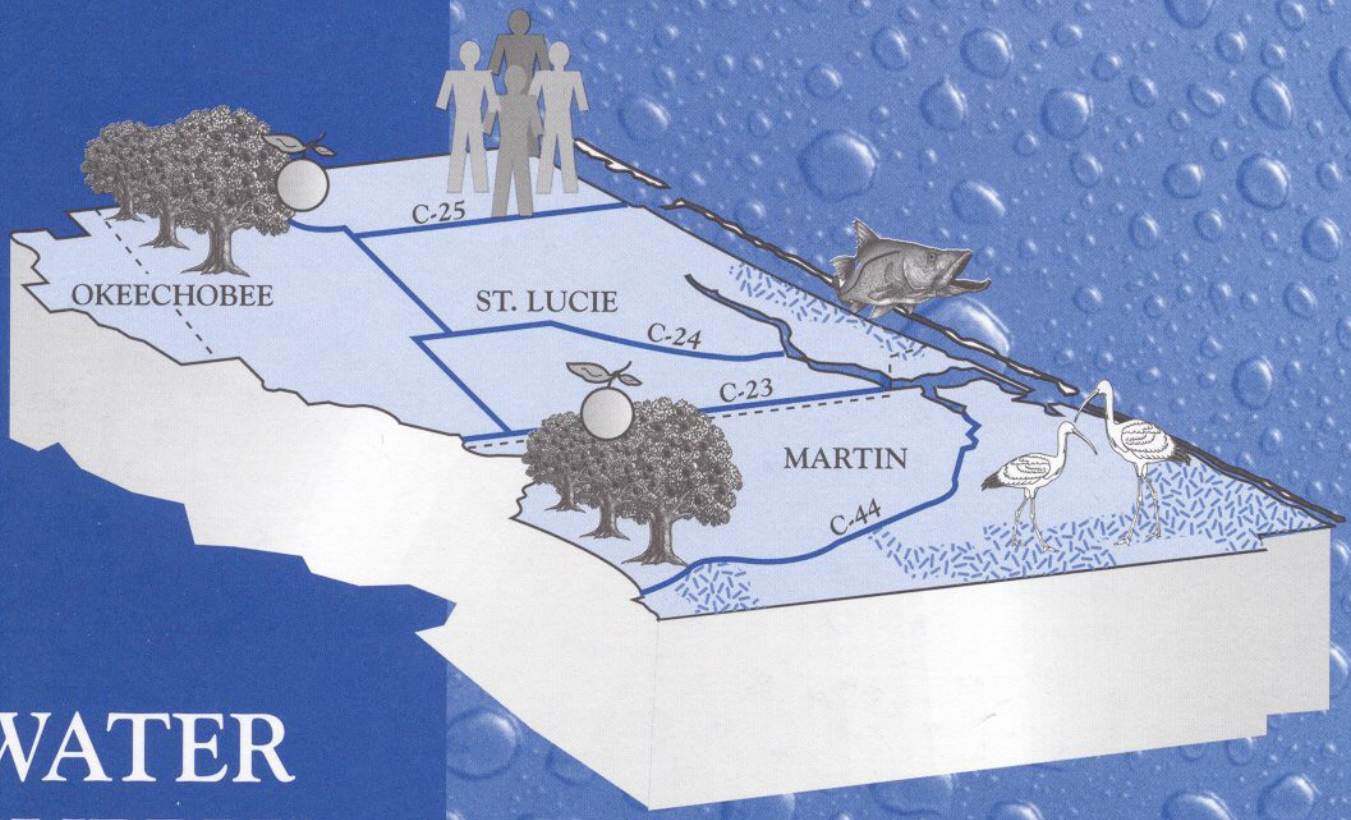
# UPPER EAST COAST




# WATER SUPPLY PLAN

## Planning Document

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

February 1998

## ACKNOWLEDGEMENTS

The South Florida Water Management District expresses our appreciation to the Upper East Coast Water Supply Plan Advisory Committee for their comments, advise, information, and assistance throughout the development of this plan.

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# EXECUTIVE SUMMARY

The Upper East Coast region is expected to experience substantial growth between now and the year 2020. Population is expected to increase by almost 80 percent from 1990 levels, with expansion occurring mostly in the coastal areas. Likewise, agriculture - primarily citrus located in the western portion of the region - is expected to remain a cornerstone of the region's economy. Meeting 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. It is the intent of the legislature to promote the availability of sufficient water for all existing and future reasonable-beneficial uses and natural systems. Implementation of the Upper East Coast Water Supply Plan should avert potential problems if the water resources are managed properly.

This planning document is the product of a public process, which relied heavily on an advisory committee of diverse membership representing the interests and concerns of the region. The planning effort provided a forum to weigh projected water demands of urban areas, agriculture and the environment against available supplies.

Overall, it was concluded that historically used sources of water, especially the Surficial Aquifer System in the coastal portions of the region, are not sufficient to meet projected water demands during a 1-in-10 drought condition. However, with appropriate management and diversification of water supply sources, there is sufficient water to meet the needs of the region. Analyses indicated that the traditional source for urban water needs, the surficial aquifer, has limited potential for expansion due to potential impacts on wetland systems, and increased vulnerability to saltwater intrusion in the vicinity of public water supply wellfields. In western portions of the region where surface water from the regional canal system is heavily relied upon 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; there are excess amounts during the summer wet season, and insufficient supplies during dry winter months. This problem of timing is particularly illustrated by the impacts of freshwater discharges to the St. Lucie Estuary and Indian River Lagoon. Excessive discharges decrease the salinity of the estuary to essentially freshwater, resulting in the loss of historic seagrass and oyster bed systems. Insufficient freshwater discharges increase the salinity to essentially saltwater resulting in negative environmental impacts.

Increasing demands and the constraints summarized above point to a need to redirect excess surface water to areas where it can be used or stored, and to look

toward new water sources for public water supply. The Floridan aquifer appears to be the most promising source for future urban potable water needs. Preliminary evaluations indicate that the Floridan aquifer has sufficient supplies to meet both existing and future urban and agricultural demands. Some urban utilities have already begun transitioning to the Floridan aquifer through desalination, which remove salts from saline water. The Floridan aquifer is also used as a primary source for some agricultural operations and as a backup source for others. Little is known, however, about long-term water quality impacts of sustained withdrawals from this aquifer. This makes water quality monitoring of the Floridan aquifer a research priority in this region.

Aquifer Storage and Recovery (ASR) technology also shows great promise both for treated and untreated water by providing a storage option during periods of water availability. Other strategies, such as targeting particularly vulnerable areas for conservation programs and greater development of reclaimed water use, are important water source options.

Local governments and users will play a key role in making these strategies a success, through adoption of conservation ordinances, homeowner awareness programs, land use decisions, and development of water source options by local utilities and users. Based on the analysis, it appears most of the water supply issues in the planning area can be addressed at the local level with appropriate diversification and management. One exception is addressing the needs of the estuaries. It is likely that ongoing studies will result in future water resource development capital projects.

Finally, other planning efforts are currently underway and are continuing to address some specific goals of this plan. For example, the Indian River Lagoon Restoration Feasibility Study will be evaluating many options for addressing specific management of freshwater inflows to the St. Lucie Estuary and Indian River Lagoon. The strategies outlined in this plan, in partnership with other efforts, should ensure that water in this region is prudently managed and available to meet the anticipated demands of the region.

# LIST OF ABBREVIATIONS

| | |
|---|---|
| ASR | Aquifer Storage Recovery |
| BEBR | Bureau of Economic and Business Research |
| C&SF | Central & Southern Florida |
| CFS | Cubic Feet Per Second |
| CUP | Consumptive Use Permitting |
| DWMP | District Water Management Plan |
| EPA | Environmental Protection Agency |
| F.A.C. | Florida Administrative Code |
| FAS | Floridan Aquifer System |
| FDEP | Florida Department of Environmental Protection |
| F.S. | Florida Statute |
| FY | Fiscal Year |
| GPD | Gallons Per Day |
| IFAS | Institute of Food and Agricultural Sciences |
| IRL | Indian River Lagoon |
| LO | Lake Okeechobee |
| LORSS | Lake Okeechobee Regulation Schedule Study |
| MGD | Million Gallons Per Day |
| MODFLOW | Modular Three–Dimensional Finite Difference Ground Water Flow Model |
| MOU | Memorandum of Understanding |
| NRCS | USDA Natural Resources Conservation Service |
| RAF | Regional Attenuation Facility |
| RO | Reverse Osmosis |
| RTA | Reduced Threshold Areas |
| SAS | Surficial Aquifer System |
| SLSWCD | St. Lucie Soil & Water Conservation District |
| SFWMD | South Florida Water Management District |

| | |
|---|---|
| SJRWMD | St. Johns River Water Management District |
| SLE | St. Lucie Estuary |
| SWIM | Surface Water Improvement and Management Plan |
| UEC | Upper East Coast |
| UECWSP | Upper East Coast Water Supply Plan |
| USACE | United States Army Corps of Engineers |
| USDW | Underground Source of Drinking Water |
| USGS | United States Geological Survey |
| WMD | Water Management District |
| WRCA | Water Resource Caution Areas |
| USDA | United States Department of Agriculture |

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# Chapter 1
# INTRODUCTION

The Upper East Coast is one of four regional planning areas in the South Florida Water Management District. The planning area covers approximately 1,200 square miles and includes most of Martin and St. Lucie counties, and a small portion of Okeechobee County (Figure 1). There is a transition in land use within the region from urban in the east to agricultural in the west. Agriculture has been the predominant land use and is expected to remain so in the future. 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 over 200,000 acres of upland forests and wetlands.

The planning area faces many challenges in maintaining adequate water supply for growing urban and agricultural demands while meeting the needs of the environment. Agricultural water demand, which accounts for 84 percent of the overall water demand in the planning area, is expected to increase by approximately 23 percent through the planning horizon. At the same time, the region's population is projected to increase by 83 percent, from 252,000 to over 460,000. Overall water demand is projected to increase by 34 percent to 565 million gallons per day.

The planning time frame for this plan is 2020. The modeling analysis for this plan used 2010 projections from local governments and the agricultural industry. In order to comply with statutory changes in 1997, these projections were reviewed with more recent information. It was concluded that growth in both population and agriculture has not occurred as rapidly as originally projected, and the projections originally prepared for 2010 reasonably represent projections for the year 2020. This is explained in greater detail in Chapter 2.

## PURPOSE

The purpose of the Upper East Coast (UEC) Water Supply Plan is to provide a framework for future water use decisions to provide adequate water supply for urban areas, agriculture, and the environment through 2020. The plan estimates the future water supply needs of urban areas and agriculture, weighs those demands against historically used water sources, and identifies areas where these demands cannot be met without harming the resource and environment, including wetlands. The plan evaluates the potential of several alternative water source options to meet any unmet demand and makes recommendations for their development.

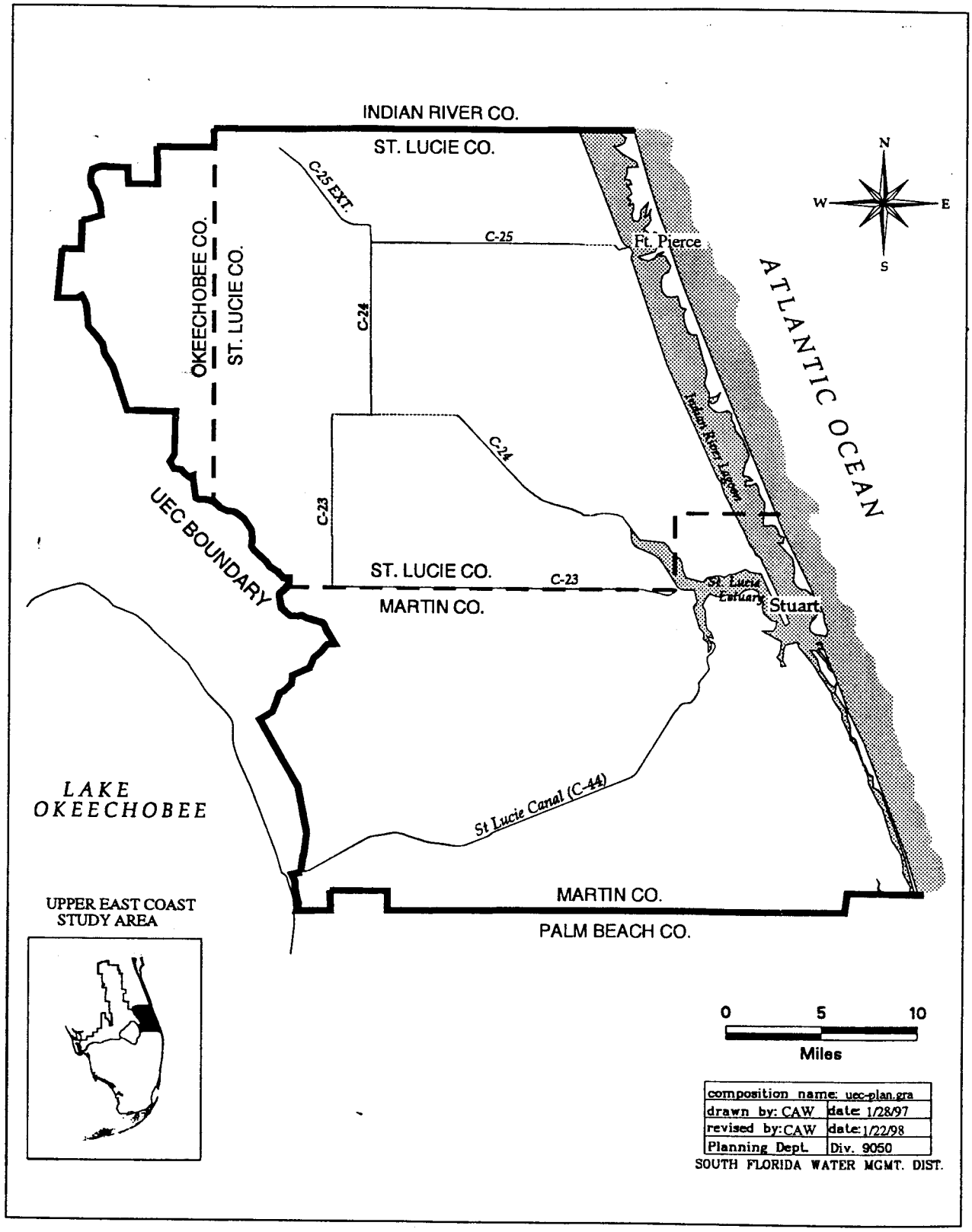


**Figure 1.** Upper East Coast Planning Area.

An important part of the planning process has been identifying constraints to water supply and exploring opportunities to maximize use of the resource. This involved extensive public input from the UEC Water Supply Plan Advisory Committee, whose members represent a variety of disciplines and interests, such as local governments, public water supply utilities, environmental interests, and agriculture, as well as the general public.

Water management in South Florida is multifunctional, reflecting the District's four main areas of responsibility: water supply, flood protection, water quality, and natural systems management. Due to the interrelationships of these areas of responsibility, the water supply plan was coordinated with other planning efforts in the region. For example, other related studies are addressing freshwater inflows to the St. Lucie Estuary. The solutions of these studies may enhance regional water supply by increasing surface water availability and improve water quality. This comprehensive, coordinated approach, combined with extensive public input throughout the planning process, ensures that solutions are balanced and consider all aspects of water management.

## BASIS OF WATER SUPPLY PLANNING

The District's water supply planning functions are guided by the directives and policies embodied in the District's Water Supply Policy Document (SFWMD, 1991), Water Resource Implementation Rule (Chapter 62-40, F.A.C.), Chapter 373, F.S., the State Comprehensive Plan (Chapter 187, F.S.), and delegation of authority from the Florida Department of Environmental Protection (FDEP). In addition, new legislative directives were monitored throughout the development of this plan, keeping it current and consistent with the 1996 Governor's Executive Order (96-297) and the 1997 legislative water supply amendments to Chapter 373, F.S. Legal authority and requirements, including new legislation, is further described in Chapter 1 of the Support Document.

The Upper East Coast Water Supply Plan is the first water supply plan developed under this new statutory direction. As other water management districts develop their water supply planning initiatives, the SFWMD and the FDEP will work with them to develop a compatible statewide approach. Aspects that may be reviewed for compatibility include application of the 1-in-10 level of certainty goal and development of associated water demands. Any results of such an effort will be reflected in the five-year update to this plan.

## PLAN GOALS

The UEC Water Supply Plan Advisory Committee adopted the water resource goal of the State Comprehensive Plan as the overall goal for the UEC Water Supply 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 ground water quality. Florida shall improve and restore the quality of waters not presently meeting water quality standards.

To ensure that the UEC Water Supply Plan addresses the specific needs of the region, the committee developed the following regional goals (no implied priority):

**Goal 1. Water Supply:** Promote the use of water supply alternatives and conservation.

Subgoals

1. Encourage the use of the lowest quality water available that is appropriate for a specific use.
2. Evaluate and promote the use of alternative sources of water including reclaimed water, aquifer storage and recovery, and the Floridan aquifer.
3. Increase water availability through increased regional storage.
4. Encourage interconnections between utilities.
5. Promote water conservation for all users of water through the use of higher efficiency irrigation systems and other water conservation measures.
6. Consider longer permit durations for permittees that commit to new technology and diversify water supply sources.

**Goal 2. Floridan Aquifer:** Establish water quality criteria limitations for the Floridan Aquifer System (FAS) within the UEC.

Subgoals

1. Continue to limit water quality degradation in the FAS by limiting drawdowns to land surface or less (no pump option). Consideration to allow short-term usage of pumps during extreme water shortages and freezes should be given. Pumps on ASR wells should be allowed on a case-by-case basis.
2. Coordinate existing well monitoring programs, expand where necessary to implement a comprehensive Floridan aquifer monitoring program to collect information on water quality (Cl, TDS, conductivity), water levels, rainfall and water use, and collect and tabulate historic data.
3. Re-establish a volunteer well abandonment program to conserve Floridan aquifer water and protect the quality of the SAS and FAS from potential contamination.
4. Continue investigation of the influence/impacts on the FAS from activities outside the UEC Planning Area, especially in southern Indian River County.
5. Coordinate investigation and development of water supply alternatives, compatible with other regional studies. Specifically, increasing surface water availability through regional attenuation facilities and ASR, to decrease the demand on the Floridan aquifer, especially in areas identified as potential

problem areas.
6. Encourage water conservation to reduce the demand on the Floridan aquifer.

**Goal 3. Wetland Protection:** Protect wetland systems from significant harm due to water use drawdowns.

Subgoals
1. Use existing regulatory protection guideline or equivalent, for the specified level of drought.
2. Establish different protection standards for different types of wetlands.
3. Applicability of protection standards based on wetland size. (For example, consider exemptions for small isolated wetlands).
4. Maintaining historical "seasonal" water levels under wetlands by encouraging use of alternative water supply sources.

**Goal 4. Saltwater Intrusion:** Develop criteria and programs for Surficial Aquifer System protection from saltwater intrusion.

Subgoals
1. Maintain current position of freshwater/saltwater interface during 1-in-10 dry rainfall event (equivalent to current criteria which bases permits on 90 day-no recharge at maximum pumpage allocation).
2. Enhance/expand saltwater monitoring network.

**Goal 5. Level of Drought:** Establish a level of certainty (annual rainfall event, expressed in terms of return frequency) for all permitted water uses and for the environment.

Subgoal
Use simulated 1 in 10 dry rainfall event for modeling purposes.

**Goal 6. Flood Protection:** Consider flood protection during the water supply planning process.

Subgoals
1. When evaluating potential water supply solutions during the planning process, flood protection benefits will be taken into account.
2. Consider rate versus volume for stormwater regulations.

**Goal 7. Compatibility with Local Governments:** Promote compatibility between the UEC Water Supply Plan and local land use decisions and policies.

Subgoals
1. Ensure that water supply plan population projections are compatible with local government comprehensive plans.
2. Review local government comprehensive plan amendments for compatibility with the UEC Water Supply Plan.

3. Review existing information and technical publications regarding impacts of various land uses on water resources.
4. Ensure coordination with the Treasure Coast Regional Planning Council to facilitate compatibility between the UEC Water Supply Plan and local land use decisions.

**Goal 8. Estuary:** Protect and enhance the St. Lucie Estuary and Indian River Lagoon.

Subgoals

1. Maintain continuity in public input by continuing UECWSP Advisory Committee through completion of the IRL Feasibility Study.
2. Endorse the salinity envelope concept from the IRL SWIM Plan.
3. Promote regional solutions for the estuaries, such as, but not limited to, regional attenuation facilities, C-131 flowway, St. Lucie flowway, onsite detention/retention, and removal of St. Lucie organic sediments.
4. Recommend investigation of impacts of discharge volume in addition to discharge rates, which is the current surface water permitting practice.
5. Identify potential solutions which are outside the scope of other existing studies to enhance and protect these estuarine systems. Possible examples include voluntary incentive-based approaches or Best Management Practices (BMPs) which decrease current discharge practices.

