. Lucie West supplements reclaimed water with water from its stormwater management lakes, while South Martin Regional Utility uses groundwater to supplement its reclaimed water.

Over 11 MGD of the 20 MGD wastewater treated in 2003 was disposed of by deep well injection. Five facilities have deep well injection systems, four in conjunction with some reuse. Ocean discharge accounts for a very small percentage of the total effluent disposal in the region. Only St. Lucie County uses ocean discharge for disposal (via the Florida Power & Light cooling outfall at its South Hutchinson Island Facility) when wastewater flows exceed reclaimed water demand. In 2003, all reclaimed water from this facility was reused and none was discharged to the ocean. The 11 MGD that was disposed of via deep well injection is potentially reusable water.

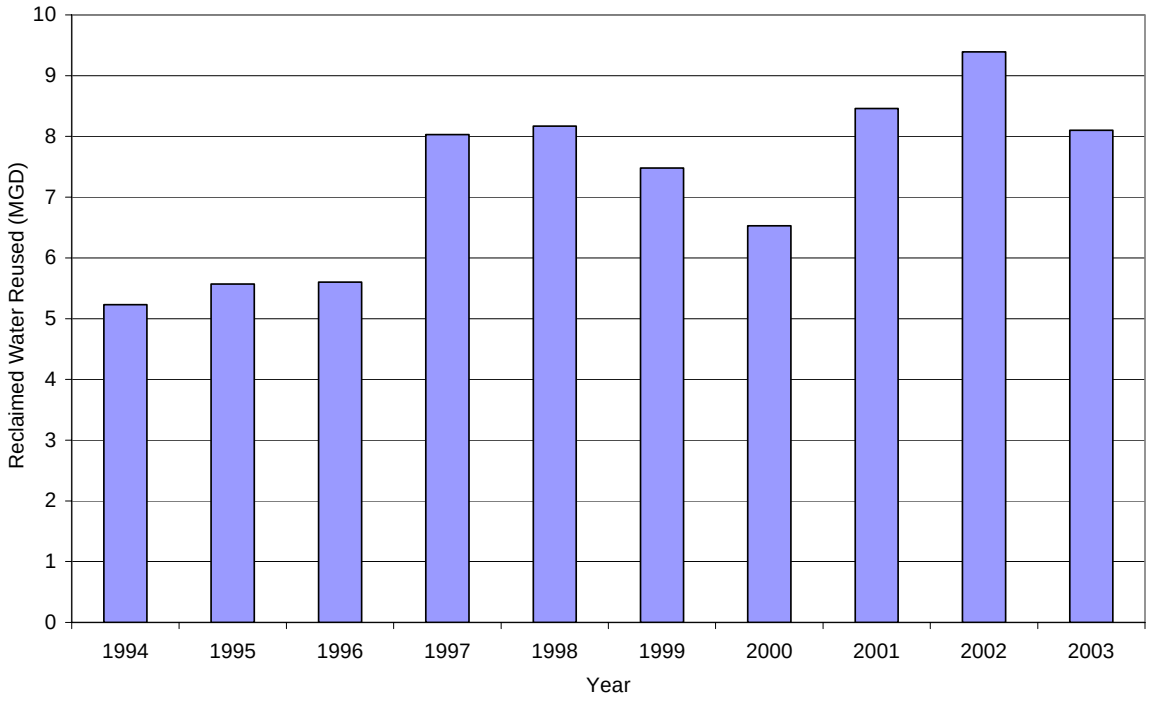


Figure 9. Reclaimed Water Use in the UEC Planning Area (1994–2003).

Future Reuse in UEC Planning Area

Wastewater flows are projected to increase to about 40 MGD by 2025. Utilities involved in reuse at this time plan to continue reuse and expand their reuse systems as additional reclaimed water and users become available. Much of the future reuse will occur in new developments and reclaimed water will be produced from proposed facilities. Utility master plans have not been developed to date showing future plans through 2025. Due to insufficient data and rapid growth in the area, conceptualization of a future reuse layout and plan is not feasible at this time. There are several activities occurring that could lead to increased reuse in the future.

Port St. Lucie is consolidating and regionalizing its wastewater systems to two regional facilities within the next eight years: a new Glades facility and expansion of the Westport facility. The primary means of wastewater management at these regional facilities will be reuse via public access irrigation of residential lots and golf courses. The Northport and Southport wastewater facilities (majority of effluent disposal through deep well injection in 2003) will be decommissioned in the future.

The City of Stuart and the Fort Pierce Utilities Authority (FPUA) treat almost 35 percent of the wastewater generated in the planning area, and dispose of the effluent almost exclusively through deep well injection. The City of Stuart is initiating a feasibility study and master plan to identify opportunities for reuse, with a focus on replacing groundwater withdrawals for irrigation with reclaimed water in the vicinity of its wellfields. The FPUA wastewater facility is located on South Hutchinson Island and has limited reuse potential because of the lack of uses in the vicinity of the facility both on Hutchinson Island and the mainland. The FPUA is planning to use reclaimed water for irrigation of green space at a proposed development directly east of the facility. The FPUA, in cooperation with St. Lucie County, will identify mainland locations for a wastewater facility(s) to treat future wastewater flows beyond Fort Pierce's existing wastewater treatment facility capacity. Reuse will most likely be the primary means of wastewater management for such a facility. An alternative that may be considered in design of the new wastewater treatment facility is increasing the capacity of this new mainland facility to replace the existing capacity at the existing Fort Pierce wastewater treatment facility.

Reclaimed Water Efficiency and Effectiveness

In addition to new facilities and expansion of existing reuse systems, implementation of water conservation measures, such as metering and volume-based rates, will promote more effective and efficient use of reclaimed water. Programs that provide reclaimed water at no charge to the user and the use of flat rates encourage overuse of the reclaimed water source. Studies conducted by the Southwest Florida Water Management District concluded that simply providing meters could reduce the use of reclaimed water by residential customers by 50 percent (SWFWMD, 2002). Metering of reclaimed water use and implementation of volume-based charges, in which users pay for at least part of the actual metered volume, are encouraged as a means to effectively manage reclaimed water supplies. Metering of reclaimed water use and implementation of volume-based rates for reclaimed water is a major strategy contained in the *Water Reuse for Florida – Strategies for Effective Use of Reclaimed Water* report to promote efficient use of reclaimed water (Reuse Coordinating Committee, 2003).

Proposed revisions to Florida's Water Resource Implementation Rule, Chapter 62-40, F.A.C., directs the FDEP and the water management districts to encourage reuse that is efficient and effective and will increase potable quality water offset or recharge fraction, where consistent with water quality protection. Potable quality water offset is the amount of potable quality water (Class F-I, G-I or G-II groundwater or water meeting drinking water standards) saved through the use of reclaimed water expressed as a

percentage of the total reclaimed water used. Dividing the amount of potable quality water saved by the amount of reclaimed water used, and multiplying the quotient by 100 calculates the potable quality water offset. The recharge fraction is the portion of reclaimed water used in a reuse system that recharges an underlying potable water quality groundwater (Class F-I, G-I or G-II groundwater) that is used for potable supply, or augments a Class I surface water, expressed as a percentage of the total reclaimed water used.

Mandatory Reuse Zones

Reuse Facility

One tool to increase the use of reclaimed water is through the designation of mandatory reuse zones. Mandatory reuse zones are geographic areas designated by local governments through ordinance where the use of reclaimed water is required. These could be undeveloped areas or developed areas where retrofits will be required. These zones may be very effective in increasing reuse in the undeveloped portions of the service areas in the UEC Planning Area, where installation of the reclaimed water distribution systems and use of reclaimed water would be required at the time of development. It is much more cost-effective to install these systems at the time of development compared to retrofitting existing developments. Palm Beach County's mandatory reuse zone has successfully increased reuse at its Southern Region Wastewater Reclamation Facility.

Reclaimed Water Storage

Because reclaimed water supplies in some reuse systems in the UEC Planning Area are fully committed during certain times of the year and have a surplus during other times of the year, seasonal reclaimed water storage through ASR may allow some systems to expand their user base. Simply stated, reclaimed water is stored when supply exceeds demand and stored water is withdrawn when demand exceeds supplies. Aquifer storage and recovery could also be used to store supplemental sources when sources are available for withdrawal in compliance with applicable rules and regulations.

Supplemental Sources

Use of another water source, such as surface water, groundwater, storm water, or treated drinking water, to augment supplies of reclaimed water (largely to meet peak demands) can enable better utilization of the water resource. The use of supplemental water supplies to meet peak demands for reclaimed water may enable a reclaimed water utility to be more aggressive in implementing its reclaimed water system. More customers can be served with reclaimed water and less "excess" reclaimed water would

need to be disposed of. Use of supplemental water supplies is normally subject to consumptive use permitting by the water management districts. In some areas, these sources of water may not be available as a supplemental source in times of drought.

St. Lucie West currently supplements its reclaimed water with water from its stormwater management lakes. South Martin Regional Utility uses groundwater to supplement its reclaimed water.

Reuse System Interconnects

Reuse system interconnects refers to enhancing the connection between reclaimed water systems to facilitate reuse. More specifically, reuse interconnects are connections between two or more reclaimed water distribution systems (may be owned or operated by different utilities) or between two or more domestic wastewater treatment facilities that provide reclaimed water for reuse activities.

Reuse system interconnects offer a means to increase both the efficiency and reliability of reuse systems. When two or more reuse systems are interconnected, there is additional flexibility present in meeting the demand of the reuse system customers, as well as an increase in the reliability of providing acceptable reclaimed water for reuse. For example:

- One system may be newer with fewer customers and be adjacent to a more mature system that could utilize additional reclaimed water to meet the needs of its customers.
- An interconnect between a mature reuse system and a system that has no reuse or limited reuse customers can help avoid or limit the need for a supplemental ground or surface water supply to meet seasonal demands in the more mature system.
- If one reclaimed water facility experiences a temporary problem with producing reclaimed water of acceptable quality, the interconnect with another facility can provide a means to enable continued delivery of reclaimed water to system customers, while the problem is resolved.
- Interconnects may offer the ability to share system storage facilities, which would increase flexibility, while maximizing use of existing storage facilities. As ASR becomes more common as a means for storing reclaimed water, reuse system interconnects could provide opportunities for development of shared ASR systems as key components of regional reuse programs.

Regional Reclaimed Water Conveyance System Master Plan for Northern Palm Beach County and Southern Martin County

The District conducted the *Regional Reclaimed Water Conveyance System Master Plan for Northern Palm Beach County and Southern Martin County* in 2002 to evaluate the potential of transporting reclaimed water from the East Central Regional Wastewater Treatment Facility in West Palm Beach north to northern Palm Beach County and southern Martin County to meet current and unmet future needs (SFWMD, 2002g). Potential uses of reclaimed water included irrigation of golf courses, residential lots and other green space, industrial cooling and groundwater recharge. The study included the service areas of Seacoast Utility and the Loxahatchee River Environmental Control District in Palm Beach County and South Martin Regional and Martin County Utilities.

Several demand scenarios and pipeline routes were evaluated. Based on this evaluation, it was determined that a regional reclaimed water system is not economically feasible based on meeting unmet demands of new developments. New reclaimed water demand in northern Palm Beach County and southern Martin County within the planning period, based on local comprehensive plans and development proposals, is very limited. Most of the developable land within northern Palm Beach County has existing water use permits or includes proposed development with commitments from existing reclaimed water providers. A large portion of southern Martin County is preserved as a state park or other environmentally protected areas. In addition, a significant portion of the land is designated as agricultural or low density residential. Without changes to the future land use designations, no significant demand is projected. If a large industrial water user locates within the study area, there may be sufficient demand to lower the unit cost to a feasible level.

Martin County Consolidated Reuse System

Martin County Utilities currently operates four regional wastewater facilities within the county. Each of these facilities provides reclaimed water for public access irrigation. The county is in the process of interconnecting the Martin Downs, Port Salerno and Tropical Farms reuse systems associated with these facilities into a consolidated reuse system. Martin County is also in the process of centralizing wastewater treatment to two facilities—North and Tropical Farms. By interconnecting their reuse systems, the county will be able to maximize the use of reclaimed water by having the ability to distribute reclaimed water throughout their service area, moving reclaimed water from areas of surplus to areas where currently the potential demand is greater than the supply.

Reclaimed Water – Estimated Costs

The costs associated with use of reclaimed water can be divided into treatment costs and transmission/distribution costs. The ultimate use of the reclaimed water directly affects the treatment, distribution and costs. For the purposes of this section, the cost associated with developing a public access reuse system will be summarized. Public

access irrigation involves using reclaimed water for landscape irrigation, such as medians, residential lots, golf courses and other green space.

All the facilities in the UEC Planning Area provide secondary treatment, and several equipped with treatment components to produce reclaimed water for public access irrigation. For those facilities that have secondary treatment only, treatment would have to be upgraded to advanced secondary treatment. Advanced secondary treatment typically refers to the addition of filtration and high-level disinfection. Estimated costs for construction and operation and maintenance of advanced secondary equipment range from $0.53 per 1,000 gallons for a 1-MGD facility to about $0.24 per 1,000 gallons for a 10-MGD facility.

The cost of transmission and distribution of reclaimed water can be substantial, and varies significantly from rural settings to highly urbanized settings. Systems may consist of a single pipe conveying reclaimed water to a golf storage pond to very complex distribution systems that convey reclaimed water to individual residential lots. The length and diameter of pipe, land requirements, land costs, utilities existing in the right-of-way and terrains (sidewalks, driveways, roads, etc.) all affect the cost of transporting and distributing reclaimed water. From projects in Florida, the transmission/distribution cost have ranged from a low of around $0.40 per 1,000 gallons for some large multi-customer reuse systems, which are in close proximity to a treatment facility, to over $3.00 per 1,000 gallons for retrofit residential areas.

The use of reclaimed water also results in some cost avoidance, such as reducing the use of alternative disposal systems and eliminating the need for another water supply source by the end user. In addition, reclaimed water contains nutrients, which reduce the amount of fertilizers needed when irrigating with reclaimed water.

Reclaimed Water – Quantity of Water Potentially Available

Most of the utilities in the region have not projected wastewater flows through 2025. To estimate wastewater flows for 2025, the 2003 ratio of wastewater treated to water pumped for public water supply was applied to the 2025 public water supply projected water supply needs. In 2003, the ratio of wastewater treated (20 MGD) to water pumped for public water supply (39 MGD) was about 51 percent. The projected public water supply demand for 2025 is about 78 MGD (Appendix A). By applying the 51 percent ratio to the projected 2025 public water supply water demand for the UEC Planning Area, it is estimated wastewater flows will increase to about 40 MGD by 2025. This is all potentially reusable water. Based on utility plans and the availability of other water resources, it is anticipated that reuse of 75 percent of the wastewater treated could be achieved by 2025.

Reclaimed Water – Implementation Strategies

The following are potential strategies developed in cooperation with the public that will be considered in the development of plan recommendations regarding reclaimed water:

- Encourage reclaimed water interconnects between utilities, where appropriate, to maximize use of reclaimed water.
- Provide additional weight to criteria that recognize efficient use of the resource, rewarding the District's Water Savings Incentive Program (WaterSIP) and the Alternative Water Supply (AWS) Funding Program applicants with increased scores, which could lead to more grant awards. Projects could include metering, volume-based rates, and/or establishment of application rates consistent with the District's CUP Program allocation criteria as part of the grant project.
- Provide technical assistance to local governments in establishing mandatory reuse zones (where appropriate) to increase use of reclaimed water.
- Provide technical support to utilities pursuing reclaimed water ASR.
- Develop AWS funding criteria for reuse projects that use reclaimed water efficiently, or are requirements of consumptive use permits.

Reservoirs

This option involves the capture and storage of excess surface water in reservoirs during rainy periods and the subsequent release during drier periods for environmental and human uses. Regionally, surface water storage is anticipated to attenuate freshwater flows to the St. Lucie River and Estuary, the Indian River Lagoon and the Northwest Fork of the Loxahatchee River and Estuary during rainy periods, and to provide beneficial flows during drier times. In addition, these facilities could increase surface water availability for current and projected agricultural uses, and decrease the demand on aquifer systems, particularly the FAS.

Strategically located surface water storage (primarily storage in combination with improved stormwater management systems) could recharge Surficial Aquifer System (SAS) wellfields, reduce the potential for saltwater intrusion and reduce drawdowns under wetlands. Onsite storage in agricultural areas may reduce the need for water from the regional canal system and withdrawals from other water source options. Stormwater reservoirs could be located with ASR facilities, and provide a water source for the facility.

Reservoirs – Estimated Costs

Costs associated with reservoirs can vary significantly depending on site-specific conditions of each reservoir, land costs and facilities, such as pumps. A site located near an existing waterway will increase the flexibility of design and management and reduce costs associated with water transmission infrastructure. Another factor related to cost would be the existing elevation of the site. Lower site elevations would allow for maximum storage for the facility, while reducing costs associated with water transmission and construction excavation. Depth of the reservoir will have a large impact on the costs associated with construction. Deeper reservoirs result in higher levee elevations that can significantly increase construction costs. Costs associated with reservoirs are provided in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Document*.

Reservoirs – Quantity of Water Potentially Available

Reservoirs are considered a management option, in that these systems allow more efficient use of other sources, such as surface water. The CERP Indian River Lagoon – South Project Implementation Report (PIR) estimates the project could increase surface water availability by 26,300 acre-feet per year (23.48 MGD). District staff estimate this could result in a decrease of 19 percent in Floridan Aquifer usage for agriculture, further assuring the water needs of the agricultural community.

Reservoirs – Implementation Strategies

Regional reservoirs proposed in the UEC Planning Area are through the CERP Indian River Lagoon – South Project, Ten Mile Creek Critical Restoration Project, CERP North Palm Beach County Part 1 Project and the Northern Palm Beach County Comprehensive Water Management Plan. Recommendations related to these projects are incorporated in the Surface Water section of this chapter. One potential strategy developed in cooperation with the public that will be considered in the development of plan recommendations regarding reservoirs is:

- Agricultural operations should incorporate best management practices to include water conservation and water supply considerations in design of new or retrofitted surface water management systems.

Seawater

This option involves using seawater from the Atlantic Ocean as a raw water source. The ocean (seawater) is an unlimited source of water from a quantitative perspective; however, removal of salts (desalination) is required before potable or irrigation uses are feasible. To accomplish this, a desalination treatment technology would have to be used, such as distillation, reverse osmosis (RO) or electrodialysis reversal (EDR).

Seawater – Estimated Costs

Reverse Osmosis Facility

The cost of seawater desalination can be significant, several times the cost of brackish groundwater desalination. This is due to seawater's higher and variable salt content, intake facilities and concentrate disposal. The higher and variable salt content reduces the efficiency of the treatment facility (less gallons of potable water are produced from raw water pumped) and results in increased concentrate/reject water disposal needs compared to desalination of the brackish groundwater. Cost information on seawater desalination facilities from countries outside of the United States indicates costs can be significant for seawater desalination. For example, in Singapore, a 36-MGD seawater desalination plant was estimated to cost between $7.52 and $8.77 per 1,000 gallons in the early to mid-1990s. In the United States, the cost of seawater desalination has decreased from about $9 per 1,000 gallons for a stand-alone facility to about $3 per 1,000 gallons for a colocated facility between 1990 and 2000 (SFWMD, 2002b).