**Goal 9. Linkages with other Regional Planning Efforts:** Promote compatibility and integration with other related regional water resource planning efforts, including Indian River Lagoon (IRL) Surface Water Improvement and Management (SWIM) Plan, IRL Restoration Feasibility Study, Lake Okeechobee SWIM Plan, Lake Okeechobee Regulation Schedule Study, Lower East Coast Water Supply Plan, Central and Southern Florida Comprehensive Review Study (a.k.a: C&SF Restudy), the IRL National Estuary Program Comprehensive Conservation and Management Plan, Regional Attenuation Facility Task Force, Strategic Regional Policy Plan, and St. Johns River Water Management District Regional Water Supply Assessment.

Subgoals

1. Ensure compatibility between the goals and implementation strategies of completed plans.
2. Integrate these parallel efforts, where appropriate, when formulating plan strategies and recommendations.
3. Look for opportunities to enhance the success and timeliness of other related planning efforts.

These goals captured the key issues and concerns in the planning area, and in turn, provided direction for the planning process.

# Chapter 2
# WATER SUPPLY PLANNING PROCESS

## PLANNING PROCESS COMPONENTS

The planning process used for creation of this water supply plan can be generally divided into three broad phases: assembling background information and development of tools, issue identification and analysis, and solution development (Figure 2). Public participation was ongoing throughout the planning process, from gathering background information from local governments to holding advisory committee meetings where water supply issues and potential water supply alternatives were explored. The goals and objectives established by staff and the advisory committee provided the overall framework for the planning process.

### Background Work

#### Background Information

The District project team initially compiled extensive background information required for informed decision making later in the process. This background information included pertinent statutes and technical documents, historical information, rainfall data, land use and population information, water use demand projections, hydrogeologic and water resource information, water use permit information, details of utilities in the planning area, environmental information, and alternative water supply source concepts. The urban water use demand projections were based on population projections from local government comprehensive plans, while agricultural demand projections were based primarily on long-term historical trends. All of this information was then consolidated into a Background Document and associated appendices in October 1994 to be used by the project team and advisory committee members. As the planning process ensued, these documents were updated where new information became available. Upon completion of the UEC Water Supply Plan, the Background Document became the Support Document.

#### Tool Development

Another significant preparatory task was the identification, development and refinement of analytical tools needed for subsequent stages of the process. This included the development and calibration of regional ground water models for the two counties which comprise most of the planning area. Model preparation also involved the assembly of substantial amounts and types of information, including statistical analyses of rainfall events in the region, and descriptive data pertaining to aquifer characteristics such as transmissivity.

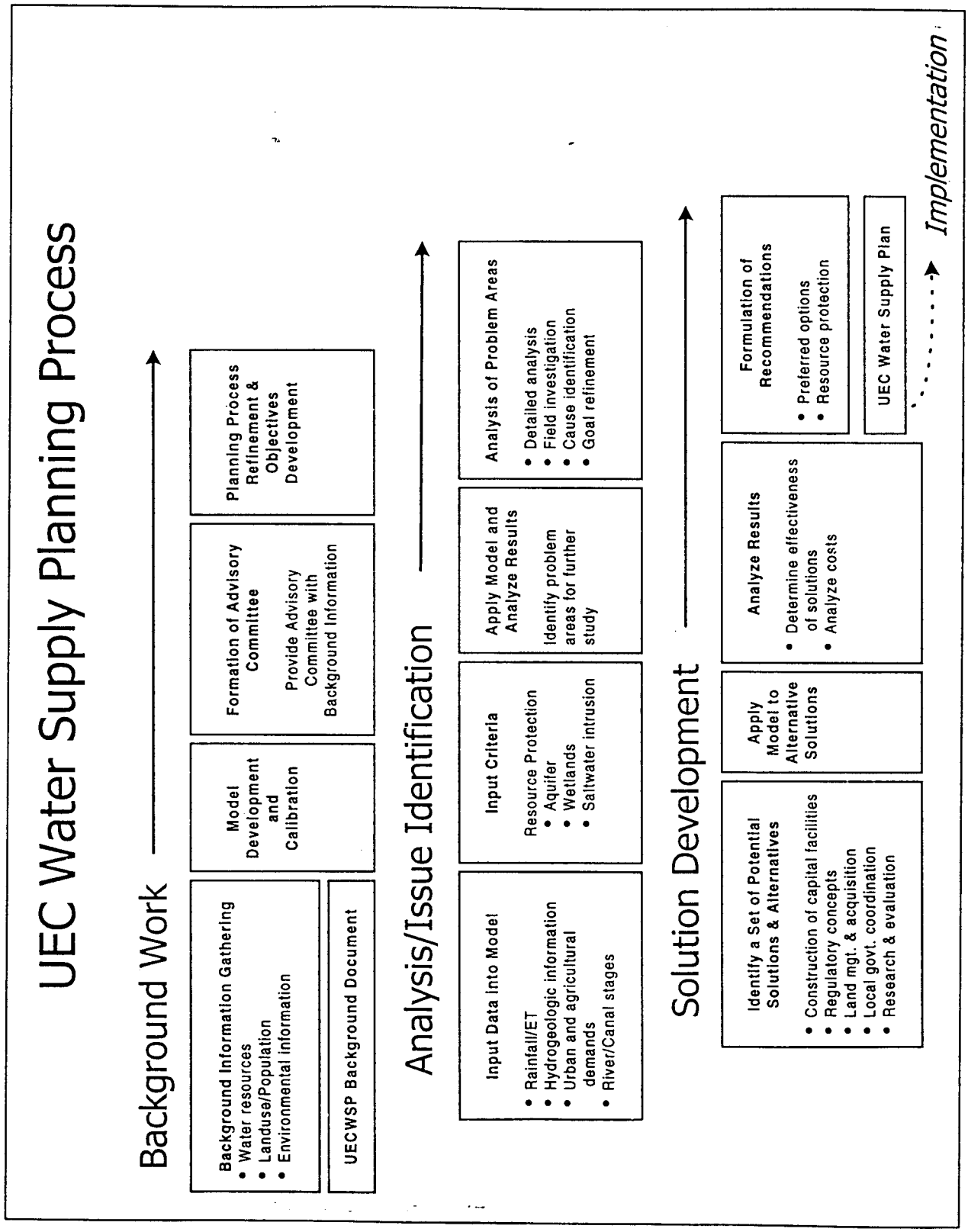


**Figure 2.** Planning Process Components.

## Advisory Committee Formation

A 30 member advisory committee, with approximately the same number of alternate members, was created to obtain public participation in the planning process. Membership included representatives of federal, state and local agencies, including planning officials; public water supply utilities; the local business community; environmental concerns; community leadership; and agricultural concerns. All committee meetings were advertised and open to the public.

The primary role of the committee, as well as the general public, was to provide input at each stage of the water supply planning process, to contribute local knowledge and the expertise of the agencies being represented, and to reflect the collective concerns and interests of various stakeholders in the Upper East Coast (UEC) Planning Area. The role of District staff was to facilitate the planning process, provide professional and technical direction, support and guidance, and prepare the planning document recognizing the committee's input.

The advisory committee spent about six monthly meetings on background presentations and sharing of information, along with development of the plan's goals and objectives (a listing of the plan goals is provided in Chapter 1). The goals established by the advisory committee served as a "road map" for the subsequent planning process. Topics scheduled for committee discussion, research and analytical work, and formulation of final recommendations all centered around these goals. Completion of the plan's initial goals marked the transition into the analytical phase of the process. The advisory committee met a total of 25 times between October 1995 and February 1998.

In addition to regular advisory committee meetings, two technical workshops were conducted to respond to questions related to the ground water modeling associated with development of the UEC Water Supply Plan. Workshop participants concluded the modeling and technical procedures used in the plan were appropriate in addressing the regional water supply picture if: (1) the results are used to address the "big picture" solutions; (2) site-specific or permit-specific solutions are not part of the plan's recommendations; and, (3) the plan focuses on development of regional water resources, not strictly regulatory solutions.

A recommendation of this plan is that the advisory committee remain in existence to help coordinate the implementation of the water supply plan with the ongoing Indian River Lagoon Restoration Feasibility Study (Goal 8) and local planning efforts. The purpose of the feasibility study is to find regional solutions to altered freshwater discharges to the Indian River Lagoon (IRL) and St. Lucie Estuary (SLE). The IRL Feasibility Study is jointly sponsored by the U.S. Army

Corps of Engineers and the South Florida Water Management District. It is scheduled to be completed in 2000.

### Analysis and Issue Identification

Ground water modeling was conducted to predict the impacts of projected water demands on the resource. Two sets of initial model simulation base runs were performed using identical rainfall conditions. The first set of runs represented estimated 1990 water demands, while the second represented projected water demands under the assumption that water use characteristics and management conditions in the region would remain constant. Comparisons between the two time periods, as well as the application of resource protection criteria pertaining to drawdowns under wetland systems and water levels in the Floridan aquifer, were used to identify potential problem areas. The limitations and input assumptions associated with the modeling effort are more thoroughly discussed in Chapter 4.

In the Martin Coastal and Jensen Beach Areas, where the regional model simulations indicated there were concentrated areas of potential impacts, smaller scale subregional models were used to more thoroughly examine: (1) whether potential problems were likely; and, (2) the magnitude of those problems. Input from advisory committee members and information gathered during the background research also served to identify issues to be addressed by the plan.

In addition to the ground water modeling, water availability in the major canal systems was evaluated. The availability of surface water in these canals was compared to its associated demands to determine the unmet needs. Demands that could not be met by surface water were then allocated to ground water sources, primarily the Floridan aquifer. Areas where there is potential for saltwater intrusion in 2010 were also identified.

Field investigations, research of existing technical documents, and other qualitative analytical methods were also used to analyze certain problem areas and to identify their potential causes. Additional detail on the problem areas identified and the analytical work conducted is provided in Chapter 4.

A subcommittee of the advisory committee was formed to evaluate options and develop strategies for issues associated with managing the Floridan aquifer. The subcommittee, composed of public utility and agricultural Floridan users and the USDA Natural Resources Conservation Service (NRCS), drew upon its local knowledge and experience with the Floridan aquifer to formulate water supply strategies and recommendations.

### Solution Development

Once potential problems were identified, a series of water source options (also referred to as water supply alternatives) were evaluated to determine their effectiveness in resolving the potential problems. Options included increased water conservation, more efficient water delivery systems, alternative water sources (e.g., reclaimed water, Floridan aquifer, surface water storage) and other approaches which would serve to maximize water resources.

Preferred options were then translated into recommendations by the advisory committee and staff. These committee recommendations were further refined into implementable strategies for the planning area. Recommendations are presented in Chapter 6.

The final product of the planning process is the UEC Water Supply Plan. The water supply plan documents the results of the planning process and provides recommendations and strategies for implementation.

## PLAN IMPLEMENTATION

Implementation is one of the most important phases of the UEC Water Supply Plan, in that strategies developed during the planning process are actually carried out to ensure adequate water supply through 2020. Implementation will follow approval of the plan by the SFWMD Governing Board, and will involve coordination with other agencies and planning efforts, and the strengthening of linkages between land use and water supply planning. Other components of implementation may include additional data collection, research, cost-share projects, capital construction, and rulemaking when regulatory criteria are changed. Specific plan implementation strategies are discussed in Chapter 6. After approval by the SFWMD Governing Board, water supply plans will be updated at least once every 5 years.

## COORDINATION

Development of the UEC Water Supply Plan was coordinated with several other planning efforts in the region, as well as with many other entities, to ensure an integrated approach and compatibility with local and regional plans. In addition, the UEC Water Supply Plan will be incorporated into the SFWMD District Water Management Plan (DWMP) which is intended to provide comprehensive long-range guidance for the actions of the water management district in implementing its responsibilities under state and federal laws.

## Related Planning Efforts

Water management planning efforts in the UEC Planning Area include a variety of interrelated studies and activities, in both the public and private sectors. Each plan or study addresses unique water management issues while maintaining close relationships with water supply planning (Table 1). These include the Indian River Lagoon (IRL) Surface Water Improvement and Management (SWIM) Plan, the IRL Restoration Feasibility Study, the Central and Southern Florida (C&SF) Comprehensive Review Study, and private sector initiatives.

The IRL SWIM Plan, initially completed in 1989 and updated in 1994, addresses water quality concerns and environmental water supply needs by providing targets for freshwater inflows to the SLE and IRL. The construction of extensive agriculture and urban drainage projects has expanded the watershed of the SLE significantly. The major effects of these man-made changes in the watershed are significant alterations in the timing (excess wet season flows, insufficient dry season flows), distribution, quality, and volume of freshwater entering the Estuary. The estuarine environment is sensitive to freshwater releases, and modification of the volume, distribution, circulation, or temporal patterns of freshwater discharges can place severe stress upon the entire ecosystem. Salinity patterns affect productivity, population distribution, community composition, predator-prey relationships, and food web structure in the in-shore marine habitat. Extreme salinity fluctuations and ever-increasing inflows have contributed to major changes in the structure of the communities within the Estuary, such as seagrass and oyster losses. In 1987, the State of Florida passed the SWIM Act, which directed the South Florida Water Management District to develop a plan to improve the water quality of the Indian River Lagoon and its tributaries, including the St. Lucie Estuary. Planning and research conducted under the direction of the SWIM program have resulted in the development of a salinity range restoration target for the Estuary.

The IRL SWIM Plan provides the basis for establishment of a minimum flow and level (MFL) for the SLE in defining the needs of the Estuary. The SLE has been designated as a priority water body by the District pursuant to Chapter 373, F.S., which requires establishment of a MFL. The District has committed to establishing a MFL for the SLE by 2001 (see Chapter 5). Establishment of MFL, including data collection, is not contingent on SWIM funding and will occur regardless of the status of the SWIM program.

**Table 1.** Upper East Coast Related Water Management Planning Efforts.

| | Scope/Primary Goal | Relationship to UECWSP | Timeframes |
|---|---|---|---|
| UEC Water Supply Plan | Adequate and reliable water supply | N/A | 1998 |
| Indian River Lagoon SWIM Plan | Restoration of IRL and SLE | -Provides water quality and quantity targets for IRL and SLE | Update to be initiated in 1998 |
| IRL Restoration Feasibility Study | Regional solutions to manage freshwater discharges to IRL and SLE and restoration of impacted watershed wetlands | -Evaluates options to meet SLE inflow range<br>-Explore potential for supplemental water supply for agriculture<br>-Provide detailed information needed for implementation | 2001 |
| Lake Okeechobee (L.O.) SWIM Plan | Protection and enhancement of Lake Okeechobee and its watershed (water quality) | -Backflow/inflow from C-44 Canal.<br>-Potential C-131 backpumping if determined viable in IRL Feasibility Study. | Update completed 1997 |
| Lake Okeechobee Regulation Schedule Environmental Impact Study | Evaluates environmental and economic impacts associated with proposed L.O. Regulation Schedules (quantity) | -Discharges from L.O. to SLE | 1999 |
| C&SF Project Restudy | Comprehensive review of environmental impacts of C&SF project | -Discharges from L.O. to SLE | 1995-1999 |
| IRL National Estuary Program Comprehensive Conservation and Mgmt. Plan | EPA program for IRL restoration | -Supports activities to enhance the IRL and SLE<br>Creates framework for:<br>-Identification of funding sources<br>-Identification of lead/support partnering | 1996 |
| Lower East Coast Water Supply Plan | Adequate and reliable water supply for the Lower East Coast, for natural systems L.O. service area | -Water supply to C-44 basin<br>-Minimum and maximum flows to SLE from L.O.<br>-Potential C-131 if determined viable in IRL Feasibility Study | 2000<br>Lower East Coast Interim Plan 1998 |

To address the freshwater discharges to the SLE, the SFWMD, in cooperation with the U.S. Army Corps of Engineers (USACE), is conducting the Indian River Lagoon Restoration Feasibility Study (Feasibility Study) to investigate regional water resource opportunities in relation to the C&SF project canal system in the UEC region. The Feasibility Study is not looking at freshwater discharges from Lake Okeechobee (these are part of the C&SF Restudy). This five-year study will develop a regional plan to address environmental restoration of areas adversely impacted by the C&SF Project system and other water supply opportunities in the region. The primary focus of the Feasibility Study is environmental restoration. This includes evaluating several alternatives, such as regional attenuation facilities (surface water storage areas), to meet the salinity envelope for the SLE, as well as enhancing surface water availability for water supply. The salinity envelope concept is discussed in greater detail in the Minimum Flows and Levels section of Chapter 5.

The IRL Restoration Feasibility Study, initiated in 1996, is a critical implementation tool for the SWIM plan, as well as this water supply plan. The IRL Feasibility Study will utilize information from the SWIM Plan to guide freshwater inflow targets and rely on the water supply plan for information about water supply deficiencies through the planning horizon.

The C&SF Project Comprehensive Review Study (Restudy) is another cooperative effort between the District and the USACE. The purpose of this study is to re-examine the C&SF Project to determine the feasibility of structural or operational modifications to the project essential to restoration of the Everglades and Florida Bay ecosystems while providing for other water-related needs such as urban and agricultural water supply and flood control. The Restudy includes all of the area of the C&SF Project with the exception of the upper St. Johns River Basin. The area encompasses approximately 18,000 square miles from Orlando to Florida Bay. Major areas include the Kissimmee River, Lake Okeechobee, St. Lucie and Caloosahatchee Estuaries, Everglades Agricultural Area, Water Conservation Areas, Upper and Lower East Coast, Lower West Coast, Everglades National Park, Big Cypress National Preserve, and Florida Bay. The Kissimmee River, Lake Okeechobee and the Everglades are the dominant watersheds that connect a mosaic of wetlands, uplands, and coastal and marine areas. The Restudy includes an evaluation of the water demands on Lake Okeechobee, including the C-44 basin, and regulatory discharges. The Restudy is scheduled to be completed in 1999.

Effective coordination among these mutually dependent studies was a priority throughout the water supply planning process (see Goal 9). Project managers from each of these plans worked together to identify opportunities to address multiple water management concerns with comprehensive solutions and to minimize duplicative efforts.

Private sector initiatives have also played a critical role in the UEC Planning Area. For example, the St. Lucie River Initiative, Inc. is a not-for-profit corporation established by concerned citizens and community leaders. The Initiative sponsors events, fund raising and community education programs which benefit the St. Lucie Estuary. Similarly, concerned citizens created the impetus for formation of the Regional Attenuation Facility (RAF) Task Force (a.k.a. the Water Preserve Area Task Force) by the Martin and St. Lucie county commissions. A RAF is a constructed facility or enhanced natural system (such as a rehydrated wetland), which stores water in order to reduce flows to an area where excessive water may cause harm (e.g., St. Lucie Estuary). Water quality improvement can also be anticipated in a RAF. The water stored in a RAF would also be used to supplement base flows to the St. Lucie Estuary during dry periods and increase surface water availability for irrigation water supply. The RAF Task Force was charged with identifying potential sites for regional attenuation facilities. In addition to the work of the task force, two charrettes (detailed public design workshops) were held to explore design issues associated with potential RAF sites in both Martin and St. Lucie counties.

Due to the potential for multiple purposes (environmental, water quality, water supply, flood control) of RAFs, there is diverse community support for creating such facilities in the planning area. Coordination with these important efforts was accomplished by including representatives from these groups in the membership of the UEC Water Supply Plan Advisory Committee, and through regular status reports on these activities.

### Local and Regional Governments

District staff coordinated development of the UEC Water Supply Plan with the St. Johns River Water Management District (SJRWMD), local governments, and other entities in the UEC Planning Area. The northern boundary of the planning area is the jurisdictional boundary between the SFWMD and the SJRWMD. Regular meetings were conducted between staffs from both districts to share information so that the plan accurately reflected water use activities in the SJRWMD, adjacent to the UEC region.

Significant efforts have also been made to develop stronger linkages between local government planning and the UEC Water Supply Plan (Goal 7). Regular meetings have been initiated between District staff and local land use planners and utilities to explore opportunities to link our planning efforts. These meetings have been successful in the sharing of information and understanding of related processes and requirements.

## PLANNING TIME FRAME

The planning time frame, or horizon, for the Upper East Coast Water Supply Plan is 2020. This results in a planning period of over 20 years. Plan recommendations and strategies are intended to be relevant to projected conditions for 2020.