One way to reduce the cost of seawater desalination is to colocate the desalination facility with a power generating facility that uses seawater for cooling. There are many benefits of colocating desalination facilities and electric power plants. One benefit and cost reduction is the sharing of facility components. There is cost savings associated with using the existing intake and discharge structures of a power plant to provide raw water to the desalination plant and to provide a means for concentrate disposal. It is possible to dispose of the desalination process concentrate by blending it with the power plant's cooling water discharge. Using power plant cooling water as a source, the temperature of the water is elevated, which reduces the pressure and associated energy necessary to produce the drinking water, providing another significant advantage.

Seawater desalination has proven to be economically feasible in some parts of Florida when colocated with power plants. Tampa Bay Water recently completed construction of a seawater desalination RO treatment facility initially capable of producing 25 MGD of drinking water. The wholesale cost for the desalinated water over the next thirty years is projected to average $2.49 per 1,000 gallons. The 25-MGD facility cost $110 million and began producing water in March 2003 (Tampa Bay Water, 2003). However, water production has been interrupted due to excessive fouling (plugging) of the RO membranes. Negotiations are continuing to rectify the problems and resolve potential contractual issues.

The SFWMD cost-shared a feasibility study with Florida Power & Light (FPL) to investigate the potential of developing colocated RO water treatment facilities with electrical power plants pursuant to a recommendation of the *2000 Lower East Coast*

Regional Water Supply Plan. The study's findings recommended FPL's Fort Myers and Port Everglades sites as technically and economically feasible for colocated seawater desalination facilities.

Seawater – Quantity of Water Potentially Available

The volume of water available from seawater is unlimited and could meet the needs of this region through the year 2025.

Seawater – Implementation Strategies

As part of the 2004 UEC water supply planning process, it was concluded that seawater is a potential alternative source of water that needs future consideration; however, not in the 2025 planning horizon. Based on the projected water demands, other water sources are available to meet projected needs that have lower treatment costs.

Surface Water

This option involves surface water and surface water-related environmental supply strategies to ensure the needs of the environment are met. Strategies include MFLs, water reservations, restoration plans, environmental restoration and CERP projects. Surface water includes the direct withdrawal of water from regional surface water sources, primarily the C-23, C-24, C-25 and C-44 canals. Related efforts involve the capture and storage of excess surface water during rainy periods and subsequent release during drier periods for environmental and human uses. Regionally, this includes reservoirs for storage of surface water that could be used to attenuate freshwater flows to the St. Lucie River and Estuary, the Indian River Lagoon (IRL) and the Loxahatchee River during rainy periods and meet minimum flows during drier periods. In addition, these facilities could increase surface water availability for other uses. In Martin and St. Lucie counties, increased surface water availability could reduce the use of the Floridan Aquifer for agricultural irrigation. This option also includes increasing flexibility in surface water management by connecting surface water basins.

St. Lucie River and Indian River Lagoon

Freshwater discharges from the C-23, C-24, C-25 and C-44 canals, and local runoff to the St. Lucie River and Estuary and the Indian River Lagoon have sometimes negatively impacted the estuarine system. Moreover, periodic, high-volume, prolonged freshwater releases from Lake Okeechobee via the C-44 Canal have also had a dramatic effect on water quality and salinity and the overall health of the estuarine system. A MFL was established for the St. Lucie River and Estuary in 2002. To address the problems caused by excessive flows, the CERP Indian River Lagoon – South PIR has been completed and the USACE and the District are pursuing the incorporation of this Project into the *Water Resource Development Act of 2004* (WRDA 2004). Construction of the CERP Indian River Lagoon – South and the Ten Mile Creek Critical Restoration projects

will address freshwater flows from the watershed; the CERP in concert with possible modifications to the Lake Okeechobee Regulation Schedule, will address freshwater discharges from Lake Okeechobee to the St. Lucie River via the C-44 Canal.

Minimum Flows and Levels

As stated previously, a MFL was established for the St. Lucie River and Estuary in 2002. The District realizes that a MFL alone will not be sufficient to maintain a sustainable resource during the broad range of water conditions occurring in the managed system. Setting a minimum flow is a starting point to define the minimum water needs to protect water resources against significant harm.

Research and monitoring for the St. Lucie River and Estuary MFL is being conducted through ongoing and proposed activities associated with the Indian River Lagoon Surface Water Improvement and Management (SWIM) Plan and the CERP Indian River Lagoon – South Project to provide for enhanced freshwater deliveries and track conditions in the system. These programs include periodic water quality sampling and the installation and monitoring of permanent flow and salinity stations at various locations in the estuary and its major tributaries.

CERP Indian River Lagoon – South Project

The purpose of the CERP Indian River Lagoon – South Feasibility Study was to evaluate methods to improve surface water management in the C-23, C-24, C-25 and C-44 basins by providing increased storage and reducing the need for periodic high-volume discharges. The actions would improve habitats in the St. Lucie River Estuary and the Indian River Lagoon and increase surface water availability. The CERP *Final Indian River Lagoon – South Project Implementation Report Public Notic*e was signed by the USACE in Atlanta in March 2004. The PIR will be submitted to the USACE Headquarters in Washington, D.C. for final review. Approvals are being sought to incorporate the CERP Indian River Lagoon – South Project in the WRDA 2004. Construction could start as early as 2006 and is scheduled to take six years to complete at an estimated cost of $1.21 billion.

The recommended plan in the CERP Indian River Lagoon – South PIR provides over 135,000 acre-feet of storage via four reservoirs covering 12,610 acres. The reservoirs, with their associated stormwater treatment areas, are expected to increase surface water availability, which should reduce agricultural demand on the Floridan Aquifer in the area.

In addition, four stormwater treatment areas are proposed to reduce phosphorus and nitrogen. These treatment areas encompass 8,731 acres, and will provide 35,000 acre-feet of storage. Additionally, 92,130 acres of natural storage and treatment areas will provide over 30,000 acre-feet of storage. The project is expected to increase water availability by 26,300 acre-feet per year (23.48 MGD), which will result in a decrease in Floridan Aquifer usage for agriculture.

The recommended plan also incorporates the removal of 5,500 cubic yards of muck and the creation of 90 acres of artificial habitat. Integrated as a component of the plan, the restoration of the North Fork floodplain includes reconnection of historic oxbows and acquisition of over 3,000 acres of floodplain. A map of the recommended plan is located in Appendix E.

Reservations

The Project Implementation Report (PIR) for the CERP Indian River Lagoon – South Project presently indicates the District will adopt initial reservations of existing water for the protection of fish and wildlife for the St. Lucie River and Southern Indian River Lagoon. The process for adopting these reservations is expected to begin in the summer of 2004 and is anticipated to occur over an approximate two-year period.

Additionally, and prior to execution of the Project Cooperation Agreement (PCA), the District will reserve water made available by the CERP Indian River Lagoon – South Project for protection of fish and wildlife. Presently, staff expects execution of the PCA to occur in approximately 2006.

Ten Mile Creek Critical Restoration Project

After many years of planning and design, construction of the Ten Mile Creek Critical Restoration Project was initiated in November 2003. The project involves construction of a 550-acre reservoir (maximum depth of 10 feet) and a 110-acre stormwater treatment area (maximum depth of 4 feet). This project is located immediately west of the Varn (a.k.a. Gordy Road) Structure on Ten Mile Creek in St. Lucie County and will provide storage and treatment of storm water from the Ten Mile Creek Basin, the largest subbasin discharging into the North Fork of the St. Lucie River. In addition, the Ten Mile Creek Critical Restoration Project will increase surface water availability to agricultural users in the basin. The construction is scheduled to take less than two years to complete and will cost approximately $26 million.

Ten Mile Creek

Basin Interconnects

For many years, there has been discussion of connecting the SFWMD's C-25 Basin with the St. Johns River Water Management District's C-52 and Upper St. Johns River Basin Project. This connection could potentially provide flexibility and efficiency in water management that would allow storage of water that is being discharged to tide.

This potential alternative would store water during wet periods and provide water for environmental needs and water supply during dry periods. Participants at the UEC Plan Water Resource Advisory Commission (WRAC) workshops supported further evaluation of this alternative by the two water management districts to determine its potential in addressing freshwater flows to the Indian River Lagoon and water supply needs of the region.

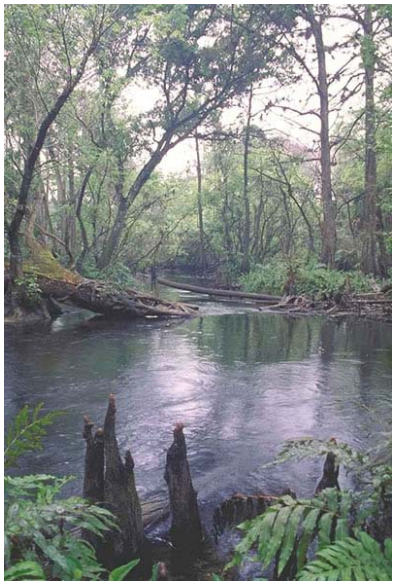
Lake Okeechobee Regulation Releases

The CERP Indian River Lagoon – South Project is addressing surface water management and freshwater flows generated within the planning area to the St. Lucie River. In addition to receiving fresh water from the watershed, the St. Lucie River also serves as a major outlet for Lake Okeechobee. The C-44 Canal conveys flood control releases from Lake Okeechobee to the South Fork of the St. Lucie River. Regulatory discharges are usually large volume releases for prolonged periods of time and drastically change the water quality in the St. Lucie River.

The Lake Okeechobee Regulation Schedule is reviewed periodically to determine if operational changes can be made that have more ecological benefits, while meeting the Central and Southern Florida (C&SF) Flood Control Project objectives. This includes evaluating discharges made to the St. Lucie Canal (C-44). Structural changes are necessary to substantially affect these discharges to the St. Lucie River. These structural changes are incorporated into the CERP. Participants in the UEC Plan public workshops agreed that the best approach to this issue is the implementation of the CERP to address regulatory releases from Lake Okeechobee to the St. Lucie River.

Loxahatchee River

The Loxahatchee River has been significantly impacted by the creation and maintenance of the Jupiter Inlet, which has contributed to the displacement of freshwater wetland communities by estuarine species in areas of the Loxahatchee River where they were not historically found. In addition, construction of the C-18 Canal and installation of drainage projects for agricultural and urban development have lowered water tables and reduced the amount of fresh water available to the Loxahatchee River and significantly altering natural flow patterns.



Loxahatchee River

Progress is being made by the District, USACE and local governments in improving flows to the Northwest Fork of the Loxahatchee River. This process includes structural improvements in addition to policy/regulatory improvements. The Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP) was accepted in

2002 by the SFWMD and a MFL has been established in 2002 for the Northwest Fork of the Loxahatchee River. Recommendations of the *2000 Lower East Coast Regional Water Supply Plan* related to the Loxahatchee River are also being implemented.

The District and the FDEP are currently developing a Loxahatchee River restoration goal and plan. This work is expected to be complete in September 2005. Based on this plan, the agencies currently envision a multi-step process. First, the District is expected to adopt an initial water reservation for the Northwest Fork of the Loxahatchee River. Subsequently, a project specific water reservation, reserving a portion of the water in the L-8 Reservoir for the Northwest Fork is to be established. Finally, a CERP reservation for the Northwest Fork will address and reserve the amount of water necessary for restoration within the Northwest Fork of the Loxahatchee River and other environmentally sensitive areas within the watershed, such as the Loxahatchee Slough. Minimum flows and levels will be established for the tributaries to the Northwest Fork (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) by 2007.

Northern Palm Beach County Comprehensive Water Management Plan

The Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP) was accepted by the SFWMD's Governing Board in May 2002 and is being implemented. The purpose of this effort was to develop a collective vision that would meet present and future urban, agricultural and environmental water resource needs for the northern Palm Beach County area. Implementation of the NPBCCWMP will bring about improvements to storage and water conveyance infrastructure that will capture water currently lost to tide in the wet season and provide supplemental supplies in the dry season—meeting environmental needs and projected urban and agricultural demands. The NPBCCWMP identifies needs for the following infrastructure improvements:

- 48,000 acre-feet of storage in regional reservoirs.
- 50 MGD of water storage in regional ASR facilities.
- 12,000 acre-feet of additional storage in wetlands and local reservoirs.
- 10 MGD obtained from reclaimed water.

Additional structural features are needed to improve the ability to convey surface water among storage areas, control water levels in the Loxahatchee Slough and provide flow to the Northwest Fork of the Loxahatchee River. The District's efforts include:

- Construction of the G-160 Loxahatchee Slough Structure in northeastern Palm Beach County was completed in January 2004. This $2.1 million spillway structure provides essential freshwater flows to the Northwest Fork of the Loxahatchee River during the dry season and also maintains a more natural hydroperiod within the slough.

- Groundbreaking for the G-161 Northlake Boulevard Structure took place in early 2004. The proposed $1 million culvert structure would create a flowway from the Grassy Waters Preserve to the Loxahatchee Slough (C-18 Basin). The structure will pass approximately 150 cubic feet per second (cfs) under Northlake Boulevard in Palm Beach Gardens.
- Purchase of approximately 44,800 acre-feet of storage at the L-8 Reservoir in the L-8 Basin. The reservoir is located immediately west of the L-8 Borrow Canal and north of the C-51 Canal in Palm Beach County.

The Northern Palm Beach County Comprehensive Water Management Plan is available from: http://www.sfwmd.gov/org/wsd/npbcwmp/npbcwmp-doc.htm.

Minimum Flow and Level

An initial MFL was established for the Northwest Fork of the Loxahatchee River in 2002 and is codified in Chapter 40E-8, F.A.C. A summary of the MFL for the Northwest Fork of the Loxahatchee River is described in **Chapter 3**. The MFL was adopted to protect the Northwest Fork from significant harm.

After completing the restoration plan and initial water reservations for the Loxahatchee River, the MFL and associated recovery plan for the Northwest Fork will be reviewed and revised, as necessary, for consistency. The MFL Rule was designed with the flexibility to further ensure no significant harm by aligning it with restoration efforts as further information and data become available. Establishment of MFLs for the tributaries (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) to the Loxahatchee River is scheduled for 2007.

Water Reservations

The MFL Rule for the Northwest Fork of the Loxahatchee River states that the SFWMD intends to adopt an initial reservation by 2004 to protect existing water used for protection of fish and wildlife, consistent with the restoration goal identified for the Loxahatchee River. This water reservation will be reviewed periodically and revised in light of changed conditions, such as the changes that will occur in the C&SF Flood Control Project as CERP projects become operational. This provides flexibility to account for changes in implementation strategies and contingency plans during the life of the project.

When developing reservations, all current existing legal uses of water will be protected as long as the use is not contrary to public interest. Adoption of water reservations will be consistent with state law. To protect water made available for the recovery and restoration of the Loxahatchee River through implementation of some of the projects identified previously, the SFWMD intends to adopt water reservations for the

Northwest Fork of the Loxahatchee River on a project-by-project basis over the next 20 years.

Future reservations related to the Northwest Fork will be consistent with the reservations being developed for restoration of the Everglades under the CERP, and will reflect the needs of the natural system through a range of hydrologic conditions. These water reservations are intended to prevent the fresh water needed for restoration of the Northwest Fork of the Loxahatchee River from being allocated for future consumptive use. The reservations will be implemented through the CUP Program, operational protocols, water shortage rules and other appropriate provisions in Chapter 373, F.S.

CERP North Palm Beach County Part 1

This project builds on the findings of the NPBCCWMP. The CERP North Palm Beach County Part 1 is addressing the interdependencies and tradeoffs between the different elements in the NPBCCWMP to provide a more efficient and effective design for the overall project. Project information can be obtained at http://www.evergladesplan.org/.

These CERP projects will provide water for environmental enhancement of the Loxahatchee River, Loxahatchee Slough and Grassy Waters Preserve. The PIR is currently under development. The projects will:

- Improve hydrologic connections between protected natural areas.
- Improve Lake Worth Lagoon.
- Reduce dependence on Lake Okeechobee during periods of drought.
- Reduce water lost to tide.
- Improve natural areas within the project boundary.
- Increase water management options.
- Improve the quality, quantity, timing and distribution of water delivery to the Loxahatchee River and Estuary, including the Northwest Fork.

Current Martin County Loxahatchee Basin Activities

Martin County's Office of Water Quality was created to ensure the county's goals and objectives for protecting, restoring and enhancing the county's rivers and overall water resources are achieved. The Office of Water Quality is responsible for development, design and implementation of capital stormwater projects that improve and enhance local waters. This office works closely with the SFWMD, FDEP, USACE, as well as related state and federal agencies in developing and implementing the CERP and other related water quality and resource projects that affect Martin County.

The following are project summaries for efforts made by Martin County to enhance water quality and expand wildlife habitat.

Tropic Vista and Little Club. Tropic Vista and Little Club are two stormwater projects that will enhance and improve water quality, timing and volume of delivery of storm water to the Loxahatchee River. In addition to these benefits, both projects will improve stormwater management to address local flooding problems. Martin County has been working with local landowners and Jonathan Dickinson State Park to complete these projects.

Pal-Mar/Cypress Creek/Hobe Grove. As part of its efforts to assist in restoring the Loxahatchee River, Martin County teamed with the SFWMD, Florida Fish and Wildlife Conservation Commission (FWC) and FDEP, to initiate a study to address water resource related issues in the Loxahatchee Basin. The first phase of the study, funded by the SFWMD with support from its partners, will complete detailed basin modeling. The next phase of work is scheduled to begin in mid to late-2004, with funding from Martin County, the SFWMD and private sources, for further investigation of engineering and design alternatives to address these basin issues. The model will provide a basis for optimal management of wetlands on the Pal-Mar property, possible diversion of flow from the C-44 Canal through irrigation infrastructure to supplement flow to the Northwest Fork, identification and management of discharges from the citrus groves and Cypress Creek to the Northwest Fork, and improved flood control for local residences.

Cypress Creek. Palm Beach and Martin counties and the SFWMD acquired approximately 4,000 acres of the Cypress Creek/Loxahatchee Tract in January 2003. The Martin County lands are under an interim management arrangement with the SFWMD, and more permanent plans for this acreage will be taking shape in the near future. Martin County is requesting state and federal funding for support of design, engineering and construction of facilities that will contribute to the restoration of the Loxahatchee River. That request will be submitted within the Loxahatchee River Preservation Initiative for 2004.

Pal-Mar East. The Pal-Mar East Project is comprised of approximately 3,000 acres of historic wetlands that have been converted largely to rangeland. This parcel is essential to the restoration of the Loxahatchee River, and is the final link in establishing the greenway and trail from the Atlantic Ocean to Lake Okeechobee. Martin County is partnering with the SFWMD in order to purchase this land.

Kitching Creek Restoration. This basin's restoration project will include headwater revitalization, rehydration of disturbed wetlands, redistribution of fresh water and restoration of historic wetlands bisected by the construction of Bridge Road (CR 708) and Flora Avenue. Benefits of this project component are improvements in the water quality and quantities flowing into Jonathan Dickinson State Park property to the southeast, as well as an increased flood protection level of service for local residences and businesses. Martin County is also working with the USACE to complete a restoration project for the main area of the Kitching Creek Basin. Currently, flows through the Kitching Creek Road Ditch cause

erosion, flooding and excessive nutrient impacts to Jonathan Dickinson State Park. Redirection of these flows will be accomplished by the re-grading of drainage ditches, providing shallow flowways through existing rights-of-way and county properties and easements. Ultimately, storm water will be conveyed to Kitching Creek's predevelopment flowway and proposed construction of a berm east of Powerline Avenue will direct flow southeasterly toward Wilson Creek and Jonathan Dickinson State Park. Reengineering and relocating existing culverts under Bridge Road, installing stormwater treatment ponds, berms and other water control structures will provide attenuation and water quality treatment for this area.

Surface Water – Estimated Costs

Costs associated with surface water use involve intake structures and pumping facilities, and are identified in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Documen*t.

Surface Water – Quantity of Water Potentially Available

Surface waters from the C-23, C-24, C-25 and C-44 canals are primary surface water sources for agricultural irrigation and inflows to the St. Lucie River and Estuary and Indian River Lagoon. The Loxahatchee River receives inflows from the C-18 Canal and several other tributaries. Significant surface water storage will be provided in the future through construction of the projects summarized previously. Development of operating protocols for these systems will determine increases in surface water availability. Water for natural systems from new projects will be reserved from allocation by the SFWMD. The volume of water that may be allocated from the remaining water by any specific user must be determined through the District's CUP Program.

Surface Water – Implementation Strategies

The following are potential strategies developed in cooperation with the public that will be considered in the development of plan recommendations regarding surface water/environmental supply:

- Establish an initial water reservation for the Loxahatchee River to protect existing water used for protection of fish and wildlife, consistent with the restoration goal identified for the Loxahatchee River in 2004, pursuant to the MFL established for the Northwest Fork of the Loxahatchee River.
- Establish MFLs for the tributaries to the Northwest Fork of the Loxahatchee River (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) by 2007, pursuant to the MFL established for the Northwest Fork of the Loxahatchee River.
- Review and revise the MFL and associated recovery plan for the Northwest Fork of the Loxahatchee River, as necessary, to be

consistent with established restoration goals and future water reservations by 2005.

- Complete construction of the Ten Mile Creek Project by 2006.
- Actively pursue authorization for the CERP Indian River Lagoon – South PIR, and construct the project to manage of freshwater flows to the St. Lucie River and Indian River Lagoon. Look for opportunities to accelerate land buying, including innovative methods such a transfer of development rights (TDR).
- Conduct a study of the feasibility of connecting the SFWMD's C-25 Basin with the St. Johns River Water Management District's C-52 and Upper St. Johns River Basin Project to identify the benefits and estimated costs of such a connection.
- Continue implementation of the Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP) to address freshwater flows to the Loxahatchee River.
- Complete the CERP North Palm Beach County Project Part 1 PIR, and implement the findings of that report, as a continuation of the NPBCCWMP.
- Develop a restoration plan for the Loxahatchee River that incorporates environmental water needs, while maintaining appropriate levels of flood protection.
- Complete construction of the CERP to address and minimize regulatory water releases from Lake Okeechobee to the St. Lucie River.

Surficial Aquifer System

The Surficial Aquifer System (SAS) is the predominate source of water for public water supply and urban irrigation in the UEC Planning Area. The Surficial Aquifer is easily recharged from the surface. Wellfields using the Surficial Aquifer can be limited by the rate of recharge and water movement in the aquifer, environmental impacts, proximity to contamination sources, saltwater intrusion and other existing legal users in the area.

The analysis from the 1998 Plan has shown that expansion of Surficial Aquifer withdrawals in the coastal areas of the UEC Planning Area is limited due to potential impacts to wetlands, as well as the increased potential for saltwater intrusion. Additional withdrawals from the Surficial Aquifer in these coastal areas will be evaluated on a project-by-project basis.

Surficial Aquifer System Estimated Costs

The costs related to well construction for the Surficial Aquifer System are provided in Chapter 3 of the *DRAFT Consolidated Water Supply Plan Support Document*. The costs to develop the Surficial Aquifer include drilling the well, pumps and treatment facilities, if necessary. Drilling of a Surficial Aquifer well is a function of diameter and depth. Cost for a 200-foot well depth is estimated to range from $32,000 for a 10-inch diameter well to $57,000 for a 24-inch diameter well. The amount of water that can be withdrawn from an individual well is site specific and varies across the UEC Planning Area. Production from Surficial Aquifer wells can be limited by the geology of the area, the rate of recharge and water movement in the aquifer, environmental impacts, proximity to contamination sources, saltwater intrusion, well diameter, pump capacity and other existing legal users' withdrawals in the area. Typical production rates from Surficial Aquifer wells in the UEC Planning Area range from 0.30 MGD to 0.75 MGD.

Pumping costs vary depending on the volume of water needed. For example, the construction cost for a 1-MGD pumping system is estimated to be about $72,000 with an annual operation and maintenance cost of $28,000. The construction cost for a 5-MGD pumping system is estimated to cost about $132,000 with an annual operation and maintenance cost of $104,000.

There are additional costs for water treatment for potable uses. Many of the treatment facilities in the planning area use lime softening for Surficial Aquifer water. Treatment cost information is provided in Chapter 5 of the *DRAFT Consolidated Water Supply Plan Support Document*. Estimated lime softening costs for construction and operation and maintenance is $1.38 per 1,000 gallons for a 1-MGD facility to about $0.80 per 1,000 gallons for a 10-MGD facility.

Utilities are beginning to convert traditional lime softening facilities to enhanced lime softening and membrane softening due to the advent of more stringent drinking water standards. The cost advantages of lime softening are in operating and maintenance expenses, where costs are typically 20 percent less than for comparable membrane technologies. One significant advantage of membrane softening over lime softening is the effectiveness of membrane softening in removing organics that function as a precursor to the formation of disinfection by-products, such as trihalomethanes.

Surficial Aquifer System – Quantity of Water Potentially Available

Based on the 1998 Plan analysis and information contained in **Chapter 3**, from a regional perspective, increases in production from the SAS along the coast beyond existing demands appears limited due to potential wetland impacts and saltwater intrusion. However, it was concluded as part of the analysis that some further development of the SAS could be accomplished in these areas at the local level through modifications to wellfield configurations and pumping regimes with respect to locations of wetlands and salt water. As a result, additional withdrawals from the SAS in these coastal areas have to be evaluated on a project-by-project basis.

Surficial Aquifer System – Implementation Strategies

The following are potential strategies developed in cooperation with the public that will be considered in the development of plan recommendations regarding the Surficial Aquifer:

- Develop tools so that Surficial Aquifer modeling can be incorporated into the next five-year update of this Plan.
- The potential of using the SAS for new and expanded uses should be evaluated on a project-by-project basis.
- Water users should consider development of alternative water sources that reduce reliance on the SAS for meeting future demands, and apply for the AWS Grant Program.

RELATED STRATEGIES

The District will continue to coordinate the 2004 UEC Water Supply Plan recommendations with other regional planning efforts, including development of the Lower East Coast Regional Water Supply Plan, the CERP North Palm Beach County Project Part 1 project, Ten Mile Creek Critical Restoration Project, Indian River Lagoon – South Project and others.

UNIT PRODUCTION COSTS FOR WATER SOURCE OPTION DEVELOPMENT

Cost information has been provided throughout this chapter and in Chapter 3 and 5 of the *DRAFT Consolidated Water Supply Plan Support Document* that could be used to estimate the planning-level total cost for different capacities for each of the water source options. This cost information was presented using the same categories in order to provide comparable cost estimates. The water supply cost estimates allow a relative comparison of the total cost for each alternative considered.

To ensure this internal comparability, the following cost estimate categories were used:

- Capital cost (including well drilling cost, construction cost, equipment cost, land cost and engineering cost).
- Operation and maintenance cost (including energy cost).

Total costs, which account for all expenditures, are an estimate of life cycle costs and are a function of the total capital costs, the expected life of the constructed facilities, the time value of money and annual operation and maintenance costs. These cost estimates aid in comparing alternatives with differing economic characteristics.

This cost information was used to develop planning-level unit production costs for each water source option (**Table 20**). The unit production cost equals the total costs divided by water production, expressed in dollars per 1,000 gallons. For all source options, the 2002 federal planning rate of 5.875 was used. A 30-year fixed capital asset life was assumed and operating level of 70 percent of capacity was used. To arrive at the unit production costs over the 20-year planning horizon, the unused capital value at the end of the planning horizon (one-third of total capital value based on straight-line depreciation) was deducted from the expenditure-based costs. All costs are expressed in projected 2005 dollars.

Because these cost criteria were used in all economic calculations, the relative cost between source options is comparable. However, the unit production costs presented here are not necessarily directly comparable to unit production costs developed in other investigations. To be considered comparable, cost estimates must use the same economic criteria.

For most of the water source options, general assumptions were used to generate the unit cost information. These costs can be highly variable depending on the specific situations of users, as reflected in the cost ranges for some of the options. In addition, the availability of water was not considered. Water supply costs vary for a number of reasons including, but not limited to:

- Hydrogeologic and hydrologic conditions relating to the depth to the aquifer, the yield of the aquifer, water availability, degree of treatment required, etc.
- Economies of scale in spreading fixed costs over a larger volume of output.
- In an area of slow growth, a larger percentage of capacity can be utilized than in areas of more rapid growth.
- Depending upon the quality of the raw water and the nature of the end use, different levels of treatment are needed.

Table 20. Summary of Unit Production Costs for Water Source Options.

Water Source Option	Water Production Range	Unit Production Costs[a] ($/1,000 gallons)
Conservation (Indoor)	Variable	$0.22 – $0.58
Conservation (Outdoor)	Variable	$0.03 – $0.88
Groundwater		
Surficial Aquifer – Withdrawal Only	3 – 20 MGD	$.03 – $.10
Surficial Aquifer w/Lime Softening	1 – 20 MGD	$.73 – $1.38
Surficial Aquifer w/Membrane Softening[d]	3 – 20 MGD	$.88 – $1.66
Floridan Aquifer – Withdrawal Only	3 – 20 MGD	$.07 – $.15
Floridan Aquifer w/Reverse Osmosis[d]	1 – 20 MGD	$1.60 – $2.15
Reclaimed Water	Variable	$.40 – $2.20
Seawater w/Reverse Osmosis	Variable	$1.71 – $8.77[b]
Storage		
Aquifer Storage and Recovery	2 – 5 MGD	$.44 – $1.05[e]
Reservoir (4 feet deep)	6,000 acre-feet	$.21[c]
Reservoir (8 feet deep)	12,000 acre-feet	$.18[c]
Surface Water – Withdrawal Only	Variable	$.03 – $.21[d]

a. All costs are over a 30-year project life and are not discounted. Because of economies of scale, the lower cost represents cost per unit for the greater capacity.
b. Lower cost in range reflects a high degree of special site-specific circumstances.
c. Represents the cost based on physical volume. Per unit cost for water made available is highly dependent on operational regimes and land costs.
d. Assumes withdrawal from existing surface water source, such as a canal or existing surface water management system. Cost could be significantly higher if separate storage area is required.
e. Varies depending on treatment required.

CONCLUSIONS

Overall, it is concluded that with continued diversification of supply sources, such as the use of the Floridan Aquifer and reclaimed water, the existing and future water demands of the UEC Planning Area can be met with minimal potential impacts. Increased conservation of all water sources could result in several million gallons per day of water savings. Existing water uses have maximized development of the Surficial Aquifer in the coastal areas such that increased withdrawals from the Surficial Aquifer are limited, and are not adequate to meet the growing needs of the UEC Planning Area during a 1-in-10 year drought condition.

The two primary uses of the Surficial Aquifer in the coastal areas of the UEC Planning Area are public water supply and landscape irrigation. For public water supply, the scenario that showed the most promise to satisfy projected demands was continued use of the Surficial Aquifer at current levels and continued development of the Floridan Aquifer to meet the growing needs for potable water. Conservation, primarily through

retrofits of plumbing fixtures in older housing was shown to have significant potential savings in water use.

For landscape irrigation, the scenario that showed the most promise to meet future needs was continued use of the Surficial Aquifer at current levels and continued development of reclaimed water to meet the growing needs for irrigation water. Additional withdrawals from the Surficial Aquifer for landscape irrigation may be possible on a project-by-project basis. Landscape irrigation savings could be increased with the installation of rain sensors on existing irrigation systems. Improvements to landscape irrigation systems resulting from urban mobile irrigation lab evaluations can also further reduce outdoor water use.

For irrigated agriculture, predominately citrus, the existing practice of use of surface water from the C-23, C-24, C-25 and C-44 canals, supplemented with Floridan Aquifer water, is sufficient to meet the existing and projected needs during a 1-in-10 year drought event. Changes in economic condition within the citrus industry have caused projections of increases in irrigated agricultural acreage in the 1998 Plan to be reassessed. Growth in overall agricultural demand from 2000 levels is not anticipated. Construction of storage reservoirs associated with the CERP Indian River Lagoon – South Project will enhance surface water availability and reduce reliance on the Floridan Aquifer. Implementation of voluntary best management practices identified by the citrus industry, continued conversion of seepage/flood irrigation systems to microirrigation and the use of the existing agricultural mobile irrigation lab can further reduce agricultural water usage.

The analysis indicates the Floridan Aquifer can support the additional projected demands without exceeding resource protection criteria. The relationship between water levels, water quality and water use needs to be better understood. However, based on limited historic water quality information and projected water levels, significant changes in water quality are not anticipated with the projected demands. Continued collection of data towards this end should lead to a better understanding of this relationship. Development of a model to predict potential Floridan Aquifer water quality changes in the future is needed, preferably in time for the next update of this Plan.

Freshwater discharges from the C-23, C-24, C-25 and C-44 canals to the St. Lucie River and Estuary and the Indian River Lagoon are problematic in maintaining a healthy estuarine system. High-volume, prolonged freshwater releases from Lake Okeechobee via the C-44 Canal have a dramatic effect on water quality and the health of the estuarine system. A MFL was established for the St. Lucie River and Estuary in 2002. To address problems due to excessive flows and to provide additional storage, the CERP Indian River Lagoon – South PIR has been completed and its incorporation into the *Water Resource Development Act of 2004 (*WRDA 2004) is being pursued. Construction of the CERP Indian River Lagoon – South Project and the Ten Mile Creek Critical Restoration Project will address regional storage and freshwater flows from the watershed; the CERP and possible modifications to the Water Supply and Environmental Regulation Schedule

will address freshwater discharges from Lake Okeechobee to the St. Lucie River via the C-44 Canal.

The Loxahatchee River has been significantly impacted by the creation and maintenance of the Jupiter Inlet, which has contributed to the displacement of freshwater wetland communities by estuarine species in the Northwest Fork. In addition, construction of the C-18 Canal and installation of drainage projects for agricultural and urban development have lowered water tables and reduced the amount of fresh water available to the Northwest Fork of the Loxahatchee River, significantly altering natural flow patterns.

The District, USACE and local governments are making progress in improving flows to the Loxahatchee River. The Northern Palm Beach County Comprehensive Water Management Plan was accepted by the SFWMD's Governing Board in May 2002 and is being implemented, in addition to recommendations in the *2000 Lower East Coast Regional Water Supply Pla*n. A minimum flow and level was established for the Northwest Fork of the Loxahatchee River in 2002. The District has purchased approximately 44,800 acre-feet of storage in the L-8 Reservoir in the southern L-8 Basin. Analysis is being undertaken through the CERP North Palm Beach County Project, Part 1 modeling initiatives to determine how much more storage will be needed in the future. Construction of the G-160 Loxahatchee Slough Structure in northeastern Palm Beach County was completed in January 2004. This $2.1 million spillway structure will provide essential freshwater flows to the Northwest Fork of the Loxahatchee River during the dry season and will also maintain a more natural hydroperiod within the slough. Construction of the G-161 Northlake Boulevard Structure began in 2004.

An initial water reservation for the Loxahatchee River will be established in 2004. By 2005, the existing MFL and associated recovery plan for the Northwest Fork of the Loxahatchee River will be reviewed and revised, as necessary, to be consistent with established restoration goals and future water reservations. Minimum flows and levels will be established for the tributaries to the Northwest Fork of the Loxahatchee River (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough) by 2007.

CHAPTER 6
Recommendations

Eight water source options were identified and discussed in **Chapter 5** that provide opportunities to address the water supply issues in the Upper East Coast (UEC) Planning Area.

- Aquifer storage and recovery
- Conservation
- Floridan Aquifer
- Reclaimed Water
- Reservoirs
- Seawater
- Surface water
- Surficial Aquifer

The water source options were reviewed to assess their potential of meeting the water supply needs of the region (**Table 21**). **Table 21** indicates the ability of options to meet identified needs, except for inland environmental needs. For inland environmental needs, the response shows the ability of that option to offset demands, primarily from the Surficial Aquifer System (SAS), thereby reducing demand and potentially enhancing nearby natural systems. The relative ability of each source option in this table was based on regional volumes (supply and demand), and does not in all cases reflect the public's sense of importance of that option. For example, significant emphasis was placed on the importance of conservation and the furthering of a conservation ethic, although from a regional perspective, and compared to other water source options; the volume of water that could be made available through conservation is low to medium. At the local level, the potential of each option may change based on the specific needs of that local situation. Elements of conservation are incorporated with the use of each of these options.

In **Table 21**, an entry of high (H) indicates the option, based on volume, has a high potential to address the associated category's water supply needs. A medium (M) entry indicates the option has a medium potential and a low (L) entry means there is low potential to address water supply needs. The high, medium and low entries are relative to one another. These options serve as a menu that local water users should consider in meeting their water needs. In many cases, several options will be used to meet the demands, depending on the specific situation.

Potential implementation strategies for each of the water source options were presented in the previous chapter. This chapter provides recommendations for these strategies to facilitate development of each of the options, both at the regional level (water resource development) and the local level (water supply development). Water

resource development recommendations and water supply development recommendations are presented in separate sections in this chapter.

The funding approach for the UEC Water Supply Plan, as well as potential funding sources for water resource and water supply development recommendations are described in the Funding section of this chapter. The recommendations contained in this Plan are subject to SFWMD Governing Board approval and fiscal budgetary appropriations. As a result, the schedules identified in the Plan are subject to change based on future resource and budgetary constraints. A five-year water resource development work program will be developed following approval of the water supply plans.

Table 21. Potential of Water Source Options in Meeting 2025 UEC Water Supply Needs.

Water Source Option	UEC Water Supply Needs					
	Public Water Supply	Recreational Self-Supply	Agriculture	Thermoelectric Power Generation	Freshwater Needs of Estuarine Systems	Inland Environ-mental Needs[c]
Aquifer Storage and Recovery	L	L	L	L	L[d]	L
Conservation[a]	L/M	L	L	L	N/A	L
Floridan Aquifer System	H	L	M	H	N/A	H
Reclaimed Water	L	M	L	H	N/A	H
Reservoirs	L	L	M	H	H	L
Seawater[b]	L	L	L	H	N/A	L
Surface Water	L	L	H	L	H	L
Surficial Aquifer System	M	M	L	L	N/A	L

L=Low; M=Medium; H=High; N/A=Not Applicable

a. Generally cost-effective and although does not yield volumes comparable to other options, is considered highly effective in contributing to long-term, climate-proof resources.
b. Potentially large volume could be made available, but determined not cost-effective at this time.
c. Ability of option to reduce demands from SAS, potentially enhancing nearby natural systems.
d. ASR was not identified as a component in the recommended CERP Indian River Lagoon – South Project.