The preparation of water demand projections for the Upper East Coast region and the development of the ground water models used for the simulation of ground water conditions began in 1992. Public water demand projections used in the ground water models were based on the 2010 projections from local comprehensive plans. The local comprehensive plans were completed in the late 1980s when this area was experiencing tremendous growth. Similarly, agricultural projections for 2010 were completed at the same time using forecasts based on historical growth, acreage and estimated future economic conditions. The model runs, using year 2010 projected demands, were completed in 1996. These results were used by District staff and the advisory committee in the development of preliminary recommendations and strategies.

In mid-1997, the Florida legislature passed new legislation pertaining to water supply plans. By this time, the advisory committee had met 18 times and the analysis and development of recommendations and strategies were substantially complete. Also, several chapters of this plan were drafted. One requirement of the new legislation is that water supply plans should have at least a 20-year planning time frame. It became apparent the 2010 demand projections would not meet the legislative requirement.

In response to this requirement, staff and the advisory committee conducted additional analysis to ensure this plan satisfied the requirement of a 20-year planning horizon. This was initiated by comparing the Plan's 2010 projections (completed in 1992) to current 2020 projections. Population projections for 2020 were obtained from the University of Florida, Bureau of Economic and Business Research (BEBR), since local comprehensive plans do not make projections to 2020. A comparison of the population projections from local comprehensive plans for 2010 to 2020 projections from BEBR indicate a difference of only 4 percent (Table 2). Based on this information, it is apparent that growth in this area has not occurred as rapidly as originally projected. BEBR projections are being used to update St. Lucie County's comprehensive plan, and Martin County's projection methodology provides similar results to BEBR.

**Table 2.** Comparison of UEC Water Supply Plan 2010 Population Projections for Martin and St. Lucie Counties to Current BEBR 2020 Projections.

| County | 2010 UECWSP and local government population projections[1] | 2020 BEBR population projections[2] | % Difference |
|---|---|---|---|
| St. Lucie | 290,100 | 285,700 | - 2% |
| Martin | 154,200 | 176,200 | + 14% |
| Total | 444,300 | 461,900 | + 4% |

Note: Eastern Okeechobee Co. is not included in the above figures because the population in this portion of the UEC Planning Area is small.

Sources: 1) County Comprehensive Plans.

2) Florida Population Studies, University of Florida Bureau of Economic and Business Research, Volume 30, Number 2, Bulletin 117, February 1997 (medium set).

Likewise, growth in UEC irrigated agricultural acreage (especially citrus) has slowed since 1992. The agricultural community has indicated the current 2010 projection may be realized in 2020 considering current economic conditions. Citrus represents the single greatest user of water in the UEC Planning Area.

Based on this information, the advisory committee and staff concluded that the analysis conducted for this plan has reasonably represented projected conditions for the year 2020. Therefore, the advisory committee and staff are confident that the plan recommendations and strategies apply to the year 2020 planning horizon.

The advisory committee and staff also recommend that the plan be updated in five years and that the update base all analyses on 2025 demand projections.

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# Chapter 3
# PLANNING AREA DESCRIPTION

## SUMMARY OF WATER RESOURCE SYSTEMS

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 is used primarily for agricultural irrigation, with the FAS used as a backup source during periods of low rainfall. The SAS is the principal source for public water supply and urban irrigation. However, as the population in the planning area increases, the urban areas are anticipated to increase their use of FAS as a source of drinking water.

The SAS and surface water are dependent upon rainfall for recharge. The average annual rainfall in the UEC Planning Area is about 51 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.

### Ground Water

In the UEC Planning Area, the surficial aquifer is a shallow unconfined aquifer with fairly good water quality and is a primary source for urban drinking water and urban irrigation. Because it is close to the surface, this aquifer is easily recharged by local rainfall in the planning area. In terms of water quantity, the SAS is not as prolific as the FAS.

The FAS is separated from the overlying SAS by a thick, low permeability confining layer and is found approximately 800 feet below the land surface in the UEC Planning Area. Because of this confining unit, the Floridan aquifer is not recharged by local rainfall, but instead is recharged in central Florida where the confining unit is thinner and more permeable.

The FAS is relatively saline in the planning area and is also artesian, meaning it flows naturally at land surface. In fact, average water levels in Floridan aquifer wells rise 20 to 30 feet above the land surface in the region. Because of concerns of upconing of higher salinity water from deeper portions of the aquifer, there is a prohibition on the use of pumps on Floridan aquifer wells. The Floridan is used by agriculture mainly as a back up to surface water. Some public water supply utilities

use the FAS for a water source, but these systems require removal of salts via desalination. Many public water suppliers are looking to the FAS as a future source.

### Surface Water

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. It 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.

## SUMMARY OF NATURAL SYSTEMS

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, the Savannas, Pal-Mar, Jonathan Dickinson State Park, and DuPuis Reserve. Figure 3 depicts natural areas in the UEC region and those that are publicly owned.

The Loxahatchee River basin, approximately 200 square miles in size, is bisected by the Martin – Palm Beach County line. This county line is also the boundary between the UEC and Lower East Coast Planning Areas. Most of the river basin within the UEC region remains relatively undeveloped, and includes large natural areas such as Jonathan Dickinson State Park and the Pal-Mar wetlands. The portion of the Loxahatchee Basin within the LEC has experienced significant hydrologic alteration and is the focus of restoration efforts. Restoration of the Loxahatchee Slough hydroperiod, and the delivery of appropriate flows to the Loxahatchee River will be addressed in the LEC Plan. Contributions from the Martin County subbasins will be considered in the LEC Plan. A detailed subregional modeling analysis of Northern Palm Beach County surface water systems is currently underway with the goal of providing an integrated environmental restoration/water supply plan for this area.

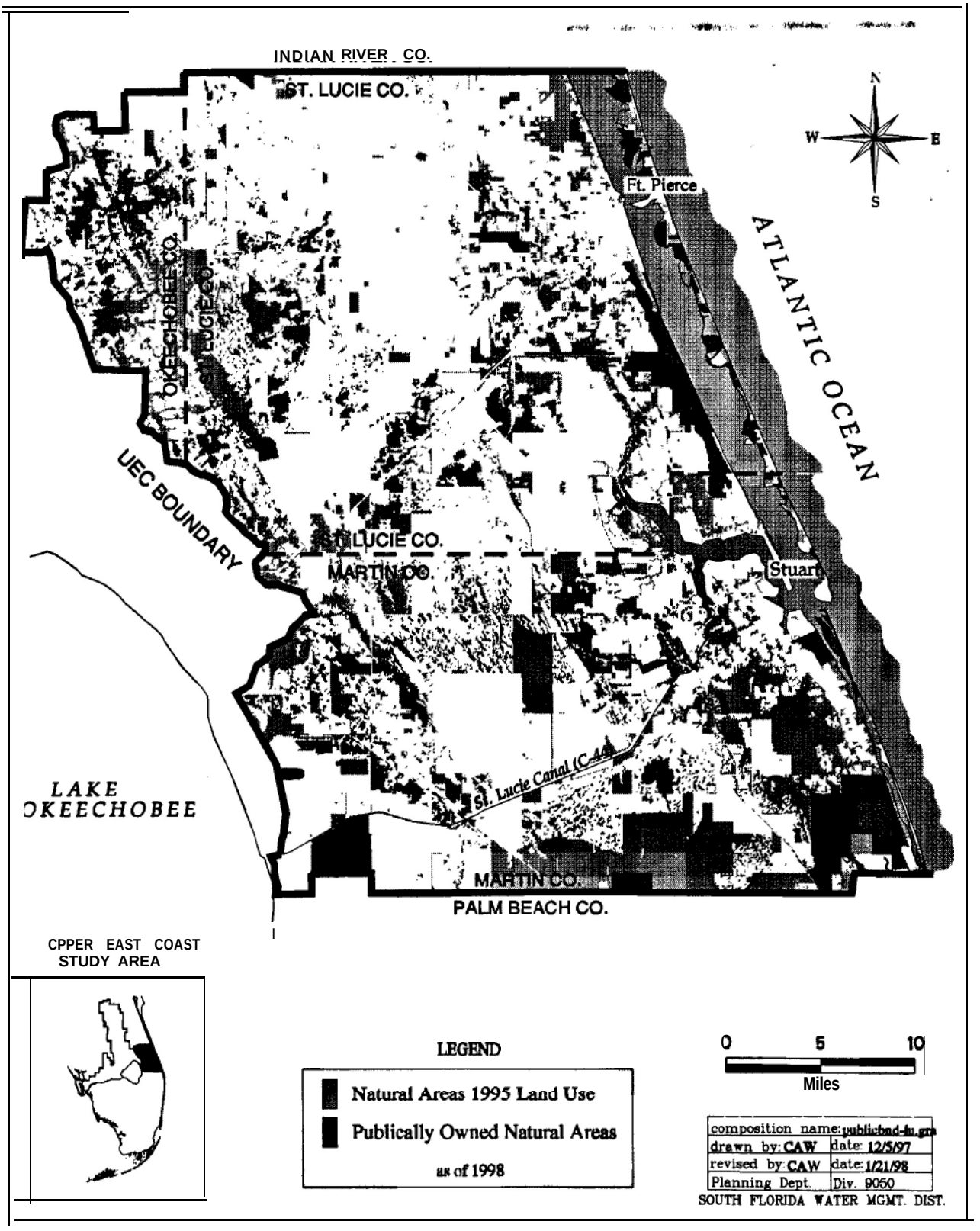


**Figure 3.** Natural Areas and Publicly Owned Lands.

## Inland Resources

Lake Okeechobee is the largest freshwater lake in the southeastern United States and is a major feeding and roosting area for wading birds and migratory fowl. The natural systems of regional significance in the western portion of the planning area include Pal-Mar and DuPuis Reserve. The Pal-Mar Tract is located at the southern edge of the planning area in Martin and Palm Beach counties. The proposed Pal-Mar Save Our Rivers acquisition boundary includes a wildlife corridor that would connect to other natural systems, including Jonathan Dickinson State Park and the DuPuis Reserve. These natural areas contain pine flatwoods, sand pine scrub, and a variety of wetland habitat.

A coastal ridge is present along the eastern edge of the planning area. This ridge is dominated by sand pine scrub and provides habitat for many protected species of plants and animals. Eastern portions of the Savannas State Reserve and Jonathan Dickinson State Park are located on the coastal ridge in St. Lucie and Martin counties. The Savannas contains a remnant coastal wetland system.

## Coastal Resources

The Indian River Lagoon system is composed of three interconnected estuarine lagoons, the Mosquito Lagoon, Indian River Lagoon and the Banana River Lagoon. The lagoon system extends about 155 miles from Volusia County southward to Palm Beach County. The system is fairly shallow and narrow, with an average depth of 4 feet, and a width that varies from 0.2 to 5.5 miles. Circulation in these lagoons is generally sluggish except during large storms and in areas near inlets.

The lagoon system is a biogeographic transition zone, rich in habitats and species, with the highest species diversity of any estuary in North America (SFWMD and SJRWMD, 1994; SFWMD, 1997). Approximately 2,200 species have been identified in the lagoon system (SFWMD and SJRWMD, 1994; SFWMD, 1997), 35 of which are listed as threatened or endangered.

The St. Lucie Estuary (SLE) is located in the southern region of the Indian River Lagoon. The Estuary, encompassing about eight square miles, has an expanded watershed area of approximately 775 square miles due to the construction of extensive agricultural and urban drainage projects. In addition, the Estuary is linked to Lake Okeechobee by the C-44 canal that is utilized for both navigation and the release of flood waters from the Lake. The Estuary is divided into three major areas; the inner estuary, comprised of the North and South Forks; the mid-estuary, consisting of the area from the juncture of the North and South Forks to Hell Gate; and the outer estuary extending from Hell Gate to the St. Lucie Inlet. The main body of the North Fork is about four miles long, and has a maximum

depth of 10 feet. The North Fork is designated as an aquatic preserve. The South Fork is approximately 2.5 miles long and has maximum depths approaching 10 feet. The mid-estuary extends approximately five miles from the Roosevelt Bridge to Hell Gate with a maximum depth of about 25 feet. Generally, the Estuary is much shallower than these maximum depths.

## LAND USE TRENDS AND WATER DEMANDS

Land use in the UEC Planning Area has been predominantly agricultural (Table 3) and is expected to remain so in the future. However, the percentage of agricultural land use in Martin and St. Lucie counties is anticipated to decrease as a result of an increase in urban land use.

**Table 3.** Acreages and Percentages of Land Use by County.

| | Martin County | | St. Lucie County | | Okeechobee Area | | UEC Planning Area | |
|---|---|---|---|---|---|---|---|---|
| Land Use | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Agriculture | 137,361 | 40 | 191,081 | 50 | 35,601 | 60 | 364,043 | 46 |
| Urban and Transportation | 50,416 | 15 | 72,500 | 19 | 717 | 1 | 123,633 | 16 |
| Wetlands | 54,116 | 16 | 33,374 | 9 | 11,669 | 20 | 99,159 | 13 |
| Upland Forest | 64,201 | 19 | 38,880 | 10 | 7,874 | 13 | 110,955 | 14 |
| Rangeland | 5,503 | 2 | 8,129 | 2 | 1,558 | 3 | 15,190 | 2 |
| Barren | 2,075 | 1 | 316 | 0 | 87 | 0 | 2,478 | 0 |
| Water | 26,706 | 8 | 40,612 | 10 | 1,955 | 3 | 69,273 | 9 |
| Total | 340,378 | 100 | 384,892 | 100 | 59,461 | 100 | 784,731 | 100 |

Source: SFWMD Florida Land Use/Land Cover GIS database, 1995.
Note: Percentages rounded to the nearest tenth.

Citrus is by far the dominant irrigated crop in the planning area and occupies over four-fifths of the irrigated agricultural acreage in the region. Since 1980, citrus acreage has grown moderately but continuously, and is associated with the movement of citrus southward from Central Florida following several severe winter freezes in the mid-1980s. Irrigated citrus acreage in the planning area is projected to grow by 32 percent from about 134,000 acres in 1990 to 176,000 acres in 2020.

Population in the planning area is projected to increase by 83 percent to almost 461,900 by 2020 (Table 4). Urban water demand in the planning area is projected to increase by 89 percent from 66 million gallons per day (MGD) in 1990 to 125 MGD in 2020, while agricultural water demand is forecast to increase by 23 percent from 357 MGD in 1990 to 440 MGD in 2020 (Table 4). About 85 percent of the agricultural water demand in 2020 will be for citrus. Total water demands in the UEC region are projected to increase 142 MGD (34 percent) above 1990 estimates to 565 MGD by 2020.

**Table 4.** UECWSP Population and Water Demands for 1990 and 2020.

| Category | 1990 | 2020 | % Change |
|---|---|---|---|
| Population | 252,086 | 461,900 | 83 |
| Water Demands (MGD) | | | |
| Agricultural | 357 | 440 | 23 |
| Urban | 66 | 125 | 89 |
| Total Planning Area | 423 | 565 | 34 |

## Water Sources by Land Use Type

There is a transition in land use from urban in the east to agricultural in the west (Figure 4). This transition is reflected in the water demands placed on surface water and ground water resources. The principal source of water for urban demands is the SAS. However, a few public water supply utilities have recently turned to the FAS, which is desalinated to supply potable uses. Martin County Utilities, as well as many coastal developments, are currently using, or plan to use desalinated FAS water to supply their service areas. In addition, the Fort Pierce Utilities Authority blends upper Floridan water of sufficient quality with SAS water treated by lime softening.

Several other utilities plan to use the FAS to supplement SAS withdrawals to meet future demands.

The primary source of water for agriculture is surface water. However, the FAS is an important source of agricultural irrigation water in St. Lucie County, and to a lesser extent, in Martin County when surface water availability is limited.

## Water Demands by Land Use Type

Annual water demand by land use type was estimated for agricultural and urban land uses (Table 5). Water demands can vary significantly between land use types. The supplemental irrigation requirements for agriculture are based on crop type, soil type, rainfall, and irrigation system efficiency, among other variables. For urban residential demand, the number of households per acre, persons per household, and per capita water use were the input variables. Factors not accounted for in the table that should be considered are the impervious surface, landscape irrigation, open space, runoff, and habitat for wildlife.

Commercial and industrial demands vary greatly by type of business. In the UEC Planning Area, commercial and industrial demand is about one percent of the overall water demand. Because the demand is relatively small and difficult to generalize, an average demand was not calculated.

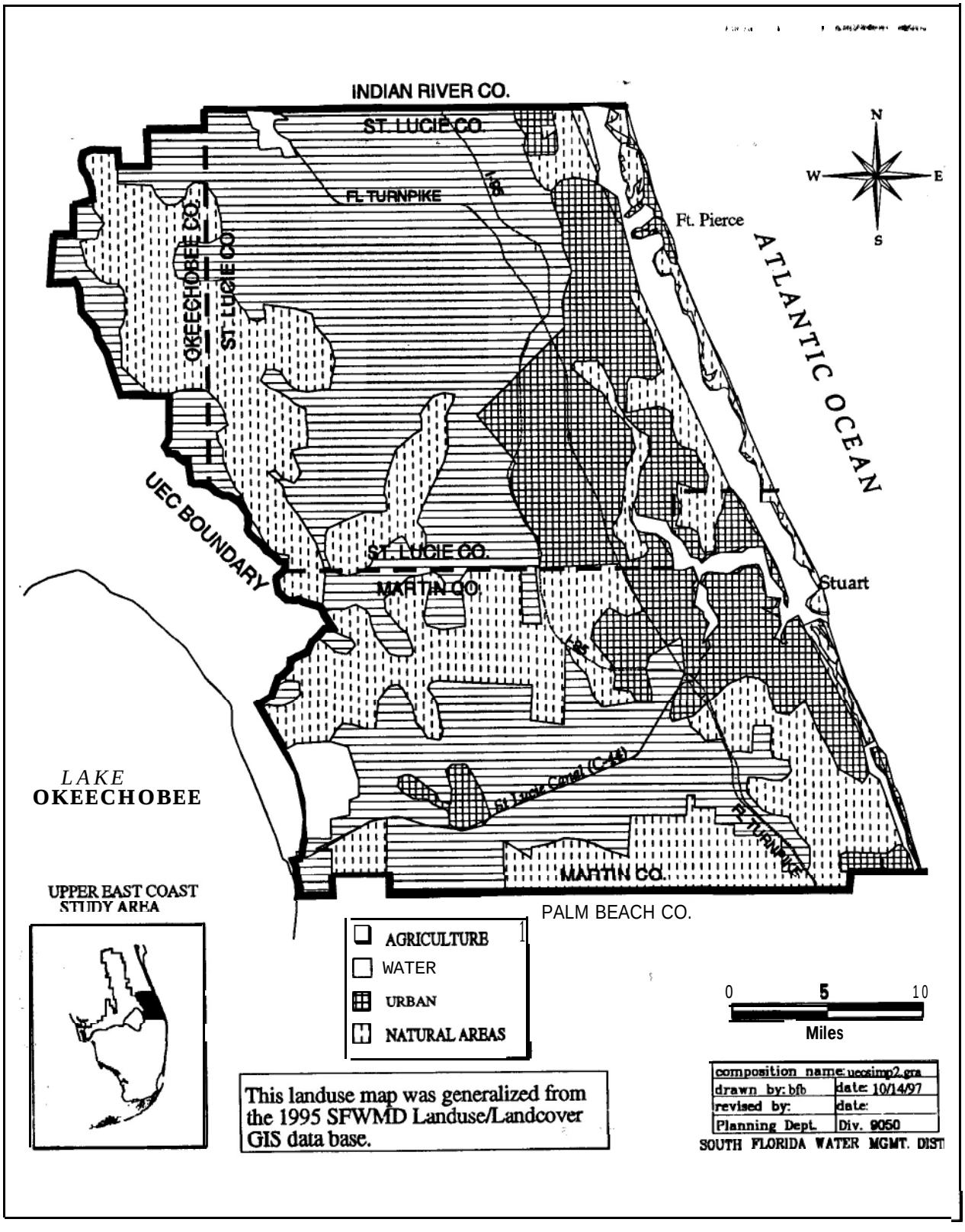


**Figure 4.** Generalized Land Use in the UEC Planning Area.

**Table** 5. Estimated Water Demand by Land Use Type.

| Land Use Category | Annual Water Demand | |
|---|---|---|
| **Agricultural** | Inches per acre | Gallons per acre |
| Citrus+ | 24.80 | 673,380 |
| Ornamental Nursery” | 31.12 | 844,970 |
| Sugarcane ▲ | 22.61 | 613,915 |
| Turf Grass*’ | 31.68 | 860,175 |
| Vegetables’ | 16.96 | 460,505 |
| **Urban** | | |
| Residential (3 units per acre)** | 16.05 | 435,700 |
| Commercial and Industrial | --- | --- |

‘Calculated using the modified Blaney-Criddle method; average using rainfall from Stuart and Ft. Pierce stations; soil type: 0.8 inches; vegetables: 3 plantings.