WATER RESOURCE DEVELOPMENT RECOMMENDATIONS

Water resource development recommendations are water resource management strategies that are regional in nature and support water supply development at the local level. These could include collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation and maintenance of major public works facilities to provide for flood control, surface and underground water storage and groundwater recharge augmentation; and related technical assistance to local governments and to government-owned and privately-owned water utilities. Water resource development recommendations are primarily the responsibility of the District.

This section presents the water resource development recommendations for each of the water source options identified in **Chapter 5**. For each water source option, a description, the potential quantity of water that could be made available through that water source option and the water resource development recommendations are provided. For each water resource development recommendation, a description of the recommendation, the quantity of water to be made available, a six-year implementation schedule (Fiscal Year 2005 through 2010), estimated cost, funding source and the implementing agency are provided. The District's fiscal year begins October 1st and ends September 30th. For example, Fiscal Year 2005 (FY 2005) begins October 1, 2004 and ends on September 30, 2005.

Costs include contract dollar estimates, cost of materials and cost-sharing with other agencies; while personnel time estimates, expressed in full-time equivalents (FTEs), represent only District staff time. Dollar costs in tables are stated in 1,000's and do not include the cost of FTEs. Total costs include monies from the District and other agencies, and unless otherwise specified, may be for a time period different than FY 2005 – FY 2010. For example, the Ten Mile Creek Critical Restoration Project has been under development for several years, with construction being initiated in November 2003. The total recommendation cost is $37,000,000, while the cost for FY 2005 – FY 2010 is $7,964,000. The entry of N/A denotes not applicable.

Aquifer Storage and Recovery

Aquifer storage and recovery (ASR) is the underground storage of injected water into an acceptable aquifer (typically the Floridan Aquifer System in south Florida) during times when water is available, and the later recovery of this water during high demand periods. The aquifer acts as an underground reservoir for the injected water, reducing water loss to evaporation.

This technology could be used for storage of treated drinking water, partially treated surface water or other treated source. Presently, there are no ASR facilities in the UEC Planning Area. Any water injected must meet all applicable state and federal regulations to ensure public health and safety.

ASR – Quantity of Water Potentially Available

The volume of water that could be made available through ASR wells depends upon several local factors, such as well yield, water availability and variability in water supply and demand. Without additional information, it is not possible to accurately estimate the quantity of water that could be available through ASR. Typical storage volumes for individual wells range from 10 to 500 million gallons per cycle or 31 to 1,535 acre-feet (Pyne, 1995). The volume of water that could be made available by any specific user must be determined through the District's Consumptive Use Permitting (CUP) Program.

ASR – Water Resource Development Recommendations

The following is the water resource development recommendation regarding ASR:

Recommendation 1: The District will provide technical assistance to utilities pursuing aquifer storage and recovery to comply with local, state and federal standards.

Description: Two potential applications of ASR were identified in the UEC Planning Area: drinking water ASR and reclaimed water ASR. For drinking water ASR, utilities whose demands are less than their allocation could store the difference in an ASR system for future use. There are several successful drinking water ASR wells in the District. Reclaimed water ASR was identified as a potential option for reclaimed water storage for utilities that are experiencing seasonal reclaimed water deficits. Aquifer storage and recovery could be used for storage of excess reclaimed water, or for supplemental sources, such as storm water, for later use. There are utilities in the Tampa area that have constructed reclaimed water ASR wells and are operationally testing these systems at this time. There are no reclaimed water ASR wells in the SFWMD.

Each of these ASR applications would have to comply with local, state and federal standards for the protection of public health, safety and welfare.

Potential Elements:

A. Continue to work with utilities to identify opportunities for drinking water or reclaimed water ASR.
B. Assist utilities in identifying benefits of ASR.
C. Identify the potential for District funding assistance, such as the Alternative Water Supply Funding Program, to assist utilities implementing ASR.

Total Recommendation Cost: $0

Potential Funding Sources: SFWMD

Estimated District Participation: $0 FTEs: 0.30

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 22. Estimated Schedule and Costs for Promoting ASR.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$0	$0	$0	$0	$0	$0
FTEs	0.05	0.05	0.05	0.05	0.05	0.05	0.30

Conservation

Conservation refers to reductions in water use. Practices and technologies that provide reductions in per capita water uses consist of both long-term, permanent reductions and short-term reductions, which result from temporary behavior changes. Long-term reductions generally result from implementation of technologies, such as ultralow flow plumbing/irrigation devices and water pricing strategies that encourage efficient water use. This is in contrast to short-term water conservation measures and cutbacks made by users during water shortage situations.

Conservation – Quantity of Water Available

With effective implementation of water conservation showerhead, toilet and rain sensor retrofit programs, it is estimated that 11 million gallons per day (MGD) of water could be saved in the urban water use sector of the UEC Planning Area. This assumes 75 percent of eligible characteristic housing stock is retrofitted. In the agricultural sector, over 80 percent of the citrus acreage is currently using microirrigation, a water-efficient technology.

Conservation – Water Resource Development Recommendations

The following are water resource development recommendations regarding conservation:

Recommendation 2: Continue mobile lab presence and expand activity.

Description: Currently there are two urban mobile irrigation labs funded by the District and one agricultural lab funded by U.S. Department of Agriculture – Natural Resources Conservation Service (USDA–NRCS) operating in the UEC Planning Area. The District should continue funding of the urban labs and look for opportunities to expand their activity in the region. This could include local government partnerships funding increased lab services, particularly in newer urban communities.

Potential Elements:

A. One agricultural MIL.

B. Two urban MILs.

Total Recommendation Cost: $2,445,000

Potential Funding Sources: SFWMD, USDA, soil and water conservation districts, and county and local governments

Estimated District Participation: $696,000 FTEs: 0.60

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 1.02 MGD

Cost per Thousand Gallons: Not available

Table 23. Estimated Schedule and Costs to Continue Mobile Irrigation Lab Activity.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$116	$116	$116	$116	$116	$116	$696
FTEs	0.10	0.10	0.10	0.10	0.10	0.10	0.60

Recommendation 3: Complete rulemaking for Water Conservation.

Description: The District should complete the ongoing rulemaking in Chapter 40E-2 of the Florida Administrative Code (F.A.C.) and *Basis of Review for Water Use Permit Applications* (SFWMD, 1997) regarding water conservation requirements, which will focus on goal-based conservation programs for public water suppliers, and other major water users.

Potential Elements:

A. Conduct rule development workshops throughout the District.

B. Conduct rulemaking workshops throughout the District.

C. Governing Board adopts rules.

D. Utilize public information and outreach strategies to expand awareness.

E. Meet with permit applicants as needed.

Total Recommendation Cost: $10,000

Potential Funding Sources: SFWMD

Estimated District Participation: $10,000 FTEs: 0.65

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 24. Estimated Schedule and Costs for Completion of Rulemaking for Water Conservation.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$5	$5	$0	$0	$0	$10
FTEs	0.00	0.25	0.10	0.10	0.10	0.10	0.65

Recommendation 4: Continue funding of the Water Savings Incentive Program.

Description: The District should continue to fund and enhance the Water Savings Incentive (WaterSIP) Program, to facilitate implementation of cost-effective indoor and outdoor retrofits, such as toilet and showerhead retrofit and rain sensor programs, in the UEC Planning Area, as recommended in this Plan. This cost-share program may benefit public agencies, such as local governments, water utilities or private entities, such as homeowners associations. In past years, the Governing Board has approved funding up to 50 percent of a program's cost, up to $50,000 for each conservation project.

Potential Elements:

A. Annually, solicit water conservation proposals from utilities, local governments and large water users via annual workshops at the service center.
B. Assist utilities in submitting proposals consistent with the UEC Plan recommendations.
C. Increase outreach and public information efforts on water savings realized from WaterSIP projects in UEC Planning Area.
D. Complete projects within 12 months.

Total Recommendation Cost: $5,000,000*

Potential Funding Sources: SFWMD

Estimated District Participation: $5,000,000* FTEs: 2.00*

Implementing Agency: SFWMD

Quantity of Water to be Made Available: 6.60 MGD* (based on two years of program experience and projected savings as a result of increased funding over time)

Cost per Thousand Gallons: Not available

Table 25. Estimated Schedule and Costs for Continuing Water Savings Incentive Program.*

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$500	$750	$750	$1000	$1,000	$1,000	$5,000
FTEs	0.20	0.20	0.30	0.30	0.50	0.50	2.00

*Districtwide.

Recommendation 5: Expand water conservation outreach and education.

Description: The District, in cooperation with local governments, utilities, large water users and water industry professional organizations, will expand water conservation outreach and education in the UEC Planning Area through District-sponsored workshops, educational materials and funding partnerships, such as Florida Yards and Neighborhoods, MILs and Building Green Workshops.

Potential Elements:

A. Coordinate project priorities with the District's Department of Public Information and Regional Service Centers.

B. Develop partnerships with local governments, utilities and other large water users to implement retrofit recommendations.

C. Implement Outreach/Education recommendations of the Florida Water Conservation Initiative and continually expand awareness of the progress of the Joint Statement of Commitment.

D. Support efforts of major water users (by industry) to promote best management practices for water conservation by facilitating annual conservation funding workshops.

Total Recommendation Cost: $2,600,000*

Potential Funding Sources: SFWMD, local governments, utilities, large water users and water industry professional organizations

Estimated District Participation: $2,600,000* FTEs: 1.30*

Implementing Agency: SFWMD

Quantity of Water to be Made Available: Not available

Cost per Thousand Gallons: Not available

Table 26. Estimated Schedule and Costs for Expanding Water Conservation Outreach and Education.*

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$300	$300	$500	$500	$500	$500	$2,600
FTEs	0.20	0.30	0.20	0.20	0.20	0.20	1.30

*Districtwide.

Floridan Aquifer System

The upper Floridan Aquifer is the principal source of supply to users of the Floridan Aquifer System (FAS) in the planning area. The top of the FAS lies approximately -300 feet National Geodetic Vertical Datum (NGVD) in the northwest corner of the planning area, then dips to the southeast to more than -900 feet NGVD in southeast Martin County. For most of the planning area, the Floridan Aquifer is artesian; the wells flow naturally at land surface without the need for pumps. Water in the FAS is brackish (saline) in the UEC Planning Area. Additional information on the hydrogeology of the FAS in the UEC Planning Area is provided in the *DRAFT Consolidated Water Supply Plan Support Document.*

The upper Floridan Aquifer is used extensively by citrus growers in the UEC Planning Area, primarily as a supplemental irrigation source when surface water availability is limited and as a primary source in areas where no surface water is available. Water from the Floridan is generally blended with surface water or water from the Surficial Aquifer to reduce potential problems associated with salinity. Water quality is critical in maintaining the sustainability of this resource. If the water becomes too salty, excess salinity of irrigation water can result in decreased citrus production/yield, reduction in root growth, and can be fatal to specific root stocks (Syvertsen *et al.* 1989). Construction of storage reservoirs associated with the Comprehensive Everglades Restoration Plan (CERP) Indian River Lagoon – South Project will enhance surface water availability and should reduce the use of the Floridan Aquifer by the citrus industry.

Most of the coastal utilities in the region including Fort Pierce Utilities Authority, Port St. Lucie, Martin County Utilities, South Martin Regional Utility, Plantation Utilities and Sailfish Point currently use water from the Floridan Aquifer as a source of drinking water. A number of smaller private coastal facilities also use water from the Floridan Aquifer as a primary source for potable water. Water from the aquifer is nonpotable throughout the planning area and requires desalination or blending prior to potable use. Utilities in the UEC Planning Area use reverse osmosis (RO) treatment to provide potable quality water. Most of the coastal utilities plan to use water from the Floridan Aquifer to meet increases in potable water demand in their service area.

FAS – Quantity of Water Available

The 1998 Plan analysis indicated the Floridan Aquifer has the potential of supplying, at a minimum, sufficient water to meet all the 2020 projected public water supply demands (64 MGD), while meeting the supplemental water needs (125 MGD) of agricultural users during a 1-in-10 year drought event. This assumes withdrawals will be obtained from existing or proposed wells in agricultural areas, and from wells in proximity of existing Surficial Aquifer wells for public water supply.

FAS – Water Resource Development Recommendations

The following are water resource development recommendations regarding the Floridan Aquifer:

Recommendation 6: Continue to collect data from the comprehensive regional Floridan Aquifer monitoring well network.

Description: The District should continue to collect water level, water quality and water use data from the comprehensive regional Floridan Aquifer network established pursuant to the 1998 UEC Water Supply Plan, including public water supply wells. Data from the network will be used to better understand the relationships between water levels, water quality and water use.

Potential Elements:

A. Collect and analyze water level, water quality and water use data from network.

B. Maintain electronic data loggers, flow meters and wellheads.

C. Prepare reports presenting data and analysis.

D. Use these data to develop an enhanced computer model of the FAS in time for the next update of this Plan.

Total Recommendation Cost: $744,000

Potential Funding Sources: SFWMD

Estimated District Participation: $744,000 FTEs: 2.40

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 27. Estimated Schedule and Costs for Comprehensive Regional Floridan Aquifer Network.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$122	$122	$125	$125	$125	$125	$744
FTEs	0.40	0.40	0.40	0.40	0.40	0.40	2.40

Recommendation 7: Develop a density dependent solute transport groundwater flow model for next UEC Water Supply Plan Update for predictive analysis purposes.

Description: The District will develop and calibrate a density dependent groundwater flow model for the Floridan Aquifer. Hydrogeologic data being collected for the CERP ASR Regional Floridan model will also be used in building this model. The District will use this model to support development of the next update of the UEC Water Supply Plan.

Potential Elements:

A. Install coastal recorders and sample wells to collect water level and water quality data needed for calibrating this model.

B. Develop statement of work and select contractor to develop the model.

C. Develop and calibrate model, and provide documentation for model.

D. Run calibrated model to simulate different scenarios for next update of UEC Water Supply Plan.

E. Evaluates model outputs.

Total Recommendation Cost: $200,000

Potential Funding Sources: SFWMD

Estimated District Participation: $200,000 FTEs: 2.60

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 28. Estimated Schedule and Costs for Development of Density Dependent Groundwater Model.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$50	$100	$50	$0	$0	$0	$200
FTEs	0.30	0.30	1.00	1.00	0	0	2.60

Recommendation 8: Implement a Floridan Aquifer exploratory well program to gather additional hydrogeologic data for development of a Floridan Aquifer density dependent groundwater model.

Description: The District will implement a Floridan Aquifer exploratory well drilling program to gather Floridan Aquifer hydrogeologic information. There are currently only two sites in the planning area where the District has gained comprehensive knowledge of the FAS. This recommendation incorporates three Floridan Aquifer exploratory well sites in the planning area. The effort involves construction of a multi-zone monitoring well, geophysical logging and aquifer performance testing at each site. Each site will be thoroughly documented and all hydrogeologic data stored in the database.

Potential Elements:

A. Select drilling sites (3).

B. Select sites and obtain access agreements.

C. Develop scope of work and select contractor.

D. Mobilize drilling site and complete work.

E. Install recorders on wells, incorporate wells into monitoring network, and conduct sampling quarterly.

F. Repeat process for second and third sites.

G. Compile information and prepare report.

Total Recommendation Cost: $2,250,000

Potential Funding Sources: SFWMD

Estimated District Participation: $2,250,000 FTEs: 1.40

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 29. Estimated Schedule and Costs for Implementation of Floridan Aquifer Exploratory Well Program.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$750	$750	$750	$0	$0	$0	$2,250
FTEs	0.40	0.40	0.40	0.20	0.00	0.00	1.40

Recommendation 9: Conduct Floridan Aquifer tracer tests to better understand flow paths in Floridan Aquifer.

Description: The District will conduct and document tracer tests in the Floridan Aquifer at two sites. The tracer tests will show preferential flow paths within the aquifer and allow the District to calculate dispersivity for the density dependent model as recommended.

Potential Elements:

A. Select tracer test sites.

B. Select contractor to conduct tracer tests.

C. Evaluate results from tests and prepare a report.

Total Recommendation Cost: $200,000

Potential Funding Sources: SFWMD

Estimated District Participation: $200,000 FTEs: 0.70

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 30. Estimated Schedule and Costs for Floridan Aquifer Tracer Tests.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$10	$70	$120	$0	$0	$0	$200
FTEs	0.20	0.20	0.20	0.10	0.00	0.00	0.70

Recommendation 10: Refine Floridan well inventory, increase public awareness of the presence of Floridan wells as land is converted from agricultural use to urban use and support local initiatives to decommission wells that are no longer used.

Description: Through renewal of consumptive use permits in the UEC Planning Area, the District will refine its inventory of Floridan Aquifer wells. The Floridan well inventory will be employed to ensure that Floridan wells are appropriately decommissioned as land used for citrus production (or other agricultural use) is developed into urban uses. Developers will be notified of the presence of Floridan wells on properties through the District's Environmental Resource Permitting (ERP) and/or Consumptive Use Permitting (CUP) Program. The District will provide technical assistance to local Floridan well decommissioning initiatives, including support in securing state and federal funding.

Potential Elements:

A. Refine Floridan well inventory based on consumptive use permit renewal information.

B. Provide Floridan well inventory data to the ERP Program.

C. Educate developers on the location of Floridan wells on properties.

D. Provide technical assistance and support to local initiatives in securing state and federal funding for decommissioning inactive Floridan wells.

Total Recommendation Cost: $0

Potential Funding Sources: SFWMD

Estimated District Participation: $0 FTEs: 0.35

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 31. Estimated Schedule and Costs for Refining Floridan Well Inventory.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$0	$0	$0	$0	$0	$0
FTEs	0.10	0.05	0.05	0.05	0.05	0.05	0.35

Reclaimed Water

Reclaimed water is wastewater that has received at least secondary treatment and is reused after flowing out of a wastewater treatment plant (Chapter 62-610, F.A.C.). Water reuse is the deliberate application of reclaimed water for a beneficial purpose, in compliance with the FDEP and water management district rules. Potential uses of reclaimed water include landscape irrigation, including medians, residential lots, golf courses and other green space, agricultural irrigation, groundwater recharge via percolation ponds, industrial uses, environmental enhancement and fire protection.

Reclaimed Water – Quantity of Water Available

Twenty-seven of the 28 wastewater facilities in the UEC Planning Area with a capacity of 0.10 MGD or greater employ reuse for all or a portion of their disposal. Over 40 percent (8.10 MGD) of the wastewater treated in the planning area in 2003 was reused for a beneficial purpose with 5.43 MGD used for irrigation. In 2002, reclaimed water was used for irrigation of over 5,400 residential lots, 20 golf courses, three parks, five schools and a citrus grove (FDEP, 2002c). About 2.20 MGD was used for groundwater recharge and the remainder was used for industrial and toilet flushing purposes. The results of the analysis indicate that current reuse in the UEC Planning Area, primarily irrigation of golf courses, has contributed to reduce potential resource impacts. It is estimated that wastewater flows will increase to about 40 MGD by 2025—all potentially reusable water.

Reclaimed Water – Water Resource Development Recommendations

The following are water resource development recommendations regarding Reclaimed Water:

Recommendation 11: The District will continue to encourage reclaimed water interconnects between utilities, where appropriate, to maximize the use of reclaimed water.

Description: Interconnections between reclaimed water systems could increase the volume of reclaimed water being used by providing an alternative to deep well injection when wastewater flows exceed reclaimed water demand. By interconnecting reuse systems, reclaimed water could be transferred to an adjoining utility that may be experiencing a deficit of reclaimed water or as reclaimed water storage, stored and retrieved, for use at a later date. For facilities that have minimal reuse capabilities, interconnects with a utility that has these capabilities will make beneficial use of reclaimed water. Reclaimed water interconnects that result in regional benefits should be considered for water resource development funding from the District similar to recommendations in the 1998 Plan.

Potential Elements:

A. Continue to work with utilities to identify opportunities for reclaimed water interconnects.

B. Assist utilities in identifying benefits of reclaimed water interconnects.

C. Identify the potential for District funding assistance, such as the Alternative Water Supply Funding Program and water resource development funds.

Total Recommendation Cost: $0*

Potential Funding Sources: SFWMD

Estimated District Participation: $0* FTEs: 0.30

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 32. Estimated Schedule and Costs for Encouraging Reclaimed Water Interconnects.*

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$0	$0	$0	$0	$0	$0
FTEs	0.05	0.05	0.05	0.05	0.05	0.05	0.30

*Potential alternative water supply funding or future water resource development funding to be identified.

Recommendation 12: Modify WaterSIP application criteria to encourage efficient use of reclaimed water.

Description: Utilities are encouraged to become more efficient in the use of reclaimed water. This could include installing meters and establishing volume based rates and/or establishing application rates consistent with District allocation criteria. The District should modify project-scoring criteria for the WaterSIP funding program to give greater emphasis for efficient use of reclaimed water.

Potential Elements:

A. Modify scoring criteria, as appropriate; to increase scoring for reclaimed water projects involving installation of meters and establishment of volume-based rate structures.

B. Implement new criteria.

Total Recommendation Cost: $0

Potential Funding Sources: SFWMD

Estimated District Participation: $0 FTEs: 0.15

Implementing Agency: SFWMD

Quantity of Water To be Made Available: TBD

Cost per Thousand Gallons: TBD

Table 33. Estimated Schedule and Costs for Revising WaterSIP Scoring Criteria.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$0	$0	$0	$0	$0	$0
FTEs	0.15	0.00	0.00	0.00	0.00	0.00	0.15

Recommendation 13: The District will provide technical assistance to local governments in establishing mandatory reuse zones.

Description: Mandatory reuse zones are geographic areas designated by local governments through ordinance where the use of reclaimed water is required. Mandatory reuse zones are very effective in increasing reuse, especially in undeveloped areas where installation of reclaimed water distribution systems and use of reclaimed water would be required at the time of development for projects located in the zone. It is much more cost-effective to install reclaimed water distribution systems at the time of development compared to retrofitting existing developments.

Potential Elements:

A. Educate utilities and local governments on the mandatory reuse zone concept.

B. Provide technical support to entities interested in pursuing mandatory reuse zones, including example ordinances and contacts with entities who have implemented similar mandatory zones.

Total Recommendation Cost: $0

Potential Funding Sources: SFWMD

Estimated District Participation: $0 FTEs: 0.35

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 34. Estimated Schedule and Costs for promoting Mandatory Reuse Zones.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$0	$0	$0	$0	$0	$0
FTEs	0.05	0.10	0.05	0.05	0.05	0.05	0.35

Reservoirs

This option involves the capture and storage of excess surface water during rainy periods and subsequent release during drier periods for environmental and human uses. Regionally, surface water storage could be used to attenuate freshwater flows to the St. Lucie River and Estuary, southern Indian River Lagoon and the Northwest Fork or the Loxahatchee River and Estuary during rainy periods and to provide beneficial flows during drier times. In addition, these facilities could increase surface water availability for current and projected uses, and decrease the demand on aquifer systems. However, evaporative and seepage losses need to be considered as these losses could significantly effect water availability.

Reservoirs – Quantity of Water Potentially Available

Reservoirs are considered a management option as these systems allow more efficient use of other sources, such as surface water. The CERP Indian River Lagoon – South Project Implementation Report estimates the project could increase surface water availability by 26,300 acre-feet per year (23.48 MGD). District staff estimate this could result in a decrease of 19 percent in Floridan Aquifer usage for agriculture, further assuring the water needs of the agricultural community.

Reservoirs – Water Resource Development Recommendations

Regional storage through reservoirs is addressed in the Surface Water recommendations of this chapter.

Seawater

This option involves using seawater from the Atlantic Ocean as a raw water source. The ocean (seawater) is an unlimited source of water from a quantitative perspective; however, removal of salts (desalination) is required before potable or irrigation uses are feasible. To accomplish this, a desalination treatment technology would have to be used, such as distillation, reverse osmosis (RO) or electrodialysis reversal (EDR).

Seawater – Quantity of Water Potentially Available

The volume of water available from seawater is unlimited and could meet the needs of this region through the year 2025.

Seawater Recommendations

As part of the UEC 2004 water supply planning process, it was concluded that seawater is a potential alternative source of water, which needs future consideration; however, not in the 2025 planning horizon. Based on the projected water demands, other water sources are available to meet projected needs that have lower treatment costs.

Surface Water

This option involves surface water and surface water related environmental supply strategies to ensure the needs of the environment are met. Strategies include minimum flows and levels (MFLs), water reservations, environmental restoration plans and CERP projects. In the UEC Planning Area, surface water includes direct withdrawal of water from regional surface water sources, primarily the C-23, C-24, C-25 and C-44 canals. Related efforts involve the capture and storage of excess surface water during rainy periods and subsequent release during drier periods for environmental and human uses. Regionally, this includes reservoirs for storage of surface water that could be used to attenuate freshwater flows to the St. Lucie River and Estuary, southern Indian River Lagoon and Northwest Fork of the Loxahatchee River during rainy periods and meet minimum flows during drier periods. In addition, these facilities could increase surface water availability for other uses. In Martin and St. Lucie counties, increased surface water availability could reduce the use of the Floridan Aquifer for agricultural irrigation. This option also includes increasing flexibility in surface water management by connecting surface water basins.

This 2004 Update supports implementation of the CERP to address freshwater regulatory discharges from Lake Okeechobee to the St. Lucie River via the C-44 Canal. The CERP will create more flexibility in the operations of the regional water management system, including storage, additional conveyance systems and improvements to existing conveyance systems, among others. Components of the CERP, such as the Indian River Lagoon – South and Northern Palm Beach County Part 1 projects, located in the UEC Planning Area are itemized in the recommendations. Implementation of the CERP, which is supported from the UEC Planning Area, will not be listed as an individual recommendation in this Plan, as it will be incorporated into the Lower East Coast Regional Water Supply Plan.

Surface Water – Quantity of Water Potentially Available

Surface water from the C-23, C-24, C-25 and C-44 canals is primary surface water sources for agricultural irrigation and inflows to the St. Lucie River and Estuary and southern Indian River Lagoon. The Loxahatchee River receives inflows from the C-18 Canal and several other tributaries. Significant surface water storage will be provided in the future. Development of operating protocols for these storage systems will determine increases in surface water availability. The CERP Indian River Lagoon – South Project Implementation Report estimates the project could increase surface water availability by 26,300 acre-feet per year (23.48 MGD). District staff estimate this could result in a decrease of 19 percent in Floridan Aquifer usage for agriculture, further assuring the water needs of the agricultural community. Water for natural systems from new projects will be reserved from allocation by the SFWMD. The volume of water that may be allocated from the remaining water by any specific user must be determined through the District's CUP Program.

Surface Water – Water Resource Development Recommendations

The following are water resource development recommendations regarding Surface Water:

Recommendation 14: Continue implementation of the Northern Palm Beach County Comprehensive Water Management Plan.

Description: The Northern Palm Beach County Comprehensive Water Management Plan (NPBCCWMP) was accepted by the District's Governing Board in May 2002 and is being implemented. Approximately 44,800 acre-feet of storage has been purchased in the L-8 Reservoir. The G-160 Loxahatchee Slough Structure has been constructed and the G-161 Structure is in design and scheduled for completion in 2005. Improvements to storage and water conveyance infrastructure will capture water currently lost to tide in the wet season and provide supplemental supplies in the dry season—meeting environmental needs and projected urban and agricultural demands for the year 2020.

Potential Elements:

A. Construct G-161 Structure.

B. Widen M-Canal.

C. Replace Control-2 Structure.

D. Construct L-8 Reservoir.

Total Recommendation Cost: The cost of this project will be determined in the CERP North Palm Beach County Part 1 Project Implementation Report (PIR).

Potential Funding Sources: SFWMD, State of Florida, federal government, local governments

Estimated District Participation: $ TBD FTEs: TBD

Implementing Agency: SFWMD

Quantity of Water to be Made Available: TBD

Cost per Thousand Gallons: N/A

Table 35. Estimated Schedule and Costs for Implementation of the Northern Palm Beach County Comprehensive Water Management Plan.*

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FTEs	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Costs and FTEs to be determined in the CERP North Palm Beach County Part 1 PIR.

Recommendation 15: Complete the CERP North Palm Beach County Project Part 1 Project Implementation Report and implement the findings.

Description: The District and U.S. Army Corps of Engineers (USACE) are developing the CERP North Palm Beach County Project Part 1 Project Implementation Report (PIR). This project will serve as a continuation of the NPBCCWMP.

The PIR will document the project elements, cost and schedule, as well as describe the funding sources and implementing agencies. The amount of water that will be reserved for the environment and also made available as water supply will be determined during the PIR process. The CERP North Palm Beach County Project Part 1 is scheduled for completion and operation in 2014 at an initial estimated cost of $425 million. Local government support and coordination is needed to develop and implement the PIR.

Potential Elements: TBD during PIR

Total Recommendation Cost: $425,079,000

Potential Funding Sources: SFWMD/USACE

Estimated District Participation: $212,539,500 FTEs: TBD

Implementing Agency: SFWMD/USACE

Quantity of Water to be Made Available: TBD

Cost per Thousand Gallons: TBD

Table 36. Estimated Schedule and Costs to Complete the CERP North Palm Beach County Project Part 1 Project Implementation Report and Implement the Findings.*

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FTEs	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Elements, phasing of construction, FTEs and costs to be determined in PIR. Project implementation runs through 2014.

Recommendation 16: Develop a restoration plan for the Loxahatchee River.

Description: The District, in cooperation with other agencies and stakeholders, will develop a restoration plan for the Loxahatchee River that incorporates environmental water needs, while maintaining existing levels of flood protection and public water supply. A draft Restoration Plan may be completed at the end of 2004.

Potential Elements:

A. Summarize available data.

B. Provide modeling results.

C. Develop Plan recommendations.

Total Recommendation Cost: $ TBD

Potential Funding Sources: SFWMD

Estimated District Participation: $ TBD FTEs: 4.00

Implementing Agency: SFWMD

Quantity of Water to be Made Available: TBD

Cost per Thousand Gallons: TBD

Table 37. Estimated Schedule and Costs for Development of a Restoration Plan for the Loxahatchee River.*

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$0	$0	$0	$0	$0	$0
FTEs	4.00	0.00	0.00	0.00	0.00	0.00	4.00

*Costs and FTEs beyond FY'05 will be identified with development of Restoration Plan.

Recommendation 17: Establish initial reservation for Northwest Fork of the Loxahatchee River.

Description: The MFL rule for the Northwest Fork of the Loxahatchee River states the District intends to adopt an initial reservation to protect existing water used for protection of fish and wildlife, consistent with the restoration goal identified for the Northwest Fork of the Loxahatchee River by 2004. The District initiated rulemaking for the water reservation in April 2004. This water reservation will be reviewed periodically and revised as conditions change, such as the changes that will occur in the region as CERP projects become operational. This provides flexibility to account for changes in implementation strategies and contingency plans during the life of the project.

Potential Elements:

A. Conduct workshops.

B. Develop final rule language.

C. Governing Board adopts rule.

Total Recommendation Cost: $0

Potential Funding Sources: SFWMD

Estimated District Participation: $0 FTEs: 1.00

Implementing Agency: SFWMD

Quantity of Water to be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 38. Estimated Schedule and Costs for Establishing Initial Reservation for Northwest Fork of the Loxahatchee River.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$0	$0	$0	$0	$0	$0
FTEs	1.00	0.00	0.00	0.00	0.00	0.00	1.00

Recommendation 18: Review and revise the MFL and associated recovery strategy for the Northwest Fork of the Loxahatchee River by 2005.

Description: By 2005, review and revise, as needed, the existing MFL and associated recovery plan for the Northwest Fork of the Loxahatchee River to consider information developed during the establishment of restoration goals and water reservations pursuant to the MFL rule.

Potential Elements:

A. Collect/compile data.

B. Develop revised criteria and documentation, if needed.

C. Peer review, if needed.

D. Conduct rule development workshops, if needed.

E. Conduct rulemaking workshops

F. Governing Board adopts rules.

Total Recommendation Cost: $20,000

Potential Funding Sources: SFWMD

Estimated District Participation: $20,000 FTEs: 2.00

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 39. Estimated Schedule and Costs for Reviewing and Revising the MFL for Northwest Fork of the Loxahatchee River (if needed).

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$20	$0	$0	$0	$0	$0	$20
FTEs	2.00	0.00	0.00	0.00	0.00	0.00	2.00

Recommendation 19: Establish MFLs for the tributaries to the Northwest Fork of the Loxahatchee River.

Description: The District's *MFL Priority Water Body List* (SFWMD, 2004a) identifies the establishment of MFLs for the tributaries to the Northwest Fork of the Loxahatchee River (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough), scheduled for 2007.

Potential Elements:

A. Collect/compile data.

B. Develop criteria and documentation.

C. Peer review.

D. Conduct rule development workshops.

E. Conduct rulemaking workshops.

F. Governing Board adopts rules.

Total Recommendation Cost: $60,000

Potential Funding Sources: SFWMD

Estimated District Participation: $60,000 FTEs: 3.75

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 40. Estimated Schedule and Costs to Establish MFLs for the Tributaries to the Northwest Fork of the Loxahatchee River.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$20	$40	$0	$0	$0	$60
FTEs	0.00	1.50	2.25	0.00	0.00	0.00	3.75

Recommendation 20: Complete construction of the Ten Mile Creek Project.

Description: After many years of planning and design, construction of the Ten Mile Creek Critical Restoration Project was initiated in November 2003. The project involves construction of a 550-acre reservoir (maximum depth of 10 feet) and a 110-acre stormwater treatment area (maximum depth of 4 feet). This project is located immediately west of the Varn (a.k.a. Gordy Road) Structure on Ten Mile Creek in St. Lucie County and will provide storage and treatment of storm water from the Ten Mile Creek Basin, the largest subbasin discharging into the North Fork of the St. Lucie River. In addition, the Ten Mile Creek Critical Restoration Project will increase surface water availability to agricultural users in the basin.

Potential Elements:

A. Construction of the project.

B. Operation of the project.

Total Recommendation Cost: $37,000,000

Potential Funding Sources: SFWMD, St. Lucie County, State of Florida Grants

Estimated District Participation: $18,500,000 FTEs: 1.0

Implementing Agency: SFWMD and USACE

Quantity of Water to be Made Available: 6,000 acre-feet of storage provided for the entire project

Cost per Thousand Gallons: N/A

Table 41. Estimated Schedule and Costs for construction of the Ten Mile Creek Critical Restoration Project.*

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$7,894	$70	$0	$0	$0	$0	$7,964
FTEs	0.50	0.50	0.00	0.00	0.00	0.00	1.00

*Large portion of project cost expended in FY'04.

Recommendation 21: Implement the CERP Indian River Lagoon – South Project.

Description: The District should actively pursue federal authorization for the CERP Indian River Lagoon (IRL) – South Project Implementation Report (PIR), and construct the project to manage freshwater flows to the St. Lucie River and southern Indian River Lagoon.

Potential Elements:

A. Secure authorization of IRL – South Project.

B. Obtain federal funding appropriation for IRL – South Project.

C. Construct project.

D. Operate and maintain project.

Total Recommendation Cost: $1,200,000,000

Potential Funding Sources: SFWMD, State of Florida, USACE, county governments, USDA–NRCS

Estimated District Participation: $600,000,000 FTEs: 32.00

Implementing Agency: SFWMD

Quantity of Water to be Made Available: 135,000 acre-feet of storage; 23.48 MGD for human water supply

Cost per Thousand Gallons: N/A

Table 42. Estimated Schedule and Costs for Implementation of CERP Indian River Lagoon – South Project Implementation Report.*

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$136,000	$190,000	$173,000	$24,000	$4,000	$1,600	$528,600
FTEs	5.00	6.00	6.00	6.00	5.00	4.00	32.00

*Portion of project cost expended prior to FY'05.

Recommendation 22: Conduct study of connecting the SFWMD's C-25 Basin with the SJRWMD's C-52 and Upper St. Johns River Basin Project.

Description: This is a cooperative study between the SFWMD and SJRWMD to evaluate the feasibility of connecting the SFWMD's C-25 Basin with the SJRWMD's C-52 and Upper St. Johns River Basin Project. The study would identify the benefits and estimated costs of such a connection.

Potential Elements:

A. Develop scope of work/services.

B. Solicit and choose contractor.

C. Complete study.

D. Implement recommended course of action.

Total Recommendation Cost: $100,000

Potential Funding Sources: SFWMD and SJRWMD

Estimated District Participation: $50,000 FTEs: 0.50

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 43. Estimated Schedule and Costs to Conduct Basin Connection Study.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$50	$0	$0	$0	$0	$0	$50
FTEs	0.50	0.00	0.00	0.00	0.00	0.00	0.50

Surficial Aquifer System

The Surficial Aquifer System (SAS) is the predominant source of water for public water supply and urban irrigation in the UEC Planning Area. The Surficial Aquifer is easily recharged from the surface and is found from land surface to about 200 feet below land surface. Wellfields using the Surficial Aquifer can be limited by the rate of recharge and water movement in the aquifer, environmental impacts, proximity to contamination sources, saltwater intrusion and other existing legal uses in the area.

SAS – Quantity of Water Available

Based on the 1998 Plan analysis and information contained in **Chapter 4**, from a regional perspective, increases in production from the SAS along the coast beyond existing demands appears limited due to potential wetland impacts, and increased potential for saltwater intrusion. However, it was concluded that some further development of the SAS could be accomplished in these areas at the local level through modifications to wellfield configurations and pumping regimes with respect to locations of wetlands and salt water. As a result, additional withdrawals from the SAS in these coastal areas will be evaluated on a project-by-project basis in the planning area. The volume of water that could be withdrawn by any specific user must be determined through the District's CUP Program.

SAS – Water Resource Development Recommendations

The following are water resource development recommendations regarding the SAS:

Recommendation 23: Develop tools in order to conduct SAS modeling that can be incorporated into the next update of the UEC Water Supply Plan.

Description: The District will develop, improve and update modeling tools in order to conduct SAS modeling as part of the next update to this Plan.