°Calculated using the modified Blaney-Criddle method; average using rainfall from Stuart and Ft. Pierce stations; soil type: 1.5 inches.

▲ Calculated using the modified Blaney-Criddle method; rainfall station: Indiantown; soil type: 0.8 inches

*Includes golf courses, landscaped areas, and sod farms.

**Assumes per capita of 173 gpcd and 2.3 persons per household.

# Chapter 4
# ANALYSIS

## ANALYTICAL TOOLS

Computer models were used extensively to assist in development of this plan. The models represent the performance of a real system through a series of equations which describe the physical processes that occur in that system; they represent a simplified version of the real world that may be used to predict the behavior of the modeled system under various conditions. Models were used to simulate the potential impact of 1990 estimated water demands and projected water demands on the environment and ground water sources in the UEC Planning Area, during a 1-in-10 year drought condition and average rainfall conditions. Information from local comprehensive plans, utilities, University of Florida Institute of Food and Agricultural Sciences (IFAS), and the District's permitting data base was used to support this analysis. Where specific information was not available, conservative professional judgement was used.

Analytical tools used in this analysis included surface water budgets, numerical ground water 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 ground water models were used to identify potential impacts of water use on the environment and ground water resources. Vulnerability mapping was used to identify areas where there is the potential for future saltwater intrusion in the SAS. A process diagram of the analytical tools used in the UEC Water Supply Plan is located in Figure 5.

### 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 region (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 (a deficit of surface water would indicate there is insufficient surface water to meet demands) of surface water in each of the major canal basins for the rainfall event chosen. 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. If outflows exceed inflows, then there is not sufficient surface water to meet

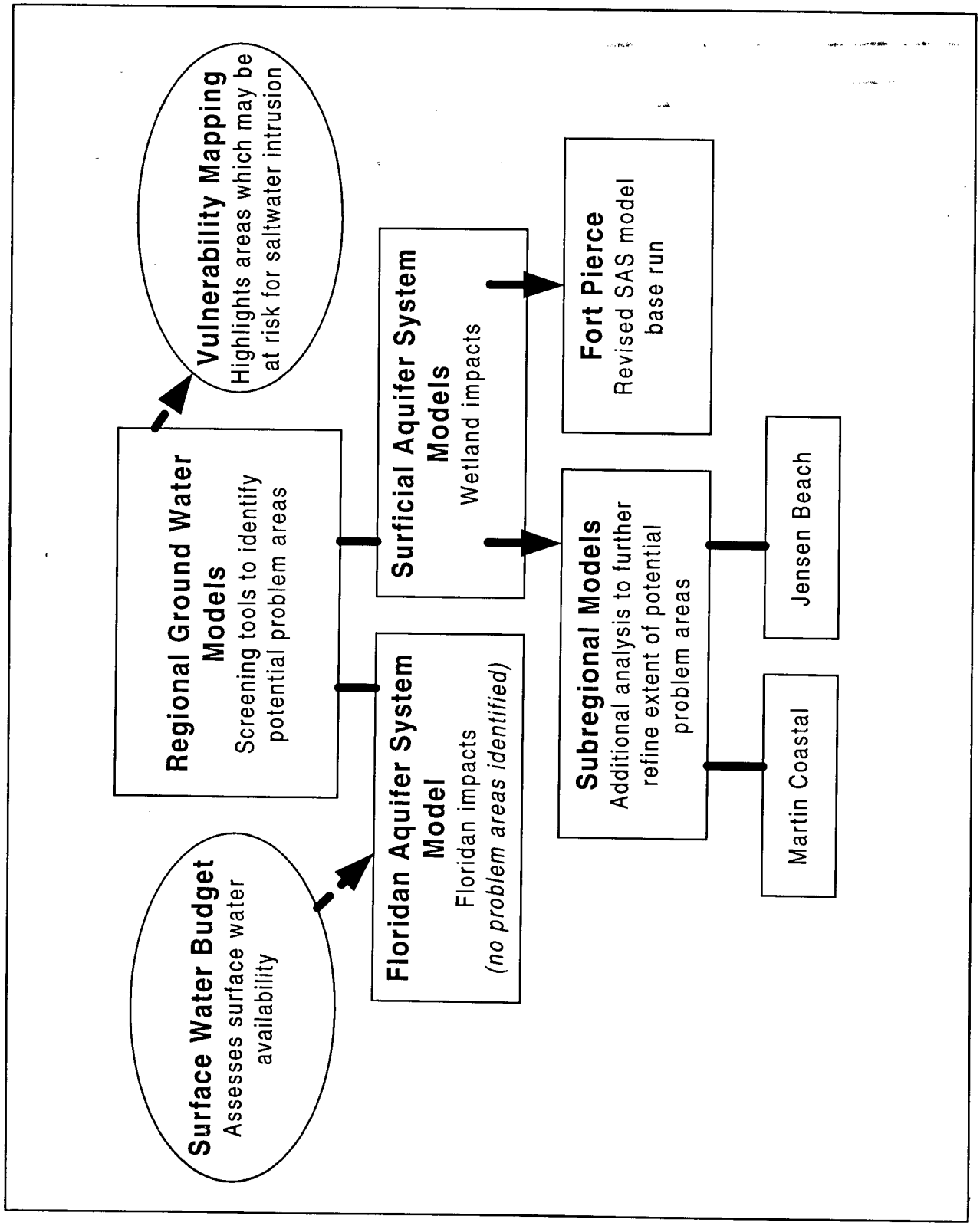


**Figure 5.** UEC Water Supply Plan Process Diagram and Analytical Tools.

the surface water demand. Unmet surface water needs were distributed to available ground water sources, primarily the Floridan aquifer.

The surface water budgets did not include minimum flows to the St. Lucie Estuary and Indian River Lagoon in that minimum flows have not been determined for these estuarine systems and the tools are not available to analyze the surface water implications. A discussion of minimum flows and levels is provided in Chapter 5. In addition, there are numerous combinations of potential solutions to meet the minimum flow, which are being evaluated in the Indian River Lagoon Restoration Feasibility Study. The results of these efforts will be incorporated into the five-year update of this Plan.

Ground Water Models

Ground water models used in the development of the UEC Water Supply Plan included regional and subregional models. Regional ground water models were used as screening tools to identify areas where water use, based on historical water sources and existing and proposed withdrawal facilities, is potentially impacting 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 system (SAS) 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" ground water 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 ground water models and the areas that required additional analysis.

Both the regional and subregional ground water models use the United States Geological Survey (USGS) modular three-dimensional finite difference ground water 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 ground water models generate two principal types of output, computed head (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 UEC Water Supply Plan Support Document.

In addition to the identified peer-review of the regional ground water models and Jensen Beach subregional ground water model during their development, the Martin Coastal model and the post-calibration modeling activities for all the ground water models were peer-reviewed for their reasonableness and appropriateness. The reviewers concluded the Martin Coastal model was acceptable, the post-calibration modeling activities were reasonable, and that the overall ground water modeling effort was appropriate for development of this water supply plan.

### Regional Ground Water Models

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

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 Ground Water 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 ground water 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 that was updated for this planning effort. The Jensen Beach model encompasses the Jensen Beach peninsula in Martin County and is comprised of cells that are 240 by 240 feet. Approximately 69 Jensen Beach model cells fit into one regional model cell.

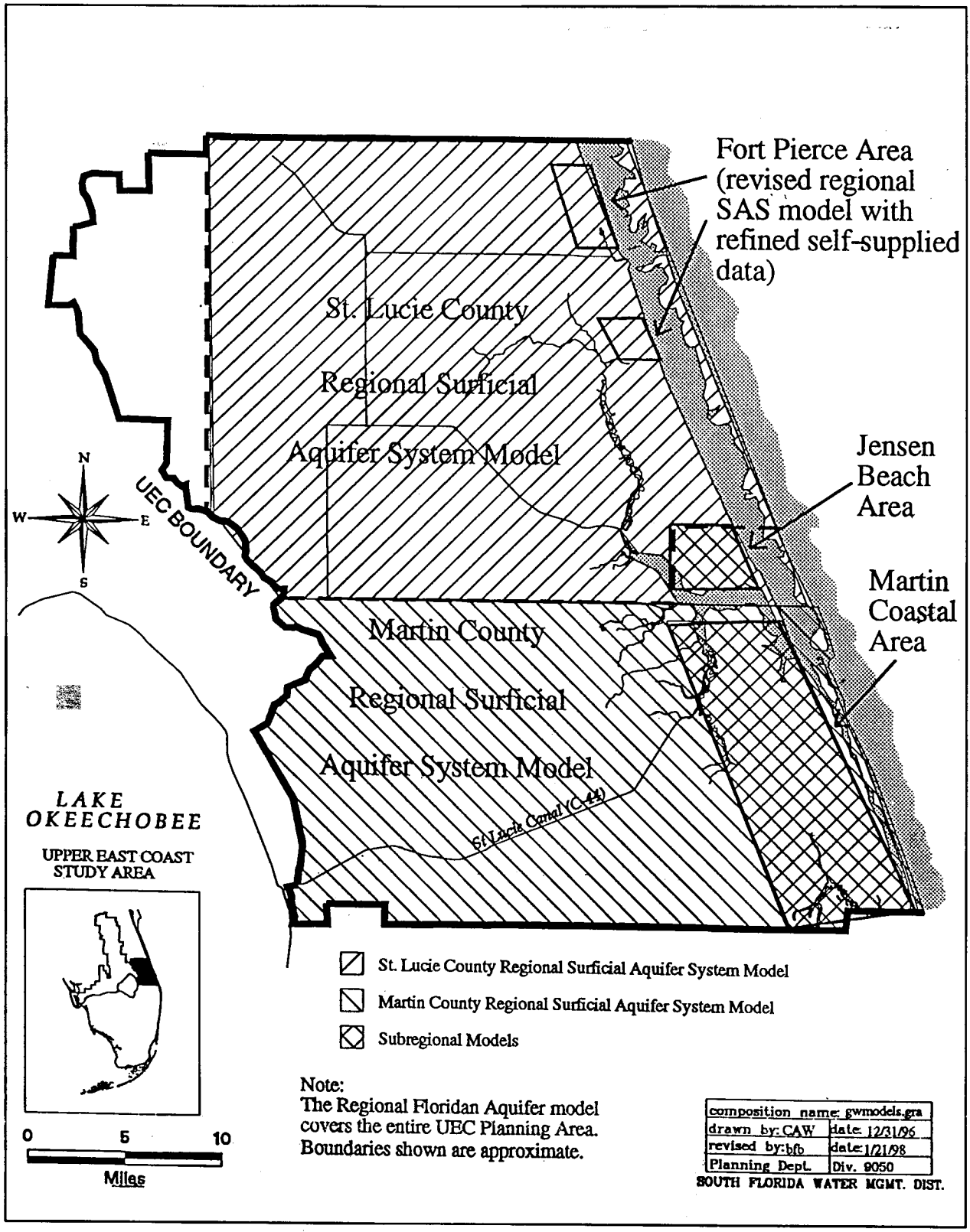


**Figure 6.** Regional Ground Water Modeling and Subregional Areas.

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

### 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 UEC Water Supply Plan to evaluate the potential for saltwater intrusion. The factors used in this evaluation were: water levels, proximity to saltwater, 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 saltwater 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 which exceeds its recharge capacity, the amount of freshwater head available to impede the migration of saltwater is reduced, and saltwater intrusion becomes likely. Saltwater intrusion has been identified in Hobe Sound, resulting in several wells being taken out of service.

Historically, the District's consumptive use permitting (CUP) program has required water users to maintain a minimum of one foot of freshwater head between their wellfields and saline water as a guideline for the prevention of saltwater intrusion. This guideline, in combination with a saltwater intrusion monitoring program, has been largely successful in preventing saltwater intrusion in the Upper East Coast 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 the foundation from which to take a strong proactive approach to the management of saltwater intrusion.

## RESOURCE PROTECTION CRITERIA

In order to assess the potential impacts (harm) of cumulative water use on the environment and ground water resources using the ground water modeling tools, the potential impacts must be defined in terms of water levels and duration and frequency of drawdowns. These water levels are referred to as resource protection criteria. The resource protection criteria are guidelines to identify areas where there is potential for cumulative water use withdrawals to cause harm to wetlands and ground water resources. Areas where simulations show the resource protection criteria are exceeded during the selected level of certainty are areas where the water resource may not be sufficient to support the projected demand under the constraints.

Resource protection criteria in this plan are designed to prevent harm to the resources up to a 1-in-10 drought event. These criteria are not intended to be a minimum flow and level. For drought conditions greater than a 1-in-10 event, it may be necessary to decrease water withdrawals to avoid causing significant harm to the resource. Water shortage triggers, or water levels at which phased restrictions will be declared under the District's water shortage program, can be used to curtail withdrawals by water use types to avoid water levels declining to and below a level where significant harm to the resource could potentially occur.

There were two resource protection criteria used in this plan: the wetland resource protection criterion and the Floridan aquifer protection criterion. The advisory committee endorsed the use of these criteria. The resource protection criteria define the severity, duration, and frequency of declines in ground water levels as the result of water use withdrawals. Drawdowns in the vicinity of ground water contamination sites were not evaluated in this plan.

The related strategies section contained in Chapter 5 discussed incorporation of the criteria into the consumptive use permitting process.

### Wetland Protection Criterion

The wetland protection criterion is defined as follows: *Ground water level drawdowns induced by cumulative pumping withdrawals in areas that are classified as a wetland should not exceed 1 foot at the edge of the wetland for more than 1 month during a 12-month drought condition that occurs as frequently as once every 10 years.* For planning purposes, this criterion was applied to surficial aquifer drawdowns in areas that have been classified as a wetland according to the National Wetlands Inventory.

Section 3.3, Environmental Impacts, of the District's Basis of Review for Water Use Permit Applications (BOR-1997) requires that withdrawals of water must not cause adverse impacts to environmental features sensitive to magnitude, seasonal timing and duration of inundation. Maintaining appropriate wetland hydrology (water levels and hydroperiod) is scientifically accepted as the single most critical factor in maintaining a viable wetland ecosystem (Duever, 1988; Mitch and Gossecink, 1986; Erwin, 1991). Water use induced drawdowns under wetlands potentially affect water levels, hydroperiod and the areal extent of the wetland. A guideline of no greater than one foot of drawdown at the edge of a wetland after 90 days of no recharge and maximum day withdrawals is used currently for consumptive use permitting (CUP) purposes to indicate no adverse impacts. Wetlands for CUP purposes are delineated using the statewide methodology as described in Chapter 62-340, F.A.C.

The wetland protection criteria used in this plan is intended to be consistent with the guidelines currently used in the CUP program. Modeling studies conducted in conjunction with the District's Lower West Coast Water Supply Plan suggested that the withdrawals associated with different use types might have different drawdown impacts at wetlands. It was concluded that for public water supplies, the 90-day no recharge guideline currently used was equivalent to five months of maximum day pumpage in models with 1-in-10 year drought conditions and recharge. This was also confirmed for the UEC Water Supply Plan and was included in the analysis.

The District began a research project in 1995 to support development of wetland drawdown criteria. This project involves long-term monitoring of wellfields and wetland systems including some systems (southwest corner of Savannas State Reserve in vicinity of Martin County North's wellfield, Jonathan Dickinson State Park) in the UEC Planning Area. The wetland protection criterion regarding the relationship between water use drawdowns and impacts to specific wetland types will be reviewed in the future as this field data becomes available. Additional information on this study is provided in the UEC Water Supply Plan Support Document.

Floridan Aquifer Protection Criterion

The Floridan aquifer protection criterion is defined as follows: *Ground water 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*.

This protection criterion is 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 Upper Floridan aquifer is an artesian aquifer. 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, the 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.

The District's CUP program currently prohibits pumps on all flowing Floridan wells in the UEC region because of the concern of the potential for 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 a result, 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 CUP program. Users located outside, but in the vicinity, of the planning area were incorporated into the analysis to evaluate their potential impacts on the UEC region.

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. Pumps on ASR wells is discussed in Chapter 5.

## ANALYSIS

In order to determine the potential effects of projected water demands on the environment and water resources, a series of base model runs were performed. The first set of runs represented the current demands (1990) under average and 1-in-10 year drought conditions, while the second represented future demands (for the year 2020) under identical rainfall conditions. Potential problem areas were identified by applying the resource protection criteria. Resulting ground water levels were compared to model runs without the demands to determine drawdowns resulting from water withdrawals. This difference was compared to the resource protection criteria. Areas where this difference exceeded the applicable resource protection criteria were identified as a potential problem area.

### Water Supply Needs

The 1990 demand level represents the estimated urban and agricultural water demand for the use type and acreage that was permitted by the District through the

end of 1990. For public water supply, actual pumpage information was used. For irrigation uses, the permitted acreage was used and the associated demand was then calculated based on the simulated rainfall event. The 2010 demand level is based on 2010 population projections from local government comprehensive plans and estimated 2010 agricultural acreage. For reasons explained in more detail in Chapter 2, these numbers are also reasonable and justified conditions for 2020.

All irrigation demands were calculated using the modified Blaney-Criddle method for each rainfall condition. A detailed discussion of this method can be found in the District's Management of Water Use Permitting Information Manual, Volume III (1994). Blaney-Criddle is currently used in estimating supplemental crop requirements in the District's consumptive use permitting program.

Public water supply and residential self-supplied demands were based on historic per capita water use and monthly distribution patterns. For the regional model runs, self-supplied demand, which is not usually incorporated in the cumulative analysis associated with consumptive use permitting, was uniformly distributed over utility service areas and planning areas. No recharge from septic tanks was incorporated into the analysis, but local public health units estimate these systems are treating up to 8 mgd in the UEC Planning Area (additional information provided in wastewater reuse section in Chapter 5). Recharge from septic tanks could potentially offset potential impacts from residential self-supplied users, since many wells coexist with septic tanks.

### Level of Certainty

Two rainfall conditions were simulated to identify the difference between likely chronic problems, occurring under average rainfall conditions, versus problems expected only during droughts. A 12-month dry rainfall event that occurs, statistically, no more frequently than once every ten years was simulated for each county. This rainfall event is referred to as a 1-in-10 year drought condition or a 1-in-10 level of certainty. The advisory committee and staff concluded a 1-in-10 drought condition was a reasonable rainfall scenario for the plan to balance the needs of urban and agricultural users, and the environment while maximizing the use of resource. It also provides a uniform rainfall scenario to base demands and resource impacts on. This level of certainty was codified as a planning goal in Chapter 373, F.S. during the 1997 legislative session. The CUP program currently uses a 2-in-10 year drought condition and a 90-day no recharge resource impact guideline.

## Model Simulations

"Base case" model runs were conducted using both the 1990 estimated demand level (1990 base case) and the 2020 projected demand level (future base case). The future base case assumed water use characteristics and management conditions would remain the same. It was assumed that future water users would obtain water from the same sources as existing users. It was further assumed that existing water users would utilize the same sources for both their current and future demands unless information was made available indicating a change. The existing and projected use of reclaimed water (where information was available) was incorporated into the simulations, as well as reductions in public water supply water use resulting from implementation of mandatory conservation measures.

Base case runs represent the "do nothing" approach and not necessarily the likely scenario. Public water supply demand for the projected population was taken from existing facilities and/or proposed facilities that were not necessarily intended to supply that level of demand. Also, the wetland protection criterion applied in these modeling runs was intended to replicate the effect of the 90-day no-recharge guideline currently applied in the District's CUP program, but for the 1-in-10 drought condition. In order to do this, the simulation of public water supply requires that utilities pump at their maximum daily demand for much longer periods than they would ever be likely to do. While this approach may be based on some assumptions that are unlikely to occur, it provides a means for comparison against alternative approaches.

## Overview of Plan and Permitting Criteria

A comparison of the assumptions used in development of the UEC Water Supply Plan with the guidelines/criteria used in the District's consumptive use permitting program is provided in Table 6.