Potential Elements:

A. Review available hydrogeologic and hydrologic data and update database accordingly.

B. Enhance and recalibrate existing Martin County and St. Lucie County SAS models with new data and technology.

C. Prepare data sets for base and projected year simulations.

D. Conduct plan model runs and present results.

E. Conduct alternative analysis.

F. Document and conduct peer review.

Total Recommendation Cost: $300,000

Potential Funding Sources: SFWMD

Estimated District Participation: $0 FTEs: 4.50

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 44. Estimated Schedule and Costs for SAS Modeling.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$0	$100	$100	$100	$0	$300
FTEs	0.00	0.00	1.50	1.50	1.50	0.00	4.50

Related Strategies

This section includes those recommendations that apply to several options or could not be associated with a specific option.

Recommendation 24: Coordinate the 2004 UEC Water Supply Plan with other efforts.

Description: Coordinate the 2004 UEC Water Supply Plan recommendations with other regional planning efforts, including development of the Lower East Coast Regional Water Supply Plan, CERP North Palm Beach County Project Part 1, Ten Mile Creek Critical Restoration Project, CERP Indian River Lagoon – South and others.

Potential Elements:

A. Monitor other efforts.

B. Actively participate and coordinate UEC Water Supply Plan recommendations with other planning area efforts.

Total Recommendation Cost: $0

Potential Funding Sources: SFWMD

Estimated District Participation: $0 FTEs: 1.20

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 45. Estimated Schedule and Costs to Coordinate 2004 UEC Plan with Other Efforts.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$0	$0	$0	$0	$0	$0
FTEs	0.20	0.20	0.20	0.20	0.20	0.20	1.20

Recommendation 25: Ensure the timely coordination of local government land use planning and SFWMD regional water supply planning.

Description: The District will share vital water supply planning information with local governments as it is developed. This information includes, but is not limited to, the projection of anticipated future demands, identification of existing and future sources of available water, sustainability of water resources and natural systems and technical assistance on other related issues, such as water conservation and reuse. The District will provide this information and technical assistance on water supply development issues at the local government level throughout the planning horizon.

Potential Elements:

A. Assist individual local governments in their efforts to develop 10-year Water Supply Facility Work Plans.

B. Provide technical assistance to local governments for preparation of water supply related sections of their Evaluation and Appraisal Reports (EARs).

C. Continue to review and comment on water supply related issues of local government comprehensive plans and associated amendments.

D. Continue to seek active participation of local governments in regional water supply planning/updating efforts.

E. Continue to provide funding assistance to local governments in their quest for Alternative Water Supply (AWS) development.

Total Recommendation Cost: $0

Potential Funding Sources: SFWMD

Estimated District Participation: $0 FTEs: 2.90

Implementing Agency: SFWMD

Quantity of Water To be Made Available: 0 MGD

Cost per Thousand Gallons: N/A

Table 46. Estimated Schedule and Costs for Coordination of UEC Water Supply Plan with Local Governments.

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$0	$0	$0	$0	$0	$0	$0
FTEs	0.60	0.50	0.50	0.40	0.40	0.50	2.90

Recommendation 26: Continue the Alternative Water Supply Funding Program (Districtwide).

Description: The District will continue the Alternative Water Supply (AWS) Funding Program to facilitate implementation of cost-effective and appropriate alternative water supplies, such as reuse and development of the Floridan Aquifer.

Potential Elements:

A. Modify criteria to provide more weight to scoring criteria, which incorporate direction of regional water supply plans.

B. Solicit AWS projects on an annual basis.

C. Conduct public workshops throughout the District.

D. Selection Committee to rank approved projects.

E. Governing Board to determine funding.

Total Recommended Cost: $27,000,000 ($4,500,000 per year)*

Potential Funding Sources: SFWMD

Estimated District Participation: $27,000,000* FTEs: 24.00*

Implementing Agency: SFWMD

Quantity of Water to be Made Available: 300 MGD from FY 2005 through FY 2010*.

Cost per Thousand Gallons: Not available

Table 47. Estimated Schedule and Costs for Alternative Water Supply Funding Program.*

Cost	FY'05	FY'06	FY'07	FY'08	FY'09	FY'10	Total
Dollars ($1,000)	$4,500	$4,500	$4,500	$4,500	$4,500	$4,500	$27,000
FTEs	4.00	4.00	4.00	4.00	4.00	4.00	24.00

*Districtwide.

Summary of Water Resource Development Recommendations

Recommendation 1 – *Aquifer Storage and Recovery*: The District will provide technical assistance to utilities pursuing ASR to comply with local, state and federal standards. Aquifer storage and recovery could be used for storage of available water sources for later use.

Recommendation 2 – *Mobile Irrigation Labs*: Continue to fund the existing urban mobile irrigation labs in the UEC Planning Area. There are two urban mobile irrigation labs funded by the District and one agricultural lab funded by USDA–NRCS in the UEC Planning Area. Additionally, the District should look for opportunities to expand urban mobile lab activity. This could include local government partnerships funding increased lab services, particularly in newer urban communities.

Recommendation 3 – *Water Conservation Rulemaking*: The District should complete the ongoing rulemaking in Chapter 40E-2, F.A.C., Basis of Review – Water Conservation Requirements, which will focus on goal-based conservation programs for public water suppliers, and other major water users.

Recommendation 4 – *Water Savings Incentive Program*: The District should continue to fund and enhance the Water Savings Incentive Program to facilitate implementation of cost-effective indoor and outdoor retrofits, such as plumbing and rain sensor programs in the UEC Planning Area. This cost-share program may benefit public agencies, such as local governments, water utilities or private entities, such as homeowners associations.

Recommendation 5 – *Water Conservation Outreach and Education*: The District, in cooperation with local governments, utilities, large water users and water industry professional organizations, should expand water conservation outreach and education through funding partnerships.

Recommendation 6 – *Comprehensive Regional Floridan Aquifer Monitoring Well Network*: The District should continue to collect water level, water quality and water use data from the Comprehensive Regional Floridan Aquifer Network established pursuant to the 1998 UEC Water Supply Plan, including public water supply wells. Data from the network will be used to better understand the relationships between water levels, water quality and water use.

Recommendation 7 – *Floridan Aquifer Density-Dependent Flow Model*: The District will develop and calibrate a density dependent groundwater flow model for the Floridan Aquifer for predictive analysis purposes. This model will be an “inset model” developed from a larger scale regional Floridan Aquifer model. The District will use this model to support development of the next update of the UEC Water Supply Plan.

Recommendation 8 – *Floridan Aquifer Exploratory Well Program*: The District will implement a Floridan Aquifer exploratory well drilling program to gather Floridan Aquifer hydrogeologic information for development of a Floridan Aquifer density dependent groundwater model. This recommendation incorporates three Floridan Aquifer exploratory well sites in the planning area. This includes construction of a multi-zone monitoring well, geophysical logging and aquifer performance testing at each site.

Recommendation 9 – *Floridan Aquifer Tracer Tests*: The District will conduct tracer tests in the Floridan Aquifer at two sites. The tracer tests will show preferential flow paths within the aquifer and allow the District to calculate dispersivity for the density dependent model as recommended.

Recommendation 10 – *Floridan Aquifer Well Inventory*: Through renewal of consumptive use permits in the UEC Planning Area, the District will refine its inventory of Floridan Aquifer wells. The Floridan well inventory will be employed to ensure that Floridan wells are appropriately decommissioned as land is converted from agricultural to urban use. Developers will be notified of the presence of Floridan wells on properties through the District's Environmental Resource Permitting process and/or Consumptive Use Permitting Program. The District will support local initiatives to decommission wells that are no longer used.

Recommendation 11 – *Reclaimed Water Interconnects*: The District will continue to encourage reclaimed water interconnects between utilities, where appropriate, to maximize the use of reclaimed water. Interconnections between reclaimed water systems could increase the volume of reclaimed water being used by providing an alternative to deep well injection when wastewater flows exceed reclaimed water demand. For facilities that have minimal reuse capabilities, interconnects with a utility that has these capabilities will make beneficial use of reclaimed water.

Recommendation 12 – *Efficient Use of Reclaimed Water*: The District should modify project scoring criteria for the WaterSIP funding program to promote efficient use of reclaimed water. Utilities are encouraged to become more efficient in the use of reclaimed water. This could include installing meters and establishing volume based rates and/or establishing application rates consistent with District allocation criteria.

Recommendation 13 – *Mandatory Reuse Zones*: The District will provide technical assistance to local governments in establishing mandatory reuse zones. Mandatory reuse zones are geographic areas designated by local governments through ordinance where the use of reclaimed water is required. Mandatory reuse zones are very effective in increasing reuse, especially in undeveloped areas where installation of reclaimed water distribution systems and use of reclaimed water would be required at the time of development.

Recommendation 14 – *Northern Palm Beach County Comprehensive Water Management Plan*: Continue implementation of the Northern Palm Beach County Comprehensive Water Management Plan. Approximately 44,800 acre-feet of storage has been purchased in the L-8 Reservoir. The G-160 Loxahatchee Slough Structure has been constructed and the G-161 Structure is in design and scheduled for completion in 2005. Improvements to storage and water conveyance infrastructure will capture water currently lost to tide in the wet season and provide supplemental supplies in the dry season—meeting environmental needs and projected urban and agricultural demands.

Recommendation 15 – *CERP North Palm Beach County Project Part 1*: Complete the CERP North Palm Beach County Project Part 1 Project Implementation Report and implement the findings. This project will serve as a continuation of the Northern Palm Beach County Comprehensive Water Management Plan.

Recommendation 16 – *Loxahatchee River Restoration Plan*: The District, in cooperation with other agencies and stakeholders, will develop a restoration plan for the Loxahatchee River that incorporates environmental water needs, while maintaining existing levels of flood protection and public water supply.

Recommendation 17 – *Initial Reservation for Northwest Fork of Loxahatchee River*: The District intends to adopt an initial reservation to keep existing water used for fish and wildlife protection, consistent with the restoration goal and pursuant to the Minimum Flow and Level (MFL) rule for the Northwest Fork of the Loxahatchee River by 2004. The District initiated rulemaking for the water reservation in April 2004. This water reservation will be reviewed periodically and revised as conditions change, such as the changes that will occur in the region as CERP projects become operational. This provides flexibility to account for changes in implementation strategies and contingency plans during the life of the project.

Recommendation 18 – *Review MFL for Northwest Fork of Loxahatchee*: By 2005, review and revise, as needed, the existing MFL and associated recovery plan for the Northwest Fork of the Loxahatchee River to consider information developed during the establishment of restoration goals and water reservations pursuant to the MFL rule.

Recommendation 19 – *Establish MFLs for Northwest Fork of Loxahatchee River Tributaries*: Establish MFLs for the tributaries to the Northwest Fork of the Loxahatchee River (Cypress Creek, Hobe Grove Ditch, Kitching Creek and Loxahatchee Slough), which are on the District's *MFL Priority Water Body List*.

Recommendation 20 – *Ten Mile Creek*: Complete the construction of the Ten Mile Creek Critical Restoration Project, which was initiated in November 2003. The project involves construction of a 550-acre reservoir (maximum depth of 10 feet) and a 110-acre stormwater treatment area (maximum depth of 4 feet).

Recommendation 21 – *CERP Indian River Lagoon – South*: The District should actively pursue federal authorization to implement the CERP Indian River Lagoon (IRL) – South Project Implementation Report (PIR), and construct the project to manage freshwater flows to the St. Lucie River and southern Indian River Lagoon.

Recommendation 22 – *C-25 to C-52 Basin Connectivity Study*: Conduct a cooperative study between the SFWMD and SJRWMD to evaluate the feasibility of connecting the SFWMD's C-25 Basin with the SJRWMD's C-52 and Upper St. Johns River Basin Project. The study would identify the benefits and estimated costs of such a connection.

Recommendation 23 – *Surficial Aquifer Modeling*: The District will develop, improve and update modeling tools in order to conduct SAS modeling as part of the next five-year update of this Plan.

Recommendation 24 – *Coordinate UEC Water Supply Plan with Other Efforts*: Coordinate the 2004 UEC Water Supply Plan recommendations with other regional planning efforts, including development of the Lower East Coast Regional Water Supply Plan, CERP North Palm Beach County Project Part 1, Ten Mile Creek Critical Restoration Project, CERP Indian River Lagoon – South and others.

Recommendation 25 – *Coordinate Land Use and Water Supply Planning*: Ensure the timely coordination of local government land use planning and SFWMD regional water supply planning. The District will share vital water supply planning information with local governments as it is developed. This information includes, but is not limited to, the projection of anticipated future demands, identification of existing and future sources of available water, sustainability of water resources and natural systems and technical assistance on other related issues, such as water conservation and reuse.

Recommendation 26 – *Alternative Water Supply Program*: The District will continue the Alternative Water Supply (AWS) Funding Program to facilitate implementation of cost-effective and appropriate alternative water supplies, such as reuse and development of the Floridan Aquifer.

Table 48. Water Resource Development Recommendations Summary Table.

Recommendation	Plan Implementation Costs ($1,000 and FTEs)													
	FY'05		FY'06		FY'07		FY'08		FY'09		FY'10		Total	
	$	FTE	$	FTE	$	FTE	$	FTE	$	FTE	$	FTE	$	FTE
1 Aquifer Storage and Recovery	0	0.05	0	0.05	0	0.05	0	0.05	0	0.05	0	0.05	0	0.30
2 Mobile Irrigation Labs	116	0.10	116	0.10	116	0.10	116	0.10	116	0.10	116	0.10	696	0.60
3 Water Conservation Rulemaking	0	0.00	5	0.25	5	0.10	0	0.10	0	0.10	0	0.10	10	0.65
4 Water Savings Incentive Program*	500	0.20	750	0.20	750	0.30	1,000	0.30	1,000	0.50	1,000	0.50	5,000	2.00
5 Water Conservation Outreach and Education*	300	0.20	300	0.30	500	0.20	500	0.20	500	0.20	500	0.20	2,600	1.30
6 Comprehensive Regional Floridan Aquifer Monitoring Well Network	122	0.40	122	0.40	125	0.40	125	0.40	125	0.40	125	0.40	744	2.40
7 Floridan Aquifer Density-Dependent Flow Model	50	0.30	100	0.30	50	1.00	0	1.00	0	0.00	0	0.00	200	2.60
8 Floridan Aquifer Exploratory Well Program	750	0.40	750	0.40	750	0.40	0	0.20	0	0.00	0	0.00	2,250	1.40
9 Floridan Aquifer Tracer Tests	10	0.20	70	0.20	120	0.20	0	0.10	0	0.00	0	0.00	200	0.70
10 Floridan Aquifer Well Inventory	0	0.10	0	0.05	0	0.05	0	0.05	0	0.05	0	0.05	0	0.35
11 Reclaimed Water Interconnects	0	0.05	0	0.05	0	0.05	0	0.05	0	0.05	0	0.05	0	0.30
12 Efficient Reclaimed Water Use	0	0.15	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.15
13 Mandatory Reuse Zones	0	0.05	0	0.10	0	0.05	0	0.05	0	0.05	0	0.05	0	0.35
14 Northern Palm Beach County Comprehensive Water Management Plan	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Districtwide.

Table 48. Water Resource Development Recommendations Summary Table (Continued).

Recommendation	Plan Implementation Costs ($1,000 and FTEs)													
	FY'05		FY'06		FY'07		FY'08		FY'09		FY'10		Total	
	$	FTE	$	FTE	$	FTE	$	FTE	$	FTE	$	FTE	$	FTE
15 CERP North Palm Beach County Project Part 1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16 Loxahatchee River Restoration Plan	0	4.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	4.00
17 Initial Reservations NW Fork of Loxahatchee River	0	1.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.00
18 NW Fork Loxahatchee River MFL	20	2.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	20	2.00
19 NW Fork Loxahatchee River Tributaries MFLs	0	0.00	20	1.50	40	2.25	0	0.00	0	0.00	0	0.00	60	3.75
20 Ten Mile Creek	7,894	0.50	70	0.50	0	0.00	0	0.00	0	0.00	0	0.00	7,964	1.00
21 CERP Indian River Lagoon – South	136,000	5.00	190,000	6.00	173,000	6.00	24,000	6.00	4,000	5.00	1,600	4.00	528,600	32.00
22 C-25 – C52 Basin Connectivity Study	50	0.50	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	50	0.50
23 Surficial Aquifer Modeling	0	0.00	0	0.00	100	1.50	100	1.50	100	1.50	0	0.00	300	4.50
24 Coordination with Other Efforts	0	0.20	0	0.20	0	0.20	0	0.20	0	0.20	0	0.20	0	1.20
25 Coordinate Land and Water Planning	0	0.60	0	0.50	0	0.50	0	0.40	0	0.40	0	0.50	0	2.90
26 Alternative Water Supply Program*	4,500	4.00	4,500	4.00	4,500	4.00	4,500	4.00	4,500	0.40	4,500	0.40	27,000	24.00
Total	150,312	20.00	196,803	15.10	180,056	17.35	30,341	14.70	10,341	9.00	7,841	6.60	575,694	89.95

*Districtwide.

WATER SUPPLY DEVELOPMENT RECOMMENDATIONS

Water supply development recommendations are water resource management strategies that are local in nature and generally involve the planning, design, construction, operation and maintenance of public or private facilities for water collection, production, treatment, transmission or distribution for sale, resale or end use. Water supply development projects may be eligible for District funding assistance if they meet appropriate criteria. These criteria are explained in the Funding section of this chapter. Water supply development recommendations or water source options are provided for consideration by local governments, water users and utilities.

Aquifer Storage and Recovery

- Utilities should explore ASR, among other options, to extend the use of current resources in order to meet future demands, including addressing peaks in demands or in availability of resources. Aquifer storage and recovery could be used to extend water supplies during peak demand periods.

Conservation

- Local government and utilities should evaluate conservation measures appropriate for their jurisdictional area, and implement cost-effective indoor and outdoor measures. These should include general policy considerations and technology retrofits as described in this Plan.

- Local governments should consider developing and/or enhancing existing Xeriscape™ ordinances to address water- conserving landscape installation for new construction to maximize water savings in initial design and operation of both residential and commercial sites.

- Conversion of the remaining flood-irrigated citrus to microirrigation should continue on a voluntary basis, where appropriate.

- Local governments and utilities should consider continued development and implementation of water conservation public education programs in cooperation with the District.

Floridan Aquifer System

- Landowners with Floridan wells that are not actively used and/or in a state of disrepair should decommission these wells in accordance with appropriate rules and regulations. The citrus industry, as well as others, may want to pursue a state appropriation for funding assistance for a regional approach towards decommissioning Floridan wells.

- Local water users and utilities should consider involving the District in development of their FAS well drilling programs for water supply, ASR and wastewater effluent disposal to collect FAS water quality, water level and hydrologic information that could be used in predictive analysis and development or refinement of a FAS model.

Reclaimed Water

- Local governments should consider adopting building codes and land development regulations requiring proposed projects, exceeding a certain acreage threshold, to construct reclaimed water infrastructure and use reclaimed water when it becomes available.

- Utilities should incorporate water supply considerations in development of reclaimed water programs. In developing reclaimed water programs, utilities should consider the resource efficiency concept of using reclaimed water for wellfield recharge to minimize impacts to the resources.

- Utilities should consider supplemental sources and interconnects with other utilities to maximize the volume of reclaimed water that is reused. Reclaimed water storage should be explored to extend the use of current resources in order to meet future demands, including addressing peaks in demands or in availability of resources.

Reservoirs

- Agricultural operations should incorporate water conservation and water supply considerations in the design of new or retrofitted surface water management systems through best management practices.

Surface Water

There are no surface water supply development recommendations regarding Surface Water.

Surficial Aquifer System

- The potential of using the SAS for new and expanded uses will be evaluated on a project-by-project basis through the District's consumptive use permitting process.

- Water users should consider development of alternative water sources that reduce reliance on the SAS for future demands.

- Utilities performing membrane softening of SAS water should include beneficial use of the concentrate water, such as blending with reclaimed water.

FUNDING

This section addresses the funding strategy and options for implementation of this Water Supply Plan. The approach takes into account the requirements of Chapter 373, F.S., which requires water supply plans to include a funding strategy that is reasonable and sufficient to pay the costs of constructing or implementing all of the water resource development projects.

In general, the funding approach is divided into two major categories: water resource development and water supply development. The water resource development category addresses funding for projects that are primarily the responsibility of the District. Water supply development projects, on the other hand, are primarily the responsibility of local governments, utilities and other water users. However, information is included on programs that target funding of water supply development projects in general.

Water Resource Development

The water resource development projects for the UEC Planning Area were itemized earlier in this chapter. In addition, pursuant to Chapter 373, F.S., each water management district governing board is required to include in its annual budget the amount needed for the fiscal year to implement water resource development projects, as prioritized in its regional water supply plans. In addition to this Plan, the District is also developing updates of the regional water supply plans for the three other planning areas that encompass the District. All updates are scheduled for completion by the end of 2005.

Besides implementation of the water supply plans, the SFWMD is implementing the $8 billion CERP, a cost-shared effort with the U. S. Army Corps of Engineers (USACE). The recommendation tables in this Plan show the costs of the projects and potential sources of funding. Timeframes for completing the projects are preliminary and are subject to funding availability in the future years.

The traditional funding source for these types of projects has been primarily ad valorem taxes. Non-CERP projects, most of those listed in this Plan, will be ranked and prioritized along with projects in all other regional water supply plans during annual District budget preparation, and funded as money is available. Priority considerations for a project include availability of a cost-share partner and if a project makes “new” water available. Sustainability of the regional system is also an important consideration of project prioritization.

Some of the recommendations in this Plan are studies. These studies may result in construction projects at a later date. Funding associated with these will be addressed at that time. Potential funding sources for water resource development include funds provided on a project-by-project basis through the SFWMD's budget.

Water Supply Development

Chapter 373, F.S. states that, "local governments, regional water supply authorities and government owned and privately owned water utilities take the lead in securing funds for and implementing water supply development projects. Generally, direct beneficiaries of water supply development projects should pay the costs of the projects from which they benefit, and water supply development projects should continue to be paid for through local funding sources." It is not the intent that regional water supply plans mandate actions to be taken by local agencies, utilities and other water users. Therefore, the overall theme of this section is to provide direction and assistance, but not to mandate directives to local governments or utilities.

Chapter 373, F.S. requires water supply plans to identify potential sources of funding for water supply development projects. In addition to funding the projects themselves through utility rates, there are several other funding programs to assist local entities.

District's Alternative Water Supply Funding Program

The District's Alternative Water Supply (AWS) Funding Program is based upon statute adopted by the Florida Legislature in 1995 to increase the potential for the development of alternative water supplies in the state; assist utilities in developing cost-effective reclaimed water supplies; and fulfill a public purpose to fund such programs. Since FY 1997, the District has funded 139 projects Districtwide for a total cost of approximately $28 million. These projects have created an additional 337 MGD.

The AWS Funding Program is a cost-share program and requires a project's sponsor to provide a portion of the funding for the project. The District publishes guidelines for implementing this program. These guidelines address the application and review process, ranking criteria and the timeframe for implementation.

To be considered for this funding support, the project must be consistent with the local government comprehensive plan and the District's regional water supply plan. The local government must require all appropriate new facilities within the project service area to connect and use the project's alternative water supplies. Funding support shall be applied only for capital or infrastructure costs for the construction of alternative water supply systems and the project must fall within guidelines established by the District.

Projects are scored and ranked by a selection committee of non-SFWMD representatives from utilities, environmental and agricultural interests. They score and rank submitted project proposals based on criteria from the enabling legislation, and the SFWMD. The District's Governing Board approves funding of the selected projects.

Water Savings Incentive Program

In 2002, the District's Governing Board established the District's Water Savings Incentive Program, or WaterSIP, as an initiative to help implement water-efficiency measures that reduce water use demands. Projects eligible for funding under this program are non-capital in nature, meaning not part of a public water provider's or user's capital improvement program. In three years, this program has provided $700,000 for 19 projects Districtwide. Projects funded included automatic flushing devices, pressure stabilization valves and rain shutoff device incentive programs.

The WaterSIP is a cost-share program and requires a project's sponsor to provide matching funds for the project, unless the project is in an area defined in the rural economic development initiative. The project must be completed within one year. The District publishes guidelines for this funding program annually. These guidelines address the application and review process, ranking criteria and the timeframe for implementation. In the three years the program has been in place, a total of 311 MGY or 852,000 GPD of water has been saved or offset.

Drinking Water State Revolving Fund Program

The Drinking Water State Revolving Fund (SRF) Program is administered by FDEP and provides low-interest loans to eligible entities for planning, designing and constructing public water facilities. Federal and state appropriations fund the SRF. It is a "revolving" fund because loan repayments are used to make additional loans. By federal law, the SRF is to be operated in perpetuity. The FDEP solicits project information each year from January 1 to February 15. The information is used to establish the project priority list for the annual cycle. Funds are made available for pre-construction loans to rate-based public water systems, construction loans of $75,000 minimum or more and pre-construction grants and construction grants to financially disadvantaged communities. The loan terms include a 20-year (30-year for financially disadvantaged communities) amortization and low-interest rates. Small community assistance is available for communities having populations less than 10,000. Each year 15 percent of the funds are reserved exclusively for their use. In addition, small communities may qualify for loans from the unreserved 85 percent of the funds.

Further information on the Drinking Water SRF is available from: http://www.floridadep.org/water/wff/dwsrf/index.htm.

State Revolving Fund Loan Program for Water Pollution Control

The State Revolving Fund (SRF) Loan Program for Water Pollution Control Program is also administered by FDEP and provides low-interest loans for planning, designing and constructing water pollution control facilities. Federal and state appropriations have funded the SRF. Like the Drinking Water Loan Program, the Water Pollution Control Program is a "revolving" fund because loan repayments are used to make additional loans. By federal law, the SRF is to be operated in perpetuity. The FDEP solicits project information each year. The information is used to establish project priorities for the annual cycle. Funds are made available for preconstruction loans and construction loans. The loan terms include a 20-year amortization and low-interest rates. Preconstruction loans are available to all communities and provide up-front disbursements for administrative services, project planning and project design.

Further information on the Water Pollution Control SRF is available from: http://www.floridadep.org/water/wff/cwsrf/index.htm.

RELATIONSHIP OF PROJECTS TO FIVE-YEAR WORK PROGRAM

The District prepares a Five-Year Water Resource Development Work Program annually. This report is submitted to FDEP, and documents the District's progress in implementing water supply plan recommendations. The timeframe or horizon for the Work Program is a five-year minimum. For each recommendation, the work program provides:

- The cost of the project.
- An estimate of the amount of water to become available by implementing a project.
- Funding source(s).
- Implementing agency(s).
- A summary of any changes to the recommendation since the plan was implemented.
- Timetables.

The recommendations in this Plan will be incorporated into the Five-Year Water Resource Development Work Program following Governing Board approval of the Plan.

REGIONAL WATER SUPPLY PLAN IMPLEMENTATION ASSURANCES

This Plan provides strategies that identify adequate sources of water to meet future urban, agricultural and natural system demands through at least 2025 (Section 373.0361, F.S.). Regional water supply plans include water supply and water resource development components, a funding strategy for water resource development projects, minimum flows and levels (MFLs) established within the planning region, MFL recovery and prevention strategies and technical data and information supporting the Plan.

The water supply development component must include the quantification of the water supply needs for all existing and projected future uses within the planning horizon, with a level of certainty planning goal for meeting those needs during a 1-in-10 year drought event. Furthermore, it must include a list of water source options for water supply development, including traditional and alternative sources, from which local governments, government-owned and privately owned utilities, self-suppliers and others may choose. For each option, the amount of water available, the estimated unit cost of the option and sources of funding must be identified.

Water resource development projects, operational changes, consumptive use permitting and rulemaking associated with the regional water supply plans are proposed to occur in phases throughout the planning horizon. The increasing demands of consumptive users and the environment must, to the extent practicable, correspond with the timing of increased water availability. Where shifts from existing sources of water are required for environmental enhancement, it is crucial that replacement sources are available when such shifts occur.

A composite schedule for implementation of these water resource tools in concert with water resource development projects will be proposed in the regional water supply plans. This schedule will be further refined during the five-year water resource development work plan, five-year water supply plan updates, annual work plans and budget reviews, periodic rule updates and consumptive use permit renewals.

In addition to the regional water supply plans, existing Florida law provides the framework and includes several tools to protect and maintain this phased or incremental consistency between increasing supplies and demands for both consumptive users and the environment. These include water reservations, consumptive use permits, MFL recovery strategies and water shortage declarations. The framework for implementing these tools for providing water user and natural system assurances is discussed next.

Reservations

Reservations of water for the natural system will be established by the SFWMD pursuant to Florida law. Florida law on water reservations, in Section 373.223(4), F.S., provides:

> The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety. Such reservations shall be subject to periodic review and revision in the light of changed conditions. However, all presently existing legal uses of water shall be protected so long as such use is not contrary to the public interest.

In simple terms, when water is reserved under this statute, it is not available to be allocated for use under a consumptive use permit. Existing allocations under a consumptive use permit are protected to the extent they are "not contrary to the public interest." Under Florida law, permitted uses and domestic water uses (which are exempt from requirements to obtain a permit) have the legal status of an "existing legal use." Unauthorized existing uses do not constitute an "existing legal use".

Reservations are subject to periodic review based on changed conditions. This provides flexibility to account for changes in implementation strategies, restoration objectives and contingency plans during the life of the project.

Consumptive Use Permitting

The water management districts issue consumptive use permits pursuant to Part II of Chapter 373, F.S. In order to obtain a consumptive use permit, the permit applicant must provide reasonable assurances that the use is "reasonable-beneficial", will not interfere with any presently existing legal use of water and is consistent with the public interest, pursuant to Section 373.223, F.S. The SFWMD implements this three-prong test pursuant to rules adopted in Chapter 40E-2, Florida Administrative Code (F.A.C.). Permits are conditioned to assure that uses are consistent with the overall objectives of Chapter 373, F.S. and are not harmful to the water resources of the area, under Section 373.219, F.S. It is through these statutory provisions, as implemented through District rules, that the District addresses environmental water supply. Specifically, environmental water supply, primarily wetlands and coastal resources, is protected from harm through resource protection criteria implemented through consumptive use permits. These criteria assure wetland hydrology and flow regimes are not harmed as a result of a consumptive use.

For inland wetland systems, water supply is provided for through the use of resource protection criteria that are designed to prevent excessive drawdowns under wetlands that would cause harm to the wetland. Maintaining appropriate wetland hydrology (water levels and hydroperiod) is the single most critical factor in maintaining

a viable wetland ecosystem. Rainfall, along with associated groundwater and surface water inflows, is the primary source of water for the majority of wetlands in the planning areas. See Chapter 2 of the *DRAFT Consolidated Water Supply Plan Support Document* and **Chapter 3** of this Planning Document for additional information on wetland protection and the water supply needs of inland wetland systems. Protection of water supply for estuaries is discussed more specifically next.

Under Florida law, a consumptive use permit provides the permittee with the right to use water consistent with the conditions of the permit for the duration of the permit. Prior to permit expiration, the permittee must obtain a renewal of the permit in order to continue the water use. Florida law also provides specific standards to apply when competition for water occurs, such as when not enough water is available to meet the demands of all pending requests for water use permits under Section 373.233, F.S.

Existing legal uses of water must meet the conditions for issuance of a permit during a 1-in-10 year drought condition, known as the "level of certainty." This "level of certainty" provides assurance, both to the permitted user and the water resources, which harm will not occur due to permitted withdrawals in climatic conditions less severe than a 1-in-10 year drought.

Minimum Flows and Levels

The SFWMD is responsible for the implementation of statutory provisions in Section 373.042, F.S., requiring establishment of minimum flows and levels (MFLs) for watercourses and aquifers. Generally stated, the MFLs for a given watercourse or aquifer are the limit at which further withdrawals would be significantly harmful to the water resources of the area (Section 373.042, F.S.). Significant harm is defined by SFWMD rule to be the temporary loss of water resource functions that takes more than two years to recover (Rule 40E-8.021(24), F.A.C.). Certain exclusions and considerations for establishing MFLs, including defining "significant harm" for a specific water body, are contained in Section 373.0421, F.S. Recovery and prevention strategies must also be developed if there are existing or projected shortfalls in meeting the MFL, as provided by Section 373.0421, F.S.

Minimum flow and level standards for specific water bodies and aquifers within the SFWMD are contained in Chapter 40E-8, F.A.C., which also includes recovery and prevention strategies for each MFL. At this time, MFLs have been established for the following priority water bodies:

- Lake Okeechobee
- Everglades (Water Conservation Areas, Everglades National Park, Rotenberger and Holey Land Wildlife Management Areas)
- Northern Biscayne Aquifer within the Lower East Coast
- Lower West Coast confined aquifers
- Caloosahatchee Estuary

- Northwest Fork of the Loxahatchee River
- St. Lucie River and Estuary

In addition to the standards and recovery and prevention strategies in Chapter 40E-8, specific consumptive use permitting criteria for MFLs are adopted in Chapter 40E-2, F.A.C. and water shortage criteria for MFLs are adopted in Chapters 40E-21 and 40E-22, F.A.C.

For coastal resources, maintenance of appropriate freshwater inflows is essential for a healthy estuarine system. Flow regimes are typically defined in terms of total mean monthly inflows and a suitable range of acceptable minimum and maximum flow rates. As to maximum flow rates, such excessive changes in freshwater inflows to the estuary result in imbalances beyond the tolerances of estuarine organisms. The retention of water within upland basins for water supply purposes will provide management of inflows into coastal resources found in this planning area. As to minimum flow rates, the District has authority to set MFLs for coastal estuaries under section 373.042, F.S. In 2003, the District established a MFL for the St. Lucie Estuary. This MFL is a part of the process of ultimately achieving restoration of the St. Lucie Estuary through water reservations and associated projects.

In addition, flow regimes for the coastal resources in the UEC Planning Area will be determined with development of restoration plans and operational plans associated with construction of proposed storage facilities in the planning area. See Chapter 2 and Chapter 6 of the Support Document and **Chapter 3** of this Planning Document for additional information regarding water needs of coastal resources in the planning area.

Water Shortage Plan

Pursuant to Section 373.246, F.S., water shortage declarations are designed to prevent serious harm from occurring to water resources. Serious harm is defined by SFWMD rule as long-term, irreversible or permanent impacts to the water resource (Rule 40E-8.021(23), F.A.C.). Declarations of water shortages by the Governing Board are used as a tool to assist in preventing serious harm to the water resources during droughts, while equitably distributing water resources for consumptive and non-consumptive uses, as provided in Chapter 40E-21, F.A.C. Water shortage declarations are imposed in phases, with increasing water use cutbacks with increasing drought conditions.

Comprehensive Everglades Restoration Plan Implementation

The State of Florida and the U.S. Congress have approved implementation of the "*Central and Southern Florida Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement"* for Everglades restoration, known as the Comprehensive Everglades Restoration Plan (CERP). In 1999, the Governor's Commission for a Sustainable South Florida developed a consensus-based set of recommendations concerning assurances to existing users, including the

natural system (GCFSSF, 1999). These CERP related assurances were adopted into the Commission's *Restudy Plan Report* on January 20, 1999 and incorporated into the CERP. They were also used as the precursor to subsequent laws enacted by the Florida Legislature and Congress in 1999, 2000 and 2001 to provide assurances that implementation of the CERP would not adversely affect water users or natural systems.

These CERP related assurances were developed in the context of the Everglades restoration; however, such assurances are relevant to the implementation of regional water supply plan recommendations throughout the District. As a result, the SFWMD Governing Board directed that implementation of the regional water supply plans be conducted consistent with these directives. The Florida and federal water user and natural system assurance laws regarding the CERP are summarized next.

State of Florida CERP Implementation Laws

The Florida Legislature enacted a series of laws into Chapter 373 defining the roles of the SFWMD and the Florida Department of Environmental Protection (FDEP) in the implementation of the CERP, including Sections 373.026(8), 373.1501, 373.1502 and 373.470, F.S. With regard to assuring project benefits, as with the *Water Resources Development Act of 2000* (WRDA 2000), Section 373.470(b) requires that the comprehensive plan be used as a "guide and framework to ensure that the project components will be implemented to achieve the purposes of the *Federal Water Resources Development Act of 1996*." (Section 373.470(3)(b)2, F.S.)

Prior to any project component being submitted to Congress for authorization or receipt of an appropriation of State of Florida funds for construction, the FDEP must approve each project component, pursuant to Section 373.026(8), F.S., upon a finding that the SFWMD has complied with the requirements set forth in Section 373.1501(5), F.S. This section provides assurances, including flood protection to natural systems and existing legal users, for each SFWMD project component:

> "Analyze and evaluate all needs to be met in a comprehensive manner and consider all applicable water resource issues, including water supply, water quality, flood protection, threatened and endangered species and other natural system and habitat needs;…" (Subsection 373.1501(5)(a), F.S.)

> "Consistent with [Chapter 373], the purposes for the Restudy provided in the *Water Resources Development Act of 1996*, and other applicable federal law, provide reasonable assurances that the quantity of water available to existing legal users shall not be diminished by implementation of project components so as to adversely impact existing legal users, that existing levels of service for flood protection will not be diminished outside the geographic area of the project component, and that water management practices will continue to adapt to meet the needs of the restored natural environment." (Subsection 373.1501(5)(d), F.S.)

Prior to executing a Project Cooperation Agreement (PCA) for each CERP project, the SFWMD must develop a Project Implementation Report (PIR) with the U.S.

Army Corps of Engineers to address the requirements in Section 373.1501, F.S., and to obtain approval under Section 373.026, F.S., for the project from the FDEP. This helps to assure that the PIR will be sufficient to meet both Florida, as well as federal law requirements for implementing a CERP project.

In addition, Section 373.470(3)(c), F.S., requires that each PIR identify the increase in water supplies resulting from a project component. These increased water supplies for the natural system must be allocated or reserved by the SFWMD under Chapter 373, Section 373.470(3)(c), F.S.