**Table 6.** Comparison of UEC Water Supply Plan and Consumptive Use Permitting Guidelines and Criteria.

| | Upper East Coast Water Supply Plan | Consumptive Use Permitting Program |
|---|---|---|
| Rainfall Event | Statistical 1-in-10 | IFAS 2-in-10 |
| Duration | 1990-2020 | Varies, usually 5-10 years |
| Supplemental Needs | Blaney-Criddle | Blaney-Criddle |
| •Citrus (1985-1993) | 1-in-10 annual<br>1-in-10 max month | 14.40" annual<br>5.30" max month |
| •Citrus (1993-present) | 1-in-10 annual<br>1-in-10 max month | 2-in-10 annual<br>Full ET max month |
| •Other crops and landscaping | 1-in-10 annual<br>1-in-10 max month | 2-in-10 annual<br>2-in-10 max month |
| Cumulative Analysis<br>•Self-supplied | Yes<br>Yes | Case-by-case<br>No |
| RESOURCE PROTECTION<br>• Wetlands<br><br>-Wetland Delineation | <br>1 foot for greater than 1 month during a 1-in-10 drought event<br><br>NWI | <br>1 foot after 90 days of no recharge and max. day withdrawals<br>Chapter 62-340, F.A.C. |
| •Floridan aquifer | Land surface | Land surface |
| •Saltwater intrusion | Vulnerability | 1 foot mound of fresh water |

## RESULTS OF ANALYSIS

### Surface Water Budget Results

A surface water budget was prepared for each major surface water basin in the UEC Planning Area: C-23, C-24, C-25, North Fork St. Lucie River, Tidal St. Lucie, except the C-44 basin (Figure 7). Storage data in this analysis was based on canal design specifications. The surface water budgets did not include minimum flows to the SLE and IRL because they have not been determined for these estuarine systems. A discussion of minimum flows and levels is provided in Chapter 5.

The C-44 basin was omitted, because it is unique among the other basins in that it receives water from Lake Okeechobee. During periods of water shortage in the Lake, water supply allocations are determined through procedures described in the Lake Okeechobee Supply-Side Management Plan. This plan states that the amount of water that is available for use during any period is a function of the anticipated rainfall and water demands for the balance of the dry season in relation to the amount of water currently in storage. The management plan is explained in greater detail in the Support Document.

The C&SF Comprehensive Review Study (Restudy) is currently evaluating alternative operational plans for the Lake in an attempt to optimize the natural resources within the Lake, water supply for restoring the natural hydropattern of the Everglades, and flows to the estuaries without adversely impacting flood control or urban and agricultural water supply. Since future Lake operations are uncertain while the Restudy evaluations are ongoing, the C-44 basin was omitted from the plan analysis. For this planning purpose, it was assumed that any deficit in the basin would be satisfied with water from Lake Okeechobee. The five-year update of this plan will incorporate the Restudy findings and address any C-44 basin deficits once they have been identified.

All basins had surface water deficits during a 1-in-10 year drought condition, except for the Tidal St. Lucie basin. The volume of the deficits varied significantly from month to month, with April and July being the largest. Annual surface water deficit estimates for a 1-in-10 drought condition and projected demands are shown in Table 7. Monthly information is contained in Appendix J.

**Table 7.** Annual Surface Water Deficit Estimates for a 1-in-10 Drought Condition.

| | Surface Water Basin | | | | | |
|---|---|---|---|---|---|---|
| | C-23 | C-24 | C-25 | C-44 | North Fork St. Lucie River | Tidal St. Lucie |
| Acre-feet† | 48,476 | 23,372 | 49,724 | 0 | 18, 589 | 0 |
| MGD* | 43.27 | 20.88 | 44.38 | 0 | 16.60 | 0 |

† Does not incorporate minimum flows to SLE and IRL

*Determined by converting acre-feet to MG and dividing by 365

Unmet surface water needs were distributed to available ground water sources, primarily the Floridan aquifer. Potential problems exist when the ground water sources cannot support the additional demands placed on them by deficits in surface water availability.

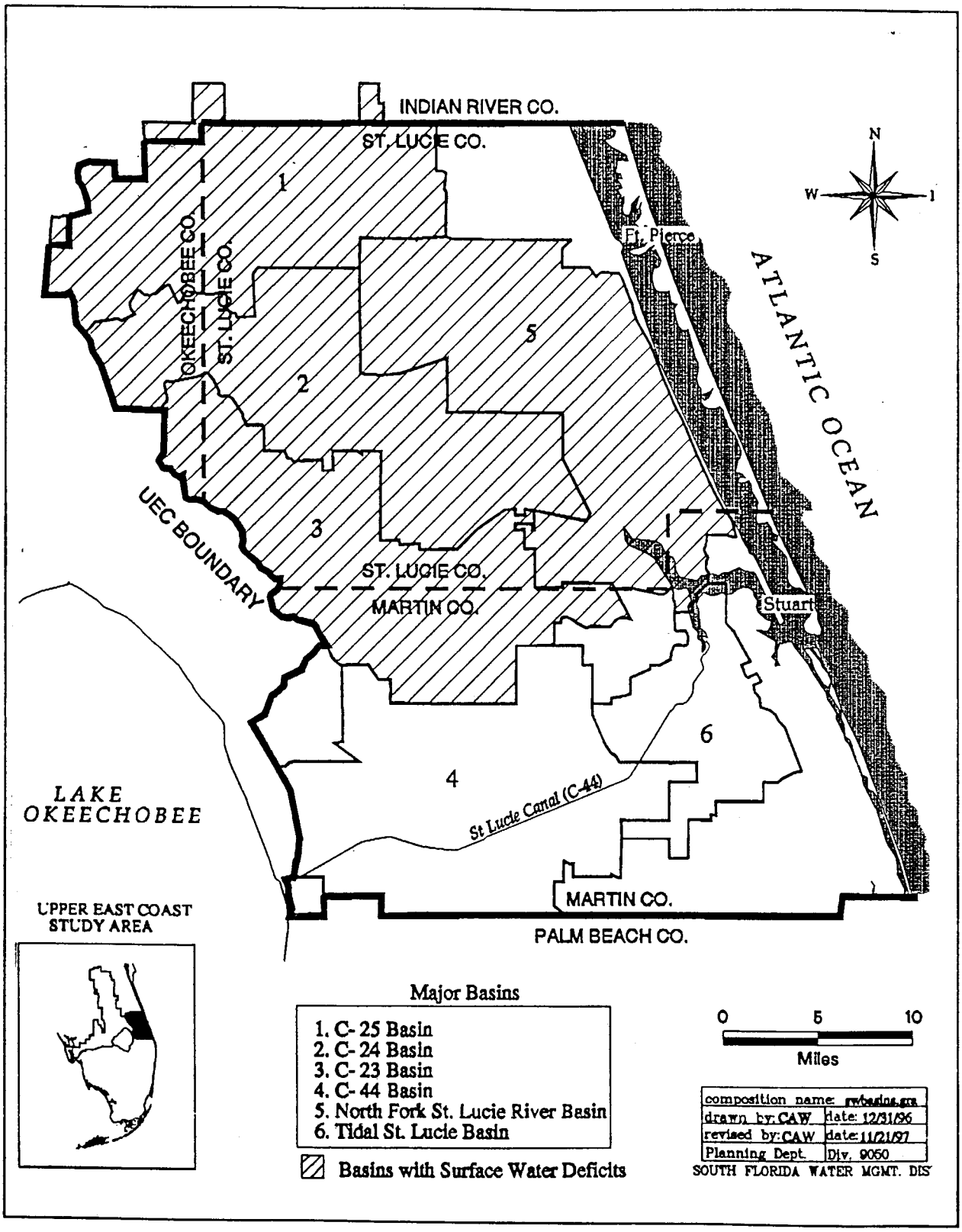


**Figure 7.** Major Surface Water Basins in the UEC Planning Area.

## Ground Water Modeling Results

### Regional Ground Water Modeling Results

**Floridan Aquifer System.** The regional Floridan aquifer modeling runs did not reveal any water use related exceedances of the Floridan aquifer protection criterion in 1990 or 2020. However, there are several natural exceedances along the western ridge in the UEC Planning Area (Figure 8). Natural exceedances are areas where the water level in the Floridan aquifer is naturally below land surface. These areas were determined by running the Floridan model with all demands turned off and comparing resulting water levels with land surface elevations and are located in topographic highs.

**Martin and St. Lucie Counties Surficial Aquifer System.** The results of the regional base case Surficial Aquifer System ground water simulations for Martin and St. Lucie counties showed where there was a potential for water use drawdowns to exceed the wetland protection criterion. In Martin County, the results indicated there was the potential for 1,084 acres of wetland protection criterion exceedances in 1990 during a 1-in-10 drought event. Moreover, almost 90 percent of these potential exceedances also occurred under average rainfall conditions. The potential for future wetland protection criterion exceedances are projected to increase to 1,682 acres under 1-in-10 year drought conditions with approximately 85 percent of these concentrated along the coast, between Stuart and Hobe Sound. The total area of wetlands incorporated in the simulation for Martin County was 67,585 acres.

In St. Lucie County, the results indicated there was the potential for 344 acres of wetland protection criterion exceedances in 1990 during a 1-in-10 drought event. Almost 72 percent of these also occurred under average rainfall conditions. The potential for future wetland protection criterion exceedances are projected to increase to 901 acres under 1-in-10 year drought conditions. The total area of wetlands incorporated in the simulation for St. Lucie County was 41,007 acres. A majority of these potential exceedances are located in the vicinity of Jensen Beach, and north and south of Fort Pierce near the coast.

Based on these results, it was decided that additional analysis was necessary in the Martin Coastal, Jensen Beach, and Fort Pierce areas to indicate whether the exceedances were the result of the model scale or water use, and to better understand the causes of the impacts. The results of the subregional analysis of these areas are discussed below.

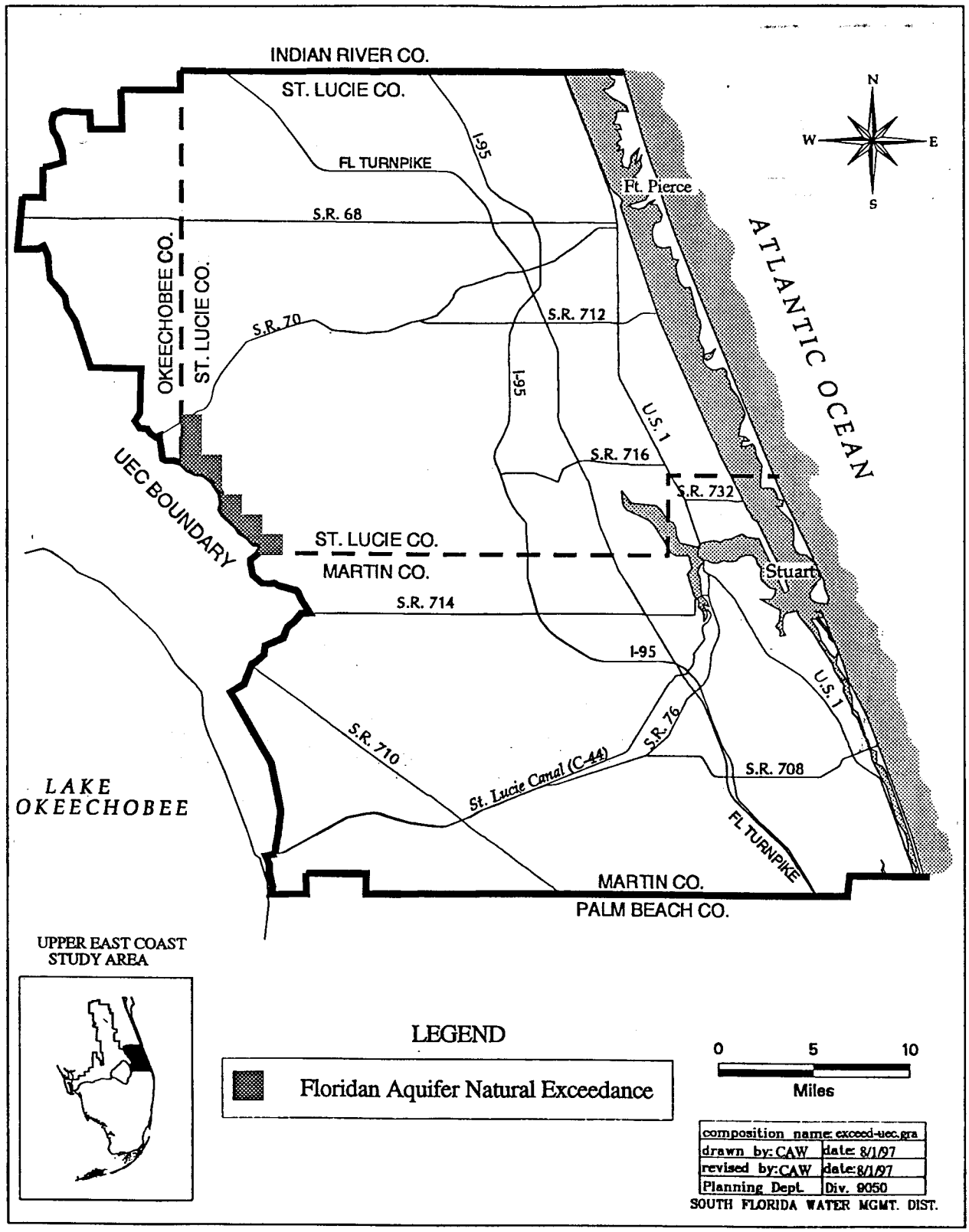


**Figure 8.** Floridan Aquifer Natural Exceedance Areas.

### Subregional Ground Water Modeling Results

The regional SAS modeling results identified three areas where there were concentrated areas of potential wetland protection criterion exceedances: the Jensen Beach Area (subregion 1), the Martin Coastal Area (subregion 2), and the Fort Pierce Area (subregion 3). These subregional areas are identified in Figure 6.

More refined data inputs were developed for each of the three areas. Specifically, rather than distributing domestic self-supplied demand evenly over an entire planning or utility service area, more precise locations for domestic self-supplied and small water treatment "package" plant withdrawals were determined by looking at aerial photographs and meeting with utility representatives.

**Subregion 1: Jensen Beach Area.** The Jensen Beach model was used in this evaluation. In addition to the changes made in self-supplied distribution, information for the Martin County North water system was also updated based on a recent water use permit approved by the District in August 1996. This water use permit authorized changes to Martin County's wellfield configuration and placed specific limitations on operations of the wellfield, including maximum permitted withdrawals for each well. The net effect of these changes was lower permitted withdrawals compared to actual 1990 pumpage.

*Jensen Beach Modeling Results.* A base model run was conducted using 2010 projected demands and a 1-in-10 drought condition. The results of the Jensen Beach modeling indicated a significant reduction in potential wetland protection criterion exceedances from the regional model runs, especially north of Jensen Beach Boulevard. However, potential future wetland protection criterion exceedances are projected under approximately 91 acres of wetlands (out of 1,657 total acres of wetlands) during a 1-in-10 drought condition. This decrease in the potential problem areas from 1990 was primarily due to Martin County's North System reducing its dependence on the SAS with development of the Floridan aquifer.

Several sensitivity runs were done to determine the contribution of the major user groups (public water supply, domestic self-supplied, package plants) on these projected exceedances. The results indicate that pumpage from package plants had no influence on the exceedances because of their location and size of withdrawals, while domestic self-supplied demand is contributing at most two tenths of a foot drawdown in some areas. However, when domestic self-supplied drawdown is added to Martin County's North System drawdown, the number of acres of exceedances almost doubles. The results suggest that the Martin County North water system is the principal cause of the projected ground water drawdowns. They

also show how minor increases in drawdowns cause significant increases in wetland protection criterion exceedances, suggesting that future expansion of withdrawals from the SAS in this area is limited.

*Jensen Beach Conclusions.* Based on the analysis, the following conclusions were made:

- While there are several package plants in the area, they are not contributing to the wetland protection criterion exceedances.
- Domestic self-supplied impact is minimal; however, it is contributing to a cumulative impact such that there is some benefit to reducing domestic self-supplied.
- Martin County North water system is having the greatest contribution to drawdowns in the area.
- Drawdowns under wetlands are projected to approach or exceed wetland protection criterion with or without domestic self-supplied.
- Future expansion of the SAS is limited.

*Jensen Beach Water Source Options.* To address the potential wetland exceedances, several options to increase water supply or reduce demand were considered. Martin County North water system has implemented many of the water supply alternatives usually considered for evaluation. These include: using the Floridan Aquifer and reverse osmosis; expanding the SAS wellfield to maximize its use; developing an interconnected water system; and, initiating a wastewater reuse program.

The UEC Water Supply Plan Advisory Committee concluded aquifer storage and recovery (ASR) was not a promising alternative for the Jensen Beach Area at this time because of the lack of a sufficient supply source. For ASR to be feasible, a supply source that has a sufficient surplus of water during a portion of the year has to be available. Such a source does not currently exist in the Jensen Beach Area.

Martin County has been working with the District since 1990 to adjust pumpages and well locations in the Jensen Beach Area to satisfy the wetland protection guidelines. Due to the extensive use of customary solutions, no additional water supply alternatives were identified during advisory committee discussions for the Martin County North water system.

The benefits of connecting residential self-supplied to the public water system were discussed. The advisory committee suggested identifying key subdivisions that could be encouraged to connect to public water supply. This could be accomplished by targeting these areas through incentive based programs (for example, cost sharing) and educational programs.

The advisory committee recognized that most of the demand in Jensen Beach is associated with residential use, both indoor and outdoor. Aside from the measures incorporated into the utility water conservation program, the advisory committee suggested an urban mobile laboratory in this area might be effective in reducing water use. The laboratory would evaluate current outdoor use practices and identify ways to use water more efficiently. It would also educate residents through homeowner meetings on how to use water more efficiently.

*Jensen Beach Recommendations.* The UEC Water Supply Plan Advisory Committee discussed the following options for the Jensen Beach Area:

- Martin County Utilities should continue to evaluate alternative water supply options to resolve potential wetland impacts.
- Future and expanded uses in the Jensen Beach Area should be encouraged to use an alternative water supply, where effective and economical.
- Encourage existing residential self-supplied users to convert to public water supply, where effective and economical. (A future task associated with this recommendation is to identify key subdivisions to be encouraged to pursue connection to public water supply).
- Encourage funding for Martin County Urban Mobile Laboratory in this area.
- Promote an active reuse program in the Jensen Beach Area. (Since this discussion, Martin County Utilities has implemented reuse in the Jensen Beach area for irrigation of a golf course and residential lots in a new development north of Jensen Beach Boulevard, committing 100 percent of their existing reclaimed water volume. The reuse system will be expanded as wastewater flows increase).

The committee later concluded that many of these options are too specific for a regional water supply plan, and the plan should not prescribe detailed local solutions. They concluded these are issues that need to be addressed at the local level.

**Subregion 2: Martin Coastal Area.** The Martin Coastal model was used in this evaluation.

*Martin Coastal Modeling Results.* A base model run was conducted using 2010 projected demands and a 1-in-10 drought condition. Compared to the regional model runs, the results of the Martin Coastal modeling indicated a 40 percent reduction in areas exceeding the wetland protection criterion exceedances from the regional runs. However, potential future wetland protection criterion exceedances are projected under approximately 860 acres of wetlands (out of 12,844 total acres of wetlands) during a 1-in-10 drought condition.

Several sensitivity runs were done to determine the contribution of the major user groups to these potential exceedances. Removing domestic self-supplied demand from the modeling reduced the potential exceedances by 97 acres. Removing all irrigation demand from the modeling reduced the potential exceedances by 349 acres. Eliminating public water supply demand resulted in 608 acres fewer potential exceedances. Some of the same potential exceedances disappeared with each use type, indicating some overlapping influence.

Several of these potential exceedances occur in 1990 as well asunder projected future conditions. Since 1990 model runs simulate permitted use, theoretically there should be few areas that do not meet the protection criteria in 1990. Some reasons why an exceedance may show up in this analysis but not during the permitting process are: (1) the regulatory process does not consider the impact of self-supplied demand; (2) cumulative impacts were not assessed on some of the permits; (3) there may be differences between the National Wetland Inventory and wetlands identified by District staff during the permitting process; and, (4) there are cases where a permit contains specific limitations, such as a specific wellfield operating schedule, that was not able to be simulated in the context of this regional scale modeling.

*Martin Coastal Conclusions.* The exceedances were broken into four areas (Figure 9) and were discussed individually by the advisory committee. These discussions were less detailed than the Jensen Beach Area discussions. Based on the analysis, the following conclusions were made:

Port Salerno Area (Area 1)

- Potential impacts result from the cumulative effect of multiple use categories.
- Future expansion of surficial aquifer use is limited.
- Self-supply's contribution alone is minimal; it only impacts already borderline areas.
- The current water supply system, without modifications, appears unable to meet future demands.
- Four of six golf courses are using reclaimed water and have minimal, if any, contribution to impacts.
- The results illustrate the delicate balance of demands on the surficial aquifer; even minor increases in drawdown can result in additional potential impacts.
- Unless alternative water supplies are utilized, future growth of public water supply is limited.

West of Hobe Sound (Area 2)

- Agriculture is the only water use in the area and uses a combination of groundwater and surface water.
- The agricultural area is already at highest efficiency (85%).
- Increased surface water availability may help the situation.
- This area appears to be a local situation and should be addressed through the permitting process rather the planning process.