Federal CERP Implementation Laws

Congress enacted the *Water Resources Development Act of 2000, Title VI, Comprehensive Everglades Restoration* (WRDA 2000) to approve implementation of the CERP "…as a framework for modifications and operational changes to the Central and Southern Florida (C&SF) Project that are needed to restore, preserve and protect the south Florida ecosystem, while providing for other water-related needs of the region, including water supply and flood protection." (Section 601(b)(1)(A), WRDA 2000). The WRDA 2000 requires the CERP "…to be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, and the improvement of the environment of the south Florida ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan,…" (Section 601(h)(1), WRDA 2000). These provisions are primarily contained in Section 601(h) entitled "*Assurance of Project Benefits*" of WRDA 2000. Some of the most pertinent portions regarding quantification and protection of water supplies from the CERP are summarized next to provide background.

Section 601(h)(2) of the WRDA 2000 requires the execution of a binding agreement between the President and the Governor of Florida to ensure that "the water made available by each project in the Plan shall not be permitted for consumptive use or otherwise made unavailable by the State until such time as sufficient reservations of water for the restoration of the natural system are made under State law in accordance with the project implementation report for that project and consistent with the Plan." The "*Comprehensive Everglades Restoration Plan Assurance of Project Benefits Agreement*" was executed on January 9, 2002.

Section 601(h)(3) of the WRDA 2000 requires the development of programmatic regulations to establish a process for implementation of the CERP, including in relevant part, procedures for development of PIRs, PCAs, operating manuals, procedures to incorporate new information and adaptive management into CERP implementation, and procedures "to ensure the protection of the natural system consistent with the goals and purposes of the Plan,..." (Section 601(h)(3)(C)(i)(I)-(III), WRDA 2000).

Section 601(h)(4) of the WRDA 2000 identifies requirements for project specific assurances in PIRs, PCAs and operating manuals. Project Implementation Reports, in relevant part, must include identification of quantity, timing and distribution of water for

the natural system and identification of water to be reserved under Florida law. (Section 601(h)(4)(A), WRDA 2000.) Project Cooperation Agreements cannot be executed "until any reservation or allocation of water for the natural system identified in the Project Implementation Report is executed under State law." (Sec. 601(h)(4)(B)). Operating manuals must be consistent "with the water reservation or allocation for the natural system described in the project implementation report and the project cooperation agreement for the project or group of projects." (Section 601(h)(4)(C)).

Section 601(h)(5) of the WRDA 2000 provides a savings clause that applies when implementing the CERP. This is a key focus of the federal legislation. It states:

> (A) NO ELIMINATION OR TRANSFER – Until a new source of water supply of comparable quantity and quality as that available on the date of enactment of this Act is available to replace the water to be lost as a result of implementation of the Plan, the Secretary and the non-Federal sponsor shall not eliminate or transfer the existing legal source of water including those for—
>
> (i) an agricultural or urban water supply;
> (ii) allocation or entitlement to the Seminole Indian Tribe of Florida under section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e);
> (iii) the Miccosukee Tribe of Indians of Florida;
> (iv) water supply for Everglades National Park; or
> (v) water supply for fish and wildlife.
>
> (B) MAINTENANCE OF FLOOD PROTECTION – Implementation of the Plan shall not reduce levels of service for flood protection that are—
>
> (i) in existence on the date of enactment of this Act; and
> (ii) in accordance with applicable law.
>
> (C) NO EFFECT ON TRIBAL COMPACT – Nothing in this section amends, alters, prevents, or otherwise abrogates rights of the Seminole Indian Tribe of Florida under the compact among the Seminole Tribe of Florida, the State and the South Florida Water Management District, defining the scope and use of water rights of the Seminole Tribe of Florida, as codified by section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e). (Section 601(h)(5), WRDA 2000.)

Glossary

1-in-10 Year Drought A drought of such intensity, that it is expected to have a return frequency of once in 10 years. A drought, in which below normal rainfall has a 90 percent probability of being exceeded over a twelve-month period. This means that there is only a ten percent chance that less than this amount of rain will fall in any given year.

1-in-10 Year Level of Certainty Probability that the needs for reasonable-beneficial uses of water will be fully met during a 1-in-10 year drought.

Acre-foot The volume of water that covers one acre to a depth of one foot; 43,560 cubic feet; 1,233.5 cubic meters; 325,872 gallons.

Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) A simple water budget model for estimating irrigation demands that estimates demand based on basin specific data.

Agricultural Self-Supplied Water Demand The water used to irrigate crops, to water cattle and for aquaculture (e.g., fish production) that is not supplied by a public water supply utility.

Aquatic Preserve Water bodies that are set aside by the state to be maintained in essentially natural or existing condition, for protection of fish and wildlife and public recreation so that their aesthetic biological and scientific values may endure for the enjoyment of future generations.

Aquifer A portion of a geologic formation or formations that yield water in sufficient quantities to be a supply source.

Aquifer Storage and Recovery (ASR) The injection of fresh water 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 heterogeneous body of intercalated permeable and less permeable material that acts as a water-yielding hydraulic unit of regional extent.

Artesian When groundwater is confined under pressure greater than atmospheric pressure by overlying relatively impermeable strata.

Available Supply The maximum amount of reliable water supply including surface water, groundwater and purchases under secure contracts.

Average Irrigation Requirement Irrigation requirement under average rainfall as calculated by the District's modified Blaney-Criddle model.

Backpumping The practice of actively pumping water leaving an area back into a surface water body.

Basin (Groundwater) A hydrologic unit containing one large aquifer or several connecting and interconnecting aquifers.

Basin (Surface Water) A tract of land drained by a surface water body or its tributaries.

Benthos/Benthic Macroscopic organisms that live on or in the bottom substrate, such as clams and worms (contrast to plankton and nekton).

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

Blaney-Criddle A formula to calculate evapotranspiration (ET) based on mean temperature and number of daylight hours. The Water Supply Department allocates water using a version of the Blaney-Criddle that employs months as time increments. The 'Modified Blaney-Criddle' is a variation of Blaney-Criddle, which multiplies the ET from Blaney-Criddle by a coefficient that relates mean air temperature to the growth stage of a crop. Additionally, effective rainfall is calculated using the mean temperature and hours of daylight, the Blaney-Criddle ET, average monthly rainfall and a soil factor. Further calculations consider average rainfall to drought rainfall (1-in-10 year drought). The difference between monthly drought effective rainfall and monthly ET becomes the basis for water allocations.

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

Central and Southern Florida Flood Control Project (C&SF Project) A complete system of canals, storage areas and water control structures spanning the area from Lake Okeechobee to both the east and west coasts and from Orlando south to the Everglades. It was designed and constructed during the 1950s by the U.S. Army Corps of Engineers (USACE) to provide flood control and improve navigation and recreation.

Class I through V Surface Water Quality Standards As defined by Section 62-302.400, F.A.C., all surface waters in Florida have been classified according to designated use as follows:

- Class I Potable water supplies
- Class II Shellfish propagation or harvesting
- Class III Recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife
- Class IV Agricultural water supplies

- Class V Navigation, utility and industrial use

Commercial and Industrial Self-Supplied Water Demand Water used by commercial and industrial operations withdrawing over 0.1 million gallons per day from individual, on-site wells.

Comprehensive Everglades Restoration Plan (CERP) The implementation of recommendations made within the Restudy, that is, structural and operational modifications to the C&SF Project are being further refined and will be implemented through this Plan.

Confined Aquifer Water bearing stratum of permeable rock, sand or gravel overlaid by a thick, impermeable stratum.

Conservation Rate Structure A water rate structure that is designed to conserve water. Examples of conservation rate structures include, but are not limited to, increasing block rates, seasonal rates and quantity-based surcharges.

Consumptive Use Use that reduces an amount of water in the source from which it is withdrawn.

Consumptive Use Permit (CUP) A permit issued by the SFWMD under authority of Chapter 40E-2, F.A.C., allowing withdrawal of water for consumptive use.

Control Structure A man-made structure designed to regulate the level/flow of water in a canal or water body (e.g., weirs, dams).

Demand The quantity of water needed to be withdrawn to fulfill a requirement.

Desalination A process that treats saline water to remove chlorides and dissolved solids, resulting in the production of fresh water.

District Water Management Plan (DWMP) Regional water resource plan developed by the District under Ch. 373.036, F. S.

Districtwide Water Supply Assessment (DWSA) This document includes water demand assessments and projections, and descriptions of the surface water and groundwater resources within each of the SFWMD's four planning areas.

Domestic Self-Supplied (DSS) Water Demand (*Same as Residential Self-Supplied Water Deman*d) The water used by households whose primary source of water is private wells and water treatment facilities with pumpages of less than 0.10 million gallons per day.

Domestic Use Use of water for household purposes of drinking, bathing, cooking or sanitation.

Drawdown The vertical distance a water level is lowered resulting from a withdrawal at a given point.

Electrodialysis Dialysis that is conducted with the aid of an electromotive force applied to electrodes adjacent to both sides of the membrane.

Environmental Resource Permit (ERP) A permit issued by the SFWMD under authority of Chapter 40E-4 F.A.C. to ensure that land development projects do not cause adverse environmental, water quality or water quantity impacts.

Estuary A water passage where the ocean or sea meets a river.

Evapotranspiration (ET) Water losses from the surface of water and soils (evaporation) and plants (transpiration).

Fiscal Year (FY) The South Florida Water Management District's fiscal year begins on October 1 and ends on September 30 the following year.

Flatwoods (Pine) Natural communities that occur on level land and are characterized by a dominant overstory of slash pine. Depending on soil drainage characteristics and position in the landscape, pine flatwoods habitats can exhibit xeric to moderately wet conditions.

Florida Administrative Code (F.A.C.) The Florida Administrative Code is the official compilation of the administrative rules and regulations of state agencies.

Florida Department of Agricultural and Consumer Services (FDACS) FDACS communicates the needs of the agricultural industry to the Florida Legislature, the FDEP, and the water management districts, and ensures participation of agriculture in the development and implementation of water policy decisions. FDACS also oversees Florida's soil and water conservation districts, which coordinate closely with the federal Natural Resources Conservation Service (NRCS).

Florida Department of Environmental Protection (FDEP) The SFWMD operates under the general supervisory authority of the FDEP, which includes budgetary oversight.

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

Florida Water Plan State-level water resource plan developed by the FDEP under Section 373.036 F.S.

Floridan Aquifer System (FAS) A highly-used aquifer system composed of the upper Floridan and lower Floridan Aquifers. It is the principal source of water supply north of

Lake Okeechobee and the upper Floridan Aquifer is used for drinking water supply in parts of Martin and St. Lucie Counties. From Jupiter to south Miami, water from the Floridan Aquifer System is mineralized (total dissolved solids are greater than 1,000 mg/L) along coastal areas and in southern Florida.

Governing Board Governing Board of the South Florida Water Management District.

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

Groundwater Heads Elevation of water table.

Harm The temporary loss of water resource functions, as defined for consumptive use permitting in Chapter 40E-2, F.A.C., which results from a change in surface or groundwater hydrology and takes a period of one to two years of average rainfall conditions to recover.

Hydropattern The pattern of inundation or saturation of an ecosystem.

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 that the substrate is either saturated or covered with water.

Indian River Lagoon Extending for 156 miles from north of Cape Canaveral to Stuart along the east coast of Florida, this lagoon is America's most diverse estuary, home to more than 4,000 plant and animal species.

Institute of Food and Agricultural Sciences (IFAS) Agricultural branch of the University of Florida that performs research, education and extension.

Irrigation The application of water to crops and other plants by artificial means.

Lagoon A body of water separated from the ocean by barrier islands, with limited exchange with the ocean through inlets.

Lake Okeechobee This lake measures 730 square miles and is the second largest freshwater lake wholly within the United States.

Lake Okeechobee SWIM Planning Area The major basins that are direct tributaries to Lake Okeechobee, including those basins that are hydrologically upstream and/or from which water is presently released or pumped into the lake on a regular basis.

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

Level of Certainty Probability that the demands for reasonable-beneficial uses of water will be fully met for a specified period of time (generally taken to be one year) and for a specified condition of water availability (generally taken to be a drought event of a specified return frequency).

Load Concentration times flow.

Marsh A frequently or continually inundated non-forested wetland characterized by emergent herbaceous vegetation adapted to saturated soil conditions.

Microfiltration A membrane separation process in which particles greater than about 20 nanometers in diameter are screened out of a liquid in which they are suspended.

Microirrigation The application of water directly to or very near to the soil surface in drops, small streams or sprays.

Microorganism A microscopic organism, including bacteria, protozoans, yeast, viruses and algae.

Minimum Flow and Level (MFL) The point at which further withdrawals would cause significant harm to the water resources/ecology of the area.

Mobile Irrigation Laboratory (MIL) A vehicle furnished with irrigation evaluation equipment which is used to carry out on-site evaluations of irrigation systems and to provide recommendations on improving irrigation efficiency.

MODFLOW A fine-scale model code created by the U.S. Geological Survey. The District uses it for subregional and groundwater modeling.

National Geodetic Vertical Datum (NGVD) A nationally established reference for elevation data.

Natural Resources Conservation Service (NRCS) An agency of the U.S. Department of Agriculture (USDA) that provides technical assistance for soil and water conservation, natural resource surveys and community resource protection. Formerly the U.S. Soil Conservation Service (SCS).

Oligohaline Term to characterize water with salinity of 0.5 to 5.0 parts per thousand, due to ocean-derived salts.

Per Capita Use Total use divided by the total population served.

Potable Water Water that is safe for human consumption. The maximum chloride concentration is 250 milligrams/liter.

Public Water Supply (PWS) Utilities that provide potable water for public use.

Public Water Supply Demand All potable water supplied by regional water treatment facilities with pumpage of 0.5 million gallons per day or more to all customers, not just residential.

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

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

Recreational Self-Supplied Water Demand The water used for landscape and golf course irrigation. The landscape subcategory includes water used for parks, cemeteries and other irrigation applications greater than 0.1 million gallons per day. The golf course subcategory includes those operations not supplied by a public water supply or regional reuse facility.

Regional Water Supply Plan (RWSP) Detailed water supply plan developed by the District under Section 373.0361, F.S., providing an evaluation of available water supply and projected demands, at the regional scale. The planning process projects future demand for 20 years and develops strategies to meet identified needs.

Reservation of Water (see Water Reservation).

Reservoir A man-made or natural water body used for water storage.

Residential Self-Supplied Water Demand (*Same as Domestic Self-Supplied Water Demand*) The water used by households whose primary source of water is private wells and water treatment facilities with pumpages of less than 0.5 million gallons per day.

Retrofit The replacement of existing equipment with equipment of higher efficiency.

Retrofitting The replacement of existing water fixtures, appliances and devices with more efficient fixtures, appliances and devices for the purpose of conservation.

Reuse The deliberate application of water that has received at least secondary treatment for a beneficial purpose, in compliance with the Florida Department of Environmental Protection and water management district rules, for a beneficial purpose.

Reverse Osmosis (RO) A membrane process for desalting water using applied pressure to drive the feedwater (source water) through a semipermeable membrane.

Rolling (Moving) Average The arithmetic average of a sequence of data within a data set moved and calculated sequentially to smooth the data and reveal trends (e.g., five-year rolling total phosphorus concentrations).

Saline Water or Saltwater Interface The hypothetical surface of chloride concentration between fresh water and seawater where the chloride concentration is 250 mg/L at each point on the surface.

Saline Water or Saltwater Intrusion This occurs when more dense saline water moves laterally inland from the seacoast, or moves vertically upward, to replace fresher water in an aquifer.

Seawater Water which has a chloride concentration equal to or greater than 19,000 milligrams per liter.

Sedimentation The action or process of forming or depositing sediment.

Self-Supplied The water used to satisfy a water need, not supplied by a public water supply utility.

Serious Harm The long-term loss of water resource functions, as addressed in Chapters 40E-21 and 40E-22, F.A.C., resulting from a change in surface or groundwater hydrology.

Significant Harm The temporary loss of water resource functions, which result from a change in surface or groundwater hydrology, that takes more than two years to recover, but which is considered less severe than serious harm. The specific water resource functions addressed by a MFL and the duration of the recovery period associated with significant harm are defined for each priority water body based on the MFL technical support document.

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.

Storm Water Surface water resulting from rainfall runoff that does not percolate into the ground or evaporate.

Stormwater Treatment Area (STA) A system of water quality treatment wetlands that use natural biological processes to reduce levels of nutrients and pollutants from surface water runoff.

Subregional Groundwater Model A computer model that is used to simulate impacts on a smaller scale than the regional models, such as effects within public water supply service areas and impacts of individual wellfields.

Surface Water Water that flows, falls or collects above the soil or substrate surface.

Surface Water Improvement and Management (SWIM) Plan A plan prepared pursuant to Chapter 373, F.S.

Surficial Aquifer System (SAS) Often the principal source of water for urban uses within certain areas of south Florida. This aquifer is unconfined, consisting of varying amounts of limestone and sediments that extend from the land surface to the top of an intermediate confining unit.

Swamp A frequently or continuously inundated forested wetland.

Thermoelectric Self-Supplied Water Demand The difference in the amount of water withdrawn by electric power generating facilities for cooling purposes and the water returned to the hydrologic system near the point of withdrawal.

Total Maximum Daily Load (TMDL) The level of loading to a body of water that will protect uses and maintain compliance with water quality standards (defined in the Clean Water Act).

Trihalomethanes (THMs) Any of several synthetic organic compounds formed when chlorine combines with organic materials in water during the disinfection process.

Ultralow-volume Plumbing Fixtures Water-conserving plumbing fixtures that meet the standards at a test pressure of 80 pounds per square inch (psi) listed below.

- Toilets - 1.6 gallons/flush
- Shower Heads - 2.5 gallons/minute
- Faucets - 2.0 gallons/minute

Underground Injection Control (UIC) A program required in each state by a provision of the *Safe Drinking Water Act (SDWA)* for the regulation of *Injection Wells*, including a permit system. An applicant must demonstrate that the well has no reasonable chance of adversely affecting the quality of an underground source of drinking water before a permit is issued.

Upconing Process by which saline water underlying fresh water in an aquifer rises upward into the freshwater zone as a result of pumping water from the freshwater zone.

Uplands An area with a hydrologic regime that is not sufficiently wet to support vegetation typically adapted to life in saturated soil conditions; nonwetland.

Valued Ecosystem Component (VEC) A resource-based management strategy similar to a program developed by the EPA as part of the National Estuary Program. For the purposes of this study, the VEC approach is based on the concept that management goals for the Northwest Fork of the Loxahatchee River can best be achieved by providing suitable environmental conditions that will support certain key species, or key groups of species, that inhabit the system.

Wastewater The waterborne discharge from residences, commercial buildings, industrial plants and institutions together with any groundwater, surface runoff or leachate that may be present.

Water Budget An accounting of total water use or projected water use for a given location or activity.

Water Conservation Reducing the demand for water through activities that alter water use practices, e.g., improving efficiency in water use, and reducing losses of water, waste of water and water use.

Water Reservations State law on water reservations, in Subsection 373.223(4), F.S., defines water reservations as follows: "The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety. Such reservations shall be subject to periodic review and revision in the light of changed conditions. However, all presently existing legal uses of water shall be protected so long as such use is not contrary to the public interest."

Water Resource Development The formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage the water resources; the development of regional water resource implementation programs; the construction, operation and maintenance of major public works facilities to provide for flood control, surface and underground water storage and groundwater recharge augmentation; and related technical assistance to local governments and to government-owned and privately-owned water utilities.

Watershed The drainage area from which all surface water drains to a common receiving water body system.

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