Hobe Sound, north of bridge road (Area 3)

- Potential impacts result from the cumulative effect of multiple use categories.
- Future expansion of surficial aquifer use is limited.
- Self-supply's contribution alone is minimal; it only impacts already borderline areas.
- The current water supply system, without modifications, appears unable to meet future demands.
- The results illustrate the delicate balance of demands on the surficial aquifer; even minor increases in drawdown can result in additional potential impacts.
- Unless alternative water supplies areutilized, future growth of public water supply is limited.
- Agriculture's contribution, alone, is minimal but contributes to cumulative impacts.
- Most golf courses have minimal contribution to impacts due to use of reclaimed water in this area.
- There is little difference between 1990 and future projected exceedances due to minimal projected increase in PWS demands.

Hobe Sound, south of Bridge Road (Area 4)

- Potential impacts are primarily the result of public water supply withdrawals, not the cumulative effect of multiple use categories.
- Future expansion of surficial aquifer use is limited.
- Self-supply's contribution alone is minimal; it only impacts already borderline areas.
- The current water supply system, without modifications, appears unable to meet future demands.

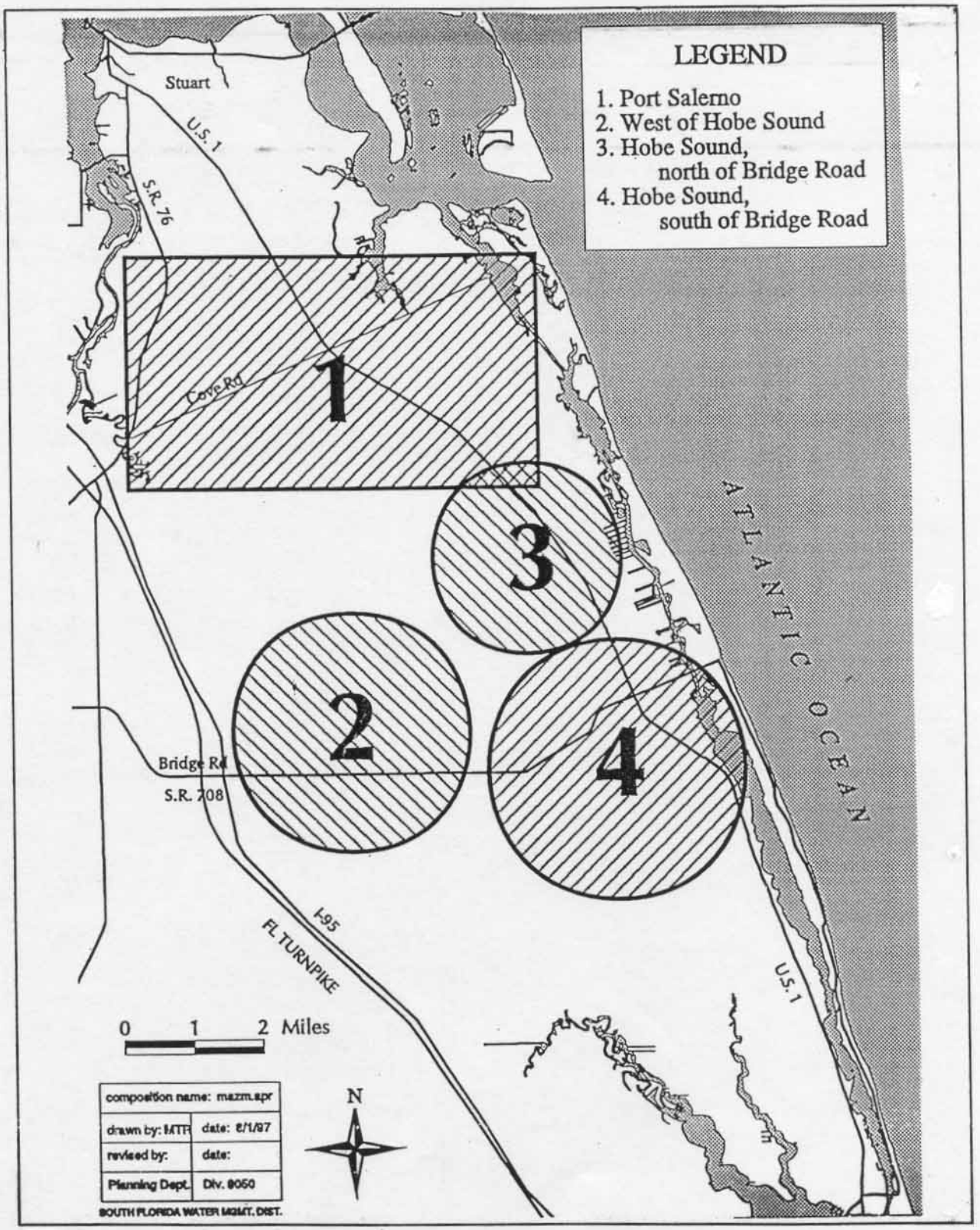


**Figure 9.** Martin Coastal Discussion Areas.

- The results illustrate the delicate balance of demands on the surficial aquifer; even minor increases in drawdown can result in additional potential impacts.
- Unless alternative water supplies are utilized, future growth of public water supply is limited.
- The utility is required to develop a long-term plan to meet demands and resolve saltwater intrusion and wetland issues (per consent order).
- One of two golf courses in area use reclaimed water for portion of needs, reducing their contribution to exceedances. A third used potable water for irrigation.
- Future demands may be overestimated due to the use of the current per capita rate in the projection. (Jupiter Island Golf Course using potable water for irrigation. They are in the process of constructing Floridan wells and a R.O. plant, removing this demand from potable water system).

*Martin Coastal Water Source Options.* Based on these conclusions, the advisory committee discussed several regional strategies to meet this future demand, including:

- Increase use of reclaimed water in area as larger wastewater stream becomes available.
- Require long-term (minimum 10 years) plans for utilities to be consistent with the regional water supply plan.
- Floridan aquifer has potential to play a key role in future water supply for area.
- Investigate how to avoid loss of water to tides and export of water outside the area.
- Employ cumulative analysis, including self-supply, during permitting analysis.

*Martin Coastal Recommendations.* Regarding reclaimed water, the advisory committee recommended increasing the use of reclaimed water in the area when a larger wastewater stream becomes available and develop regulatory (including wet weather disposal through FDEP and Chapter 62-610, F.A.C.) and fiscal incentives for reuse. Most importantly, the advisory committee stressed the need to prioritize areas in the District for reuse and to target incentive programs in these areas.

There was significant debate over the requirement for long-term utility plans because planning for the duration of a consumptive use permit is required through the permitting process, and additional requirements may not be necessary. The role of the Floridan aquifer and how to avoid loss of water to tide/export to other

areas were not discussed during this part of the process, but are discussed in Chapter 5.

Employing a cumulative analysis as part of the permitting analysis was discussed at the technical workshop. Participants at the workshop concluded employing a cumulative analysis as part of the permitting analysis was acceptable as long as the regulatory process has the flexibility to deal with local conditions and new technologies to accurately assess if the proposed use is permittable. Consistency with the plan recommendations will be assured through consistent assessment of demands and acceptable resource impacts as defined in this plan.

The advisory committee also suggested: (1) developing incentives for implementation of water conservation measures such as constructing onsite storage; (2) looking at reuse as an option for existing as well as future land use; (3) determining how proposed large-scale developments, such as SeaWind, are incorporated into this plan; and, (4) the plan needs to state that as significant changes in future land use occur, an evaluation of the regional water supply impacts should be done.

**Subregion 3: Fort Pierce Area.** To conduct this evaluation, a different approach was employed in the Fort Pierce Area than the Martin Coastal and Jensen Beach areas, where subregional models were used. In the Fort Pierce Area, most of the potential resource protection criterion exceedances were located outside of utility service area boundaries and within planning areas that are self-supplied. Therefore, the St. Lucie County regional SAS model was re-run using the refined self-supplied coverage as described earlier to determine if the exceedances were an artifact of the self-supplied methodology. A large portion of the St. Lucie County regional exceedances were located in Jensen Beach, which have been addressed by the Jensen Beach Area subregional modeling.

*Fort Pierce Area Modeling Results.* The revised regional modeling base run using this new self-supplied distribution resulted in a significant decrease in the number of potential resource protection criterion exceedances. About 150 acres of scattered exceedances remain for future conditions during a 1-in-10 drought event; 64 of these acres were also present in 1990. The exceedances are due in part to public water supply, self-supply and agricultural water use, with some cumulative impacts in the St. Lucie West area.

*Fort Pierce Area Conclusions.* It was concluded that some cumulative impacts are potentially occurring; however, most of the exceedances are the result of individual users. This is a local situation and should be addressed through the permitting process, rather than the planning process. The committee also

recommended encouraging funding for a St. Lucie County Urban Mobile Irrigation Laboratory.

### Saltwater Intrusion Vulnerability Mapping Results

The saltwater intrusion evaluation was accomplished through vulnerability mapping. This proactive approach provides a comprehensive view of the potential for saltwater intrusion in the region. It does not identify areas that have or will have saltwater intrusion during a 1-in-10 drought condition, but areas within the region that have the greatest potential for saltwater intrusion. This analysis did not include the barrier islands.

The analysis indicates the areas with the greatest potential for saltwater intrusion in the UEC Planning Area at future demand levels during a 1-in-10 drought condition are the coastal areas of the region (Figure 10). Several of these are adjacent to public water supply wellfields.

In these areas, existing proposed withdrawals should be carefully evaluated by the user and District during the CUP process with respect to saltwater intrusion, including the use of alternative sources of water. In addition to providing guidance for the CUP process, this information should be used as a planning tool in identifying future withdrawal locations. This is generally consistent with the existing CUP requirements, and will not result in substantive changes to the permitting program.

The USGS, in cooperation with the District, is conducting a study to delineate the location of the saltwater interface throughout the planning area. The results of this study should be available by the end of 1999.

## SUMMARY OF RESULTS

Based on the results of the analysis, there are several potential water supply problems projected to occur by 2020 during a 1-in-10 drought event using current facilities and historical sources of water. Some of these potential problems were also evident in the 1990, 1-in-10 drought condition and average rainfall simulations. In addition, freshwater discharges to the St. Lucie 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. A summary of the issues in the UEC Planning Area is provided in Table 8.

Resolution of these issues was the focus of the discussions of water supply options and the alternative analysis by staff and the advisory committee. In some

areas, ground water contamination may be an issue, but its effect was not incorporated into this analysis.

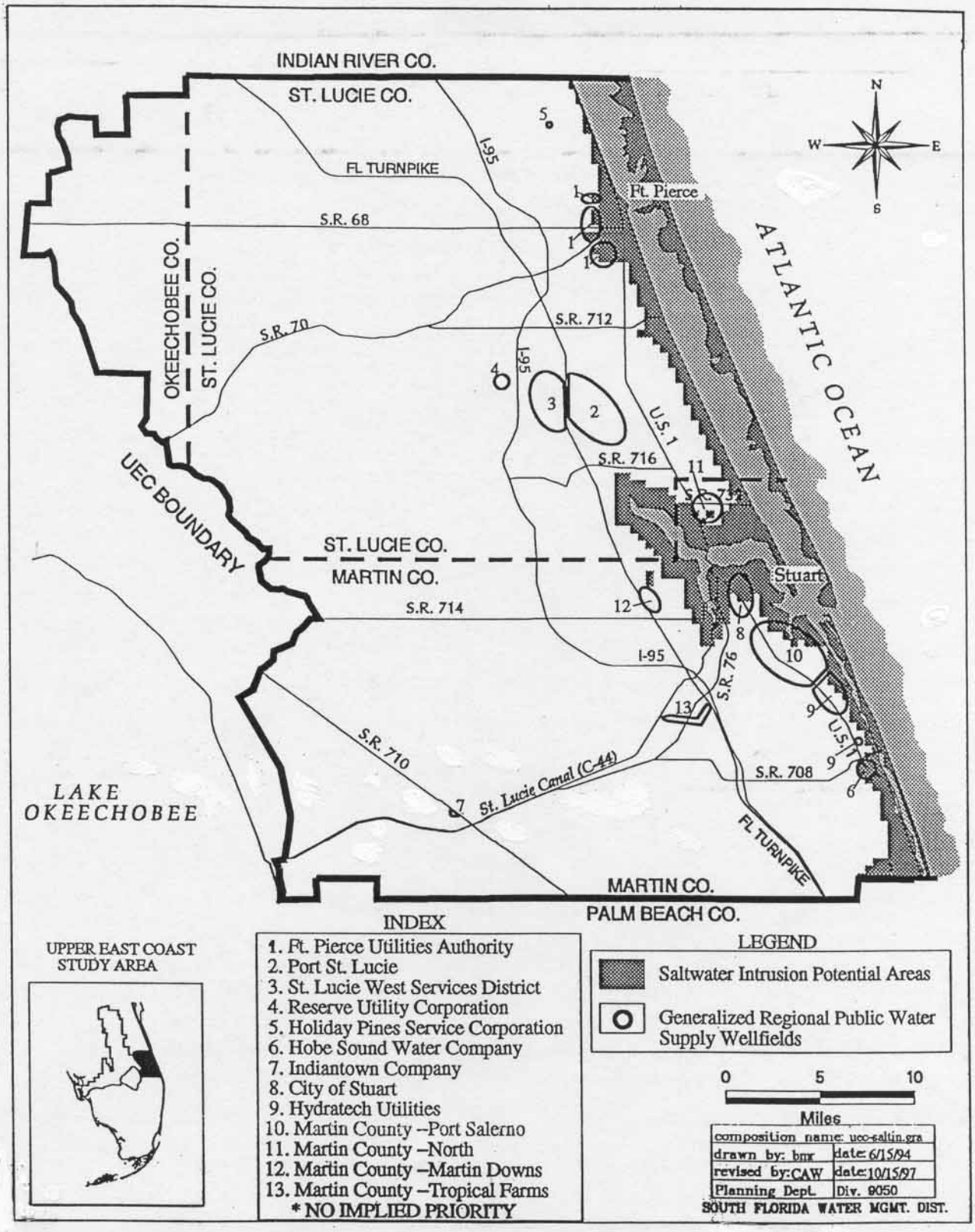


**Figure 10.** Areas with Greatest Potential for Saltwater Intrusion in UEC Planning Area.

**Table 8.** Upper East Coast Water Supply Issues Summary.

| | Inland | Coastal |
|---|---|---|
| St. Lucie County | • Surface water availability<br>• Floridan water quality<br>• Watershed management options – discharges to SLE & IRL | • Cumulative impacts (wetlands)<br>• Saltwater intrusion vulnerability<br>• Watershed management options - discharges to SLE & IRL |
| Martin County | • Surface water availability in C-23 Basin<br>• Watershed management options – discharges to SLE & IRL | • Cumulative impacts (wetlands)<br>• Expansion of SAS limited<br>• Saltwater intrusion vulnerability<br>• Watershed management options - discharges to SLE & IRL |

# Chapter 5

# SOLUTION DEVELOPMENT

In moving from issue identification/analysis 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 either make additional water available from the same source or other sources (e.g., the Floridan aquifer), or they reduce demand (e.g., conservation). The eight options are:

- Aquifer storage and recovery
- Conservation
- Floridan aquifer
- Ocean water
- SAS wellfield expansion
- Surface water storage (includes RAFs and inter-district transfers)
- Utility interconnects
- Wastewater reuse

Development of each of these options could have regional, as well as local responsibilities.

## WATER RESOURCE DEVELOPMENT AND WATER SUPPLY DEVELOPMENT

Recent amendments to Chapter 373, F.S. require that water supply plans include a list or menu of water source options for water supply development for local water users to choose from. For each source option listed, the estimated amount of water available for use, the estimated costs, potential sources of funding, and a list of water supply development projects which meet applicable funding criteria should also be provided. In addition, water supply plans must also include a listing of water resource development projects that support water supply development. For each water resource development project listed, an estimate of the amount of water to become available, timetable, funding, and who will implement, should be provided. These amendments were passed in 1997 as this plan was under development. These requirements are addressed in Chapters 5 and 6.

The statute 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 ground water 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 ground water 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 report, the advisory committee concluded the water management 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 and choosing which water source options to develop to best meet their individual needs. For an option to be a water resource development project, the advisory committee suggested the following be considered:

- Opportunity to 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
- Broad application of technology ("broad-reaching")

For an option to be a water supply development project, the advisory committee suggested the following be considered:

- Localized implementation of technology
- Delivery of resource to consumer
- "Regionalized" interconnects to consumer

## OPPORTUNITIES AND ROLES

Each option was screened by the advisory committee to determine its applicability in the UEC Planning Area. In addition, a determination if the option is a water resource development project and/or water supply development project was made. The water management district will have a primary role in implementation of a water resource development project, while local users will have the primary role in implementation of a water supply development project. The results of this assessment are located in Table 9.

**Table 9.** Opportunities and Roles.

| Water Source Option | Regional (WMD) | Local (User) |
|---|---|---|
| Aquifer Storage and Recovery | Primary | Primary |
| Conservation | Secondary | Primary |
| Floridan Aquifer System | Primary | Primary |
| Ocean Water | Primary | Primary |
| SAS Wellfield Expansion | Secondary | Primary |
| Surface Water Storage | Primary | Primary |
| Utility Interconnects | Secondary | Primary |
| Wastewater Reuse | Secondary | Primary |

The advisory committee determined the local user had a primary role in implementation of all the options, while the District had a primary role in aquifer storage and recovery (ASR), the Floridan Aquifer System, ocean water, and surface water storage. The principal reason the local user has the primary role in implementation of all of the options is that one option may be more effective (quantity, cost) than the others in meeting its individual local needs. This assessment and decision needs to take place at the local level and cannot be done in the context of this regional plan.

The advisory committee reviewed the water source options to assess those that had the most potential to address the greatest number of water supply issues (Table 10).

**Table 10.** Potential of Water Source Options to Address UEC Water Supply Issues.

| Water Source Option | UEC Water Supply Plan Issues | | | | |
|---|---|---|---|---|---|
| | Surface Water Availability | Floridan Water Quality | Cumulative Impacts/ SAS Expansion Limited | Watershed Management Options-Discharges to SLE/IRL | Saltwater Intrusion Vulnerability |
| Aquifer Storage and Recovery | X | | X | X | X |
| Conservation | | | X | | X |
| Floridan Aquifer System | X | | X | | X |
| Ocean Water | | | X | | X |
| SAS Wellfield Expansion | | | X | | |
| Surface Water Storage | X | X | X | X | X |
| Utility Interconnects | | | X | | X |
| Wastewater Reuse | | | X | | X |

## WATER SOURCE OPTIONS AND STRATEGIES

From this evaluation, surface water storage, aquifer storage and recovery, and the Floridan aquifer had the greatest potential to address several of the issues. The advisory committee discussed each of the options and defined the use of the options and strategies to implement the option.

### Surface Water Storage

#### Definition and Discussion

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 Estuary (SLE) and the Indian River Lagoon (IRL) during rainy periods and meet minimum flows during drier periods. In addition, these facilities could increase surface water availability for current and projected agricultural uses, and decrease the demand on the Floridan aquifer. This option also includes the interdistrict transfer of surface water, potentially the SJRWMD.

Locally, strategically located surface water storage (primarily storage in combination with improved storm water management systems) could recharge 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 the Floridan aquifer.

**IRL Restoration Feasibility Study.** To address the freshwater discharges to the SLE and IRL, the SFWMD, in cooperation with the U.S. Army Corps of Engineers (USACE), is conducting the Indian River Lagoon Restoration Feasibility Study (Feasibility Study) to investigate regional water resource opportunities in relation to the C&SF Project canal system in the UEC Region. As described in Chapter 2, this five-year study will develop a regional plan to address environmental restoration of areas adversely impacted by the C&SF Project system, and other water supply opportunities in the region.

The primary focus of the Feasibility Study is environmental restoration. This includes evaluating several alternatives, such as regional attenuation facilities (surface water storage areas), to meet the salinity envelope for the SLE, as well as enhancing surface water availability for water supply. The desired salinity envelope will be met through managing freshwater discharges to the SLE. Based on the analysis to date, this would equate to an inflow range of 350 cfs to 1,600 cfs. The salinity envelop and associated inflow, are being refined in the IRL Feasibility Study and development of the minimum flow and level (MFL) for the SLE. The salinity envelope concept is discussed in greater detail in the Minimum Flows and Levels section later in this chapter and the Support Document. Pursuant to Chapter 373, F.S., the District has designated the SLE as a priority water body for establishment of a MFL by 2001.

The advisory committee also recommended that any alternatives that include the transfer of excess water from the UEC Region must insure that the water needs of the UEC Region, including the estuaries be met first. In addition to identifying the volume of water that needs to be attenuated (by basin), evaluating alternatives to meet this need, and designing the preferred alternative, the advisory committee stressed the need to construct the facilities to meet the MFL for the SLE, and inflow target for the IRL. The advisory committee also stated that if the UEC Region contributes to other regions of the District, including Everglades restoration, there should be some benefit realized within the UEC Region.

A subcommitee of the advisory committee was established to review the results of the surface water budgets and other related information; and to make a recommendation of the surface water – water supply needs for the UEC Region. In addition to the results of the surface water budget analyses, the subcommittee, as well as the advisory committee, recommend the following criteria be applied in estimating future water demands during the analysis phase of the Feasibility Study to determine the implications of meeting these needs:

1. Surface water would be used to meet all western agricultural demands.
2. Demands should be based on a 1-in-10 drought condition.
3. The Floridan aquifer would be used only during drought events greater than a 1-in-10 drought condition.
4. An 85 percent irrigation efficiency should be used in determining demands.

The goal of the analysis should be to determine the amount of storage that would be needed to meet these demands in addition to environmental restoration. This should be an optimal goal; water supply demands less than this may need to be analyzed to conduct a cost/benefit analysis of providing facilities to meet this demand.

**Regional Attenuation Facility Task Force.** The Feasibility Study builds upon the findings of the Regional Attenuation Facility Task Force. The Martin and St. Lucie County Commissions jointly established the task force to identify potential sites for Regional Attenuation Facilities (RAF). The task force used the following basin storage volumes: C-23 Basin – 32,000 acre-feet; C-24 Basin – 36,500 acre-feet; C-44 Basin – 47,000 acre-feet; North Fork Basin – 46,500 acre-feet; South Fork Basin – 17,500 acre-feet; and C-25 Basin – 36,000 acre-feet. The task force identified 20 potential sites totaling over 65,000 acres. The results of the task force's efforts are contained in the Regional Attenuation Facility Task Force Final Report, dated April 30, 1997. (The Executive Summary of this report is in Appendix K.)

**Ten Mile Creek Project.** One potential regional water storage area is the Ten Mile Creek project. This $30 million project would provide storage of storm water from the Ten Mile Creek Basin, which is the largest subbasin delivering water to the North Fork of the St. Lucie Estuary. At this time, the Ten Mile Creek project is ranked eleventh on the Water Resources Development Act critical projects list and is competing with approximately 30 other south Florida projects for a share of $75 million of federal cost-share monies. A general formula for funding is a 50/50 cost split between the federal government and local sponsor (SFWMD). The environmental benefits, as well as the potential water supply benefits, are currently being quantified for this project.

**Upper St. Johns River Basin Project.** The feasibility of connecting to the Upper St. Johns River Basin Project via the C-25 extension as a potential alternative to store water during wet periods and provide water for environmental needs and water supply during dry periods was discussed. The committee supported further evaluation of this alternative to determine its potential in addressing freshwater flows to the Indian River Lagoon and water supply needs of the region. A request for USACE participation in this evaluation has been made. The USACE has considered the request and indicated that a thorough evaluation of the impacts to the Upper St. Johns River Basin Project from a proposed connection would be necessary. The evaluation tools and funding necessary to conduct this evaluation of the impacts to the Upper St. Johns River Basin Project is outside the current scope of the Feasibility Study. As such, the investigation would require the development of a Scope of Work and the SFWMD would have to enter into a cost sharing agreement to provide 50 percent of the study costs.

**Lake Okeechobee Regulation Schedule Study.** While the Feasibility Study is evaluating methods to better manage storm water generated within the planning area, the Lake Okeechobee Regulation Schedule Study (LORSS) is determining if operational changes could be made to have a more ecologically beneficial regulation schedule that simultaneously meets the C&SF Project objectives. This includes evaluating discharges made to the St. Lucie Canal (C-44). The study will include a thorough environmental impact analysis and quantification of economic issues associated

with implementation of a revised schedule. The recommended regulation schedule will be put into effect on an interim basis until such time as the C&SF Project Comprehensive Review Study (C&SF Restudy) is completed and implementation begun. The LORSS is scheduled to be completed in 1999. Preliminary results of four lake regulation schedule simulations did not result in significant changes in the number and duration of discharges to the St. Lucie Canal (Neidrauer *et al.* 1997). At this time, it appears that structural changes are required to substantially affect these discharges to the St. Lucie Estuary.

### Surface Water Storage Estimated Costs

Costs associated with surface water storage vary depending on site specific conditions of each reservoir. 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 which can significantly increase construction costs.

Costs associated with two types of reservoirs are depicted in Table 11. The first is a minor facility with pumping inflow structures and levees designed to handle a maximum water dept of 4 feet. It also has internal levees and infrastructure to control internal flows and discharges. The second type shown below is a major facility with similar infrastructure as the minor facility. However, the water design depths for this facility range from 10 to 12 feet. Costs increase significantly for construction of higher levees but can be offset somewhat by the reduced land requirements.

**Table 11.** Surface Water Storage Costs.

| Reservoir Type | Construction Cost $/Acre | Engineering/ Design Cost $/Acre | Construction Admin. $/Acre | Land $/Acre | Operations & Maint. $/Acre |
|---|---|---|---|---|---|
| Minor Reservoir | 2,842 | 402 | 318 | 4,500 | 118 |
| Major Reservoir | 7,980 | 904 | 451 | 4,500 | 105 |

Source: SFWMD

Costs for the minor reservoir are based on actual construction bid estimates received and awarded for similar projects currently being built in the Everglades Agricultural Area (EAA). Costs of these four Stormwater Treatment Areas (STAs) were averaged to develop the $/Acre costs. Land costs have been changed to generally reflect land values in the Upper East Coast Planning Area. Costs for the major reservoir were developed based on the average cost estimates

from the proposed Ten Mile Creek project and from the Regional Attenuation Facility Task Force Final Report, April 30, 1997 estimates for major Water Preserve Areas.

One example of a regional multi-purpose surface water storage project is the Upper St. Johns River Basin Project. This project includes over 100 miles of levees, six large capacity spillways, and 16 smaller water control structures, culverts and weirs. The project area totals 150,000 acres and is designed to accommodate half of the drainage basin of the Upper St. Johns River headwaters region. This project contains four Marsh Conservation Areas (MCAs) and 16,000 acres of Water Management Areas (WMAs). The MCAs are similar to the large water conservation areas in the Everglades. MCAs detain floodwater and also act as shallow reservoir systems on occasion. The WMAs are deep water reservoirs and are operated to provide for long-term water supply and temporary flood storage of agricultural discharges. Estimated project costs (in 1994 dollars) are $177.7 million of which $87.3 million is land costs.

### Quantity of Water Potentially Available from Surface Water Storage

Freshwater discharges from the C-23, C-24, and C-25 (1964-1995) and C-44 (1952-1995) canals averaged 304 billion gallons per year or 833 million gallons per day (MGD). These discharges are influenced primarily by rainfall and vary significantly over the period of record. Rainfall over this period averaged approximately 51 inches. In addition, discharges from the C-44 canal are influenced by regulatory discharges from Lake Okeechobee. These discharges may be less today based on changes in the Lake regulation schedule. Theoretically, a significant amount of the 833 MGD could be stored and made available for water supply, if sufficient volumes of storage were constructed. In addition to the urban and agricultural water supply needs, the needs of the environment (estuarine systems) also have to be accounted for. The volume of water that could be withdrawn by any specific user must be determined through the District's consumptive use permitting program.

### Surface Water Storage Recommendations

The advisory committee suggested the District consider the following water resource development recommendations regarding surface water storage:

1) Complete the Feasibility Study by 2000, including the following considerations:
   - In addition to environmental restoration, the Feasibility Study should consider enhancing surface water availability in basins where the UEC Water Supply Plan indicated there is a surface water availability deficit (Refer to Figure 7).
   - The Feasibility Study should utilize the Regional Attenuation Facility Task Force Report.
   - The Feasibility Study should examine the C-25/Fort Pierce system to the same degree as the SLE.
   - The UEC Water Supply Plan Advisory Committee and staff should contribute to

the Feasibility Study.
- The District will evaluate the potential combination of surface water storage and aquifer storage and recovery.
- Coordinate the Feasibility Study with the SJRWMD to maximize both distribution efforts.
- Implement the Feasibility Study recommendations.

The Feasibility Study is consistent with this recommendation.

2) The District will support the design and construction of the Ten Mile Creek project, and other appropriate RAFs.
3) The District will develop and adopt a minimum flow and level (which includes maximum discharges) for the SLE, based on the salinity envelope concept by 2001.
4) Evaluate increasing storage and conveyance in the C-canals through maintenance dredging of canals and sediment control.

The advisory committee made the following water supply development suggestions regarding surface water storage:

1) Water supply benefits (recharge) should be considered when designing storm water storage/treatment areas. Consideration of funding should be given to projects incorporating surface water storage meeting pre-development runoff.
2) Chapter 298 Districts should be encouraged to incorporate water supply in their Water Control Plans to the extent practicable.
3) Prioritize storm water projects that have beneficial ground water recharge.
4) Look at developments that lower the ground water table.
5) Participate in and support the Restudy Joint Coordination Committee(Martin and St. Lucie counties), which is charged with being involved in the Feasibility Study, and making reports to both counties and interested agencies.
6) New or widening roadway projects should include retention/detention and ground water recharge/water supply design elements, without compromising the structural integrity of the road.

## Aquifer Storage and Recovery

### Definition and Discussion

Aquifer storage and recovery (ASR) is the underground storage of injected water into an acceptable aquifer (typically the Floridan aquifer in southeast Florida) during times when water is available, and the subsequent recovery of this water when it is needed. In other words, the aquifer acts as an underground reservoir for the injected water, reducing water loss to evaporation. Current regulations require injected water to meet drinking water standards when the receiving aquifer is classified as an underground source of drinking water (USDW) aquifer, unless an aquifer exemption is obtained.

**Raw Water ASR.** The advisory committee discussed two different applications of this technology in the UEC Planning Area, ASR in combination with surface water storage, and utility ASR. The first involves injection of surface water that has been captured and stored in a RAF to supplement storage or enhance water supply. The evaluation should include the proposed capacity, number of wells, recovery efficiency, seasonality of demands, and operating costs. The RAF would capture excess surface water and provide sufficient volumes of water for the ASR injection cycle. Water levels in the RAF and regional canals would then be supplemented with water from the ASR system during drier periods. However, this water would have to meet drinking water standards prior to injection or an aquifer exemption from the U.S. Environmental Protection Agency (EPA) would have to be obtained. Obtaining an aquifer exemption is a rigorous process and very few have been approved. Currently, there are no operating, untreated surface water ASR projects in Florida. However, the SFWMD was previously granted a limited aquifer exemption to inject untreated surface water for the ASR Demonstration Project for Lake Okeechobee.

**ASR Demonstration Project for Lake Okeechobee.** The original purpose of the ASR Demonstration Project for Lake Okeechobee was to determine the role of ASR technology in diverting nutrients from Lake Okeechobee, with diversion of water from the Taylor Creek/Nubbin Slough basin. Other goals that were developed as the project progressed were to: determine the physical ability of storing large volumes of surface water; the effects of storage on the water quality, including bacterial survival; and recovery efficiency. The results of the study indicate large volumes of surface water could be stored through ASR wells, changes in water quality could occur (especially phosphorus), fecal coliforms could be eliminated by storage in the Floridan aquifer, and high permeability zones reduce the recovery efficiency in ASR wells. The project concluded in 1989 and the well has not been used since. The advisory committee discussed the potential of reactivating the well for research purposes.

**Treated Water ASR.** Utility ASR would involve using potable water as the injection water. Since potable water meets the drinking water standards, this type of ASR application is more easily permitted. There are many examples in Florida, including south Florida, of utilities using treated water ASR.

The committee recommended that pumps on ASR wells be evaluated on a case-by-case basis. Major consideration for approval should be given to potential impacts on existing legal users, and to a lesser extent, potential water quality changes. The advisory committee also recommended that rules be developed to address the use of the Floridan aquifer for ASR and ASR efficiency in the UEC Planning Area, in order to avoid conflicts with the use of the Floridan aquifer as a water source. One suggestion was to identify different horizons (depths) or areas for each activity.

**Other Injection Opportunities.** Another concept discussed by the committee was injecting excess surface water into the Floridan aquifer for aquifer recharge, and into the SAS (among other sources) to serve as a saltwater intrusion barrier. This potentially could serve to regionally recharge the Floridan aquifer, and result in lowering the chloride content of the water. Water would not be recovered from the injection wells, but through existing wells on users property. Excess surface water and other sources, such as reclaimed water, could be injected into the SAS to create a

saltwater intrusion barrier in high vulnerability areas. Each of these concepts would have to be shown to be both resource and cost effective and comply with appropriate regulations.

### Aquifer Storage and Recovery Estimated Costs

Estimated costs for an ASR system largely depend on whether the system requires pumping equipment. As shown in Table 12, one system uses pressurized water from a utility; whereas the second ASR system uses unpressurized treated water, thus requiring pumping equipment as part of the system cost. (Please refer to the Support Document for cost assumptions). The latter system with its associated pumping costs is more indicative of an ASR system in combination with surface water storage. There may also be additional costs for screening and filtering untreated surface water to remove floating and suspended matter.

**Table 12.** Aquifer Storage and Recovery System Costs.*

| System | Well Drilling Cost (Per Well) | Equipment Cost (Per Well) | Engineering Cost (Per Well) | O&M Cost (per 1000 gal) | Energy Cost (per 1000 gal) |
|---|---|---|---|---|---|
| Treated Water at System Pressure | $200,000 | $30,000 | $360,000 | $.004 | $.06 |
| Treated Water Requiring Pumping | $200,000 | $100,000 | $400,000 | $.006 | $.06 |

*Costs based on a 900-foot, 16-inch well, with two monitoring wells using treated water.
Source: PBS&J, 1991, Water Supply Cost Estimates.

### Quantity of Water Potentially Available from ASR

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 water that could be available through ASR in the UEC Region. Typical storage volumes for individual wells range from 10 to 500 million gallons (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. There are potentially many different applications of ASR; however, all store sufficient volumes (adequate volumes to meet the desired need) during times when water is available and recover it from the same well(s) when needed. The storage time is usually seasonal, but can also be diurnal, long-term or for emergencies. The volume of water that could be made available by any
specific user must be determined through the District's consumptive use permitting program.

### Aquifer Storage and Recovery Recommendations

The advisory committee suggested the District consider the following water resource development recommendations regarding aquifer storage and recovery:

1) The District will evaluate the potential of co-locating aquifer storage and recovery and surface water storage to supplement storage or enhance water supply, if required and

cost effective. The Feasibility Study must first conclude that RAFs are the preferred alternative to address freshwater discharges to the SLE and IRL before this co-location evaluation is conducted.

2) The District will evaluate existing water quality data in District databases for canal water in anticipation of surface water ASR.
3) The District will be available for preapplication meetings to local users evaluating the feasibility of ASR.
4) The District will evaluate the potential of reactivating the District ASR Demonstration Project for Lake Okeechobee well to collect data on surface water ASR. Also, the District will look at the potential of a public/private partnership.
5) The District will continue working with EPA and FDEP to explore rule changes to the federal and state underground injection control program to allow for (and encourage) injection of untreated surface water and ground water with ASR.
6) The District will clarify known ASR benefits of injecting untreated surface water and ground water and identify areas for further study.
7) The District will develop rules to address the use of the Floridan for ASR, as well as water use, and potential conflicts.
8) The District will evaluate injection of surface water, and other sources of water such as reclaimed water, to increase the freshwater head along the coast to decrease the potential of saltwater intrusion, where regional benefits are identified.
9) Where appropriate, the District will evaluate the feasibility of injecting excess surface water to recharge the Floridan aquifer in the UEC Region.

The advisory committee made the following water supply development suggestions regarding aquifer storage and recovery:

1) Explore treated and untreated water ASR, among other options, to supplement existing water supply sources in order to meet future demands.

2) Continue working with EPA and FDEP to explore rule changes to the federal and state underground injection control program to allow for (and encourage) injection of untreated surface water and ground water with ASR.

## Floridan Aquifer

### Definition and Discussion

The 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 to reduce potential problems associated with water quality. Water quality is critical in maintaining the sustainability of this source. Excess salinity in citrus can result in decreased production/yield, reduction in root growth, and can be fatal to specific root stocks (Syvertsen *et al.* 1989). The Floridan is nonpotable throughout the planning area and requires desalination or blending prior to potable use. The Floridan aquifer is currently being used by Fort

Pierce Utilities Authority for blending with SAS water and Martin County Utilities and a number of smaller private coastal facilities as a primary source. However, most of the utilities in the planning area plan to use the Floridan in the future. The Floridan has potential for supplying the portion of the projected demands that cannot be met by the SAS.

**Floridan Aquifer Subcommittee.** The advisory committee established the Floridan Aquifer Subcommittee to evaluate options and develop strategies for managing the Floridan Aquifer System (FAS). The subcommittee consisted of representatives from various interested and affected parties in the planning area such as Floridan users from the agricultural and utility industries, local 298 water control districts, the Florida Department of Environmental Protection (FDEP), consultants, Institute of Food and Agricultural Sciences (IFAS), the Natural Resources Conservation Service (NRCS) and St. Lucie Soil and Water Conservation District (SLSWCD).

The subcommittee reviewed existing available information including current resource allocation criteria, water quality data, water use data, water level data, regional ground water modeling results, resource protection criteria, and water use activities outside the planning area in Indian River County. Water use information (metered) is very limited; a majority of the usage data is estimated. Long-term water quality and water level information is also sparse and, the relationships between water use, water quality, and water level are uncertain. A comprehensive monitoring network does not exist at this time to collect data to provide insight into these relationships.

**Pumps on Floridan Aquifer Wells.** Based on the available information, the subcommittee concluded there is no basis (or need) to justify any change to the current resource allocation criteria at this time. The subcommittee recommended continuation of the prohibition of pumps on Floridan aquifer wells, whose purpose is to increase withdrawals over that which occurs through artesian pressure. It was also recommended that consideration be given to short-term allowances of pump usage during freezes and extreme water shortages. This conclusion is based on the limited information/data, understanding of the previously mentioned relationships, and no user need (including public water supply) to modify the criteria. Of 18 irrigation wells and 5 utilities in the UEC Region and vicinity with historic water quality records, only 6 showed a long-term increase in salinity.

Some members of the subcommittee felt that the use of the Floridan aquifer is self-regulating because of water quality concerns, and the existing resource allocation guidelines have not posed a problem to date. It was the general consensus of the subcommittee that if upconing of higher salinity water into the production zone of a well occurs, the water quality could be degraded to a point where it is probably not useful as an irrigation source. Caution should be practiced so this does not occur.

**Floridan Aquifer Monitoring Program.** The subcommittee recommended establishing a comprehensive monitoring program to collect the necessary information to develop the water use, water quality, and water level relationships. The existing well monitoring programs should be coordinated and serve as the foundation of the comprehensive program. They should be expanded where appropriate. This information will be used in future Floridan Aquifer System discussions and

evaluations, and will be useful during future updates of the UEC Water Supply Plan and resource allocation criteria.

The subcommittee recommended continued coordination between the St. Johns River Water Management District (SJRWMD) and the South Florida Water Management District.

**Related Issues.** Because of long-term water quality concerns and the sustainability of the Floridan aquifer for agricultural purposes, the subcommittee strongly recommended continued investigation and development of water source options, consistent with other regional studies. Specifically, increasing surface water availability through regional attenuation facilities and aquifer storage and recovery to

conserve the Floridan aquifer in the agricultural areas. Other efforts to decrease Floridan aquifer demands, such as water conservation, should also be encouraged.

To conserve water in the Floridan aquifer and protect the water quality in the surficial aquifer, the subcommittee also recommended reestablishment of a volunteer well abandonment program similar to the one previously administered by the District. Criteria should be developed to prioritize wells to be abandoned. The benefits versus the program cost should be quantified, and it was suggested the program be implemented through the NRCS or SLSWCD. The District's program was a 12-year cooperative effort that ended in 1991. This was a voluntary program and the purpose was to identify abandoned artesian wells, geophysically log them, and plug or rehabilitate the well as necessary to prevent the deterioration of the SAS aquifer through upward leakage or discharge at land surface. In the UEC Planning Area, 336 wells were plugged or rehabilitated, including all known free-flowing wells. A similar volunteer Floridan aquifer well abandonment program was initiated in late 1997 through the NRCS using cost-share funds from USDA's Environmental Quality Incentive Program (EQIP) and the SFWMD. This recent program is anticipated to be active at least through 1998.

The subcommittee reviewed information regarding impacts of Floridan water use on the water quality in the Surficial Aquifer System (SAS), and did not recommend further consideration. Data indicates elevated total dissolved solids concentrations in the SAS in western and central St. Lucie County. However, this is generally limited to 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.

### Floridan Aquifer Estimated Costs

The costs related to wellfield expansion for the Floridan Aquifer System are provided in Table 13. For potable water use, there are additional costs for desalination treatment, such as reverse osmosis (Table 14) and concentrate disposal (Table 15). Site-specific costs associated with reverse osmosis (RO) can vary significantly as a result of source water quality, concentrate disposal requirements, land costs, and use of existing water treatment plant infrastructure. As a general rule, RO costs are 10 to 50 percent higher than lime softening. For brackish water with total dissolved

solids up to 10,000 mg/L, electrodialysis and electrodialysis reversal are generally effective, but cost about 5 to 10 percent higher than RO treatment (Boyle Engineering, 1989).

**Table 13.** Well Costs for the Floridan Aquifer System.

| Floridan Aquifer System | Drilling Cost (per well) | Equipment Cost (per well) | Engineering Cost (per well) | O&M Cost (per 1000 gal) | Energy Cost (per 1000 gal) |
|---|---|---|---|---|---|
| Costs | $92,000 | $52,000 | $14,000 | $.003 | $.032 |

*Costs based on a 16-inch diameter well and a maximum Floridan well depth of 900 feet.
Source: PBS&J, 1991, Water Supply Cost Estimates.

**Table 14.** Reverse Osmosis Treatment Costs.*

| Facility Size (MGD) | Capital Costs (per gal/day capacity | Engineering Cost (per gal/day capacity) | Land Requirements (Acres) | O&M Cost (per 1000 gal) | Energy Cost (per 1000 gal) |
|---|---|---|---|---|---|
| 3 | $1.40 | $.21 | .40 | $.46 | $.23 |
| 5 | $1.27 | $.19 | .40 | $.43 | $.23 |
| 10 | $1.17 | $.18 | .50 | $.41 | $.23 |
| 15 | $1.14 | $.17 | .63 | $.40 | $.23 |
| 20 | $1.16 | $.16 | .78 | $.30 | $.23 |

*Costs based on 2,000 mg/L TDS, 400 PSI.
Source: PBS&J, 1991, Water Supply Cost Estimates.

**Table 15.** Concentrate Disposal Costs.

| Deep Well Disposal Facility (MGD) | Capital Cost (per gal/day capacity) | Engineering Cost (per gal/day capacity) | Land Requirements (Acres) | O&M Cost (per 1000 gal) |
|---|---|---|---|---|
| 3 | $.58 | $.087 | 0.5 | $.032 |
| 5 | $.44 | $.066 | 0.5 | $.024 |
| 10 | $.40 | $.060 | 1.0 | $.022 |
| 15 | $.37 | $.056 | 2.0 | $.020 |
| 20 | $.30 | $.045 | 3.0 | $.016 |

Source: PBS&J, 1991, Water Supply Cost Estimates.

### Quantity of Water Potentially Available from the Floridan Aquifer

The analysis indicated the Floridan aquifer has the potential of supplying, at a minimum, sufficient water to meet all public water supply demands (64 MGD) through the planning horizon while meeting the supplemental water needs (125 MGD) of agricultural users during a 1-in-10 drought event. This assumes withdrawals will be obtained from existing or proposed wells in the agricultural areas, and from wells in proximity of existing Surficial Aquifer System wells for public water supply. The Floridan aquifer model was used to evaluate the impact of increased Floridan aquifer use. Considering the worst case scenario, all future public water supply (PWS) demands were transferred to the FAS. This is in addition to the users already projected to be using the Floridan aquifer. This is an extreme case in that 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 could be significantly less than evaluated. The results of this analysis indicate there would be no resource protection criterion exceedances if all PWS met their entire demand with Floridan aquifer water. The volume of water that could be withdrawn by any specific user must be determined through the District's consumptive use permitting program.

The Floridan aquifer has been used regularly by agricultural users, and to a lesser extent, public water supply users in the UEC Region and Indian River County. Out of the limited number of Floridan wells that have historic water quality records, some have showed increases in salinity, but the majority have not. The analysis did not incorporate a water quality component nor does sufficient data exist to conduct such an analysis. However, the analysis indicated water levels are not projected to decline below land surface, and the experience in the UEC Region suggests this should not result in significant changes in water quality. As stated previously, a monitoring program is recommended to collect information on water use, water quality, and water levels.

### Floridan Aquifer Recommendations

The advisory committee suggested the District consider the following water resource development recommendations regarding the Floridan aquifer:

1) The District will develop and implement a comprehensive regional Floridan aquifer monitoring network to collect the necessary information to develop relationships between water use, water quality, and water levels.
2) The District will develop options for a volunteer or incentive based Floridan well abandonment program.
3) The District will make available the Floridan aquifer model and provide technical assistance to users exploring the potential of using the Floridan aquifer.
4) The District will work with FDEP and EPA to explore alternative desalination concentrate disposal options.
5) The District will continue prohibiting pumps on Floridan wells, except for short-term usage during extreme water shortages and freezes.
6) The District will eliminate the existing 1.5 inch allocation restriction in northwest St.

Lucie County, since the modeling did not indicate any potential problems.

7) 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.

The advisory committee made the following water supply development suggestions regarding the Floridan aquifer:

1) Evaluate desalination concentrate disposal options.
2) Local users should coordinate their plans with adjoining utilities, as well as the UEC Water Supply Plan.

## Surficial Aquifer System Wellfield Expansion

### Definition and Discussion

Expansion of an existing wellfield is usually the first option investigated by users, when additional raw water is required. Wellfield expansion is 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 committee discussed identifying recharge areas for the Surficial Aquifer System. The idea of identifying recharge areas for an aquifer is more relevant for confined aquifer systems, such as the Floridan aquifer, than unconfined aquifers. Recharge to confined aquifers is limited to areas where the confining materials between the aquifer and the source of recharge (i.e., rainfall) are thin or missing. This makes identifying prime recharge areas a straightforward, though not necessarily simple process. In an unconfined system, such as the Surficial Aquifer System in the UEC Planning Area, direct recharge to the aquifer can and does occur everywhere.

Recharge to the surficial aquifer is limited only by the availability of excess rainfall and storage space within the aquifer. The best recharge areas will have loose sandy soils, allowing rapid infiltration, and deep water tables, providing storage space for the water. Old beach ridges, for example, make excellent recharge areas. Because they are high and dry, however, these areas are also the preferred locations for development. Where development is carried out without consideration to preserving aquifer recharge, large increases in impervious areas can lead to drastic reductions in local aquifer recharge.

Wetlands also can provide recharge to ground water. Wetlands, particularly when they are topographically high, provide long-term surface water storage which contributes slow steady recharge to the surrounding aquifer. This is particularly true where ground water withdrawals induce strong gradients in the water table.

"The Bluebelt Act" (Section 193.441, F.S.) allows county governments the flexibility to implement voluntary tax assessment programs that protect the state's highwater recharge areas. To qualify for the program, the lands must be within significant recharge areas, and must be

vacant residential, commercial, industrial, or institutional lands and non-agricultural. The land owner must enter into a contract with the county to agree to maintain the recharge characteristics of the land for 10 years. The advisory committee suggested the coastal ridge may qualify for this program, but would have to be reviewed with respect to the Act.

### Surficial Aquifer Estimated Costs

The costs related to wellfield expansion for the Surficial Aquifer System are provided in Table16. There are additional costs for water treatment. Many of the treatment facilities in the planning area use lime softening for surficial aquifer water. Lime softening's cost advantages are in operating and maintenance expenses (Table17), where costs are typically 20 percent less than for comparable membrane technologies. However, due to increased water quality standards, several utilities are using membrane softening technology (Table 18). One significant advantage of the membrane softening technology is its effectiveness at removing organics that function as disinfection byproduct (such as trihalomethanes) precursors.

**Table 16.** Well Costs for the Surficial Aquifer System.

| Surficial Aquifer System | Drilling Cost (per well) | Equipment Cost (per well) | Engineering Cost (per well) | O&M Cost (per 1000 gal) | Energy Cost (per 1000 gal) |
|---|---|---|---|---|---|
| Costs | $36,000 | $49,000 | $13,000 | $.003 | $.020 |

*Costs based on a 16-inch diameter well and a maximum Surficial well depth of 200 feet.
Source: PBS&J, 1991, Water Supply Cost Estimates.

**Table 17.** Lime Softening Treatment Costs.

| Facility Size (MGD) | Capital Cost (per gal/day capacity) | Engineering Cost (per gal/day capacity) | Land Requirements (Acres) | O&M Cost (per 1000 gal) | Energy Cost (per 1000 gal) |
|---|---|---|---|---|---|
| 3 | $1.30 | $.20 | 1.5 | $.48 | $.018 |
| 5 | $1.25 | $.19 | 2.5 | $.45 | $.018 |
| 10 | $1.22 | $.18 | 4.0 | $.40 | $.017 |
| 15 | $1.00 | $.15 | 6.0 | $.33 | $.016 |
| 20 | $.90 | $.13 | 8.0 | $.30 | $.016 |

Source: PBS&J, 1991, Water Supply Cost Estimates.

**Table 18.** Membrane Softening Costs.

| Facility Size (MGD) | Capital Costs (per gal/day capacity | Engineering Cost (per gal/day capacity) | Land Requirements (Acres) | O&M Cost (per 1000 gal) | Energy Cost (per 1000 gal) |
|---|---|---|---|---|---|
| 3 | $1.33 | $.20 | 0.40 | $.44 | $.159 |
| 5 | $1.21 | $.18 | 0.40 | $.42 | $.159 |
| 10 | $1.12 | $.17 | 0.50 | $.40 | $.159 |
| 15 | $1.10 | $.17 | 0.63 | $.38 | $.159 |
| 20 | $1.06 | $.16 | 0.78 | $.37 | $.159 |

Source: PBS&J, 1991, Water Supply Cost Estimates.

### Quantity of Water Potentially Available from SAS Wellfield Expansion

The analysis indicated that expansion of SAS withdrawals for public water supply, residential self supplied, commercial and industrial self supplied, and recreational self supplied beyond existing demands (66 MGD) is limited, especially along the coast. This assumes withdrawals will be obtained from existing wells, and where information was available, from proposed wells. The analysis indicated that expansion of SAS, primarily along the coast is limited. However, there may be limited expansion potential on a project-by-project basis. The volume of water that could be withdrawn by any specific user must be determined through the District's c consumptive use permitting program. The advisory committee supports development of alternative water sources, which reduce the reliance on the SAS.

### Surficial Aquifer System Recommendations

The advisory committee made no recommendations for water resource development regarding SAS wellfield expansion.

The advisory committee made the following water supply development suggestions regarding SAS wellfield expansion:

1) The potential of using the SAS for new and expanded uses should be evaluated on a project-by-project basis.
2) Encourage development of alternative water sources that reduce the reliance on the SAS.

## Conservation

### Definition and Discussion

This option incorporates water conservation measures that address demand reduction, including practices that achieve long-term permanent reductions in water use. The other water source options in this chapter make additional water available through using new sources or storage. However, elements of conservation are incorporated in these options as well as throughout this document.

In 1992, the District amended its water use permitting rules to incorporate specific mandatory water conservation requirements for each use type. These include implementation of the mandatory water conservation measures for public water suppliers (irrigation hours ordinance, Xeriscape landscape ordinance, ultra-low volume fixture ordinance, rain sensor device ordinance, water conservation-based rate structure, leak detection and repair program, public education program, reclaimed water feasibility), commercial/industrial users (water use audit, employee water conservation awareness program, implementation of cost-effective conservation measures), landscape and golf course users (Xeriscape landscaping, rain sensor devices, irrigation hour limitations) and agricultural users (micro-irrigation systems for new citrus and container nursery projects), as well as several other retrofit measures as described in the UEC Water Supply Plan Support Document.

There are also several supplemental water conservation measures that local users could implement if they deem any of the measures to be cost effective. Measures for urban users include indoor and outdoor retrofits and landscape audit and retrofit; public water supply utilities include filter backwash recycling and distribution pressure control; and agricultural users include irrigation audits and improved scheduling, and retrofitting with a micro-irrigation system.

Several of the mandatory conservation measures have not been implemented by utilities and/or local governments in the UEC Planning Area (Table19). Four of the mandatory water conservation measures require adoption of an ordinance by local government. Generally, because of the autonomy of local governments in the planning area, each ordinance has to be adopted by each unit of local government for the measure to be fully implemented. Positive responses in the table reflect the adoption of the appropriate ordinance by the applicable local government.

**Table 19.** Public Water Supply Conservation Implementation Status.

| Public Water Supply Utility | Irrigation Hours Ordinance | Xeriscape Ordinance | ULV Fixtures Ordinance | Rain Sensor Ordinance | Water Conserv Rate Structure | Leak Detect & Repair Program | | Public Educ Program |
|---|---|---|---|---|---|---|---|---|
| | | | | | | % Lost* | Status | |
| **Martin County** Hobe Sound Water Co. | Yes | No | Yes | Yes | Yes | 13.3 | No | Yes |
| Hydratech | Yes | Yes | Yes | Yes | Yes | 4.4 | No | Yes |
| Indiantown | Yes | Yes | Yes | Yes | Yes | 3.5 | No | Yes |
| Martin County-Martin Downs | Yes | Yes | Yes | Yes | Yes | 18.4 | Yes | Yes |
| Martin County-North | Yes | Yes | Yes | Yes | Yes | 13.3 | Yes | Yes |
| Martin County-Port Salerno | Yes | Yes | Yes | Yes | Yes | 10.2 | Yes | Yes |
| Martin County-Tropical Farms | Yes | Yes | Yes | Yes | Yes | n/a | Yes | Yes |
| Stuart | Yes | Yes | Yes | No | Yes | 13.5 | Yes | Yes |
| **St. Lucie County** Ft. Pierce | No | No | No | No | Yes | 10.0 | Yes | Yes |
| Holiday Pines | No | Yes | No | Yes | No | 3.9 | No | No |
| Reserve | No | Yes | No | Yes | No | 9.0 | No | No |
| St. Lucie West | No | Yes | Yes | Yes | No | 5.0 | Yes | Yes |
| Port St. Lucie | No | Yes | Yes | Yes | No | 9.0 | No | Yes |

Source: July 1997 phone interviews with local planners and utility staff.
*District standard for leak detection requirement is 10% lost or unaccounted for water (water used for pipe flushing, fire fighting, leaks, incorrect metering, and illegal connections).

The committee discussed encouraging nonpotable uses of water to use alternative water source options, especially those who are currently using potable water. The committee also discussed prioritizing encouragement of water conservation in specific geographic areas, such as water resource caution areas.

## Conservation Estimated Costs

Cost and water savings for several indoor and outdoor urban retrofit water conservation measures are provided in Tables 20 and 21. In addition, the cost and water savings for irrigation system conversion for agricultural are discussed. This information in this section should not be interpreted as a benefit-cost analysis of these conservation measures, since no discounting is applied to the streams of cost and benefits.

**Table 20.** Representative Water-Use and Cost Analysis for Retrofit Indoor Water Conservation Measures.

| | Toilet | Showerhead |
|---|---|---|
| Cost/unit ($) | $200 | $20 |
| Flushes/day/person | 5 | -- |
| Gallons saved/flush | 1.9 | -- |
| Minutes/day/person | -- | 10 |
| Gallons saved/minute | -- | 2 |
| Persons/unit | 2.5 | 2.5 |
| Life (years) | 40 | 10 |
| Savings/year/unit (gallons) | 8,670 | 9,125 |
| Savings/unit over life (gallons) | 346,800 | 91,250 |
| Cost/1000 gallons saved | $0.58 | $0.22 |
| Savings/cost | 1.73 | 4.56 |

**Table 21.** Representative Water-Use and Cost Analysis for Retrofit Outdoor Water Conservation Measures.

| | Rain Switch | Mobile Irrigation Lab |
|---|---|---|
| Cost/unit or visit ($) | $68 | $50* |
| Acres/unit | 0.11 | 0.11 |
| Water savings (inches/year) | 70 | 70 |
| Water savings (gallons/year) | 209,070 | 209,070 |
| Life (years) | 10 years | 7 years |
| Water savings/life (gallons) | 2,090,700 | 1,463,493 |
| Cost/1,000 gallons saved ($) | $0.033 | $0.034 |
| Savings per 1,000 gallons/cost | 30.75 | 29.27 |

*Represents additional cost of site visit (currently compensated by NRCS and the District).

For the urban water conservation methods, the analysis indicated the savings are greater than the costs. The savings per unit of cost associated with the outdoor conservation measures are generally greater than those for indoor conservation measures, primarily because of the larger volumes of water involved per unit affected by the outdoor conservation measures. Water savings associated with implementation of retrofit programs can be significant. For example, if 10,000 showerheads were retrofitted in an area, this could result in a water savings of 182 MGY (0.50 MGD). Likewise, if 10,000 irrigation systems were retrofitted with rain switches, this could result in a water savings of over 2 BGY (5.73 MGD).

Conversion of existing flood-irrigated citrus to micro-irrigation is another potential source of water savings (Table 22). It is estimated by IFAS that the initial cost to install a micro-irrigation system on citrus is $1,000 per acre and the system would have estimated annual maintenance costs of $25 per year (IFAS, 1993).

**Table 22.** Irrigation Costs and Water Use Savings Associated with Conversion From Seepage Irrigation to Low Volume.

| | |
|---|---|
| Initial cost ($/acre) | $1,000 |
| Operating cost ($/acre) | $25 |
| Water savings (inches/year) | 8.519 |
| Water savings (gallons per year) | 230,805 |
| Life (years) | 20 |
| Cost over life ($) | $1,500 |
| Water savings over life | 4,616,100 |
| Cost/1,000 gallons saved ($) | $0.33 |

Source: IFAS and SFWMD

The table summarizes the cost and potential water savings from one acre of conversion. The water savings from converting 25,000 acres of citrus from flood irrigation with a 50 percent efficiency to micro-irrigation with an 85 percent efficiency could result in a water savings of approximately 6 BGY (15.8 MGD). The analysis illustrates that given the large volumes of water used for irrigation by agriculture, water conservation savings (which can be achieved at a reasonable cost) will often be extremely cost effective compared to the costs of developing additional water supplies.

In addition to the water savings associated with conversion of flood-irrigated citrus to micro-irrigation, IFAS also has indicated that prescriptive applications of water and fertilizer can be made throughout the crop-growing season with micro-irrigation. As a result, micro-irrigation systems have been demonstrated to increase crop yields and decrease nutrient losses due to leaching. However, micro-irrigation systems generally have greater maintenance requirements than flood irrigation systems.

### Quantity of Water Potentially Available from Conservation

A 10 percent reduction (4 MGD) in projected public water supply and residential self supplied water use is estimated with implementation of the mandatory conservation measures through the planning horizon. There are also retrofit (incorporation of current water conservation measures into existing projects) opportunities in both agricultural and urban areas. Retrofitting the approximately 40,000 remaining acres of citrus that currently use flood irrigation to micro-irrigation could result in a reduction in water use of up to 25 MGD (actual savings may be less due to cooperative use of water within 298 Districts) in water demands. Approximately 100,000 acres have been retrofitted to micro-irrigation. In urban areas, the following water savings could occur per 10,000 units installed: toilet, 0.24 MGD; showerhead, 0.50 MGD; and rain switches, 5.73 MGD. It is also estimated an urban mobile irrigation lab visiting 200 homes could reduce outdoor water usage by 0.12 MGD. These potential water savings are based on average rainfall conditions; greater water savings should be realized during drought conditions.

Many of the urban retrofit measures need to be evaluated at the local level (water supply development). For example, utilities that have high outdoor water use may want to implement an incentive program to install rain sensor devices on existing irrigation systems. Utility per capita water use rates can be used to indicate where outdoor water use with potable water is occurring. The advisory committee recommended urban retrofit water conservation is one of several water source options that should be evaluated by the local utility/government to meet existing and projected demands. A mandatory retrofit program was not recommended at this time.

The advisory committee recommended an urban mobile irrigation laboratory in the planning area might be effective in reducing water use in Martin and St. Lucie counties. Funding to start-up an urban mobile irrigation laboratory program in Martin County in 1998 has been provided. The laboratory will evaluate current outdoor water use practices and identify ways to use water more efficiently. It would also educate residents through homeowner meetings on how to use water more efficiently. One mobile irrigation laboratory currently serves the agricultural areas in Martin and St. Lucie counties. Funding for this is provided by the NRCS in support of the IRL National Estuaries Program (NEP).

### Conservation Recommendations

The advisory committee suggested the District consider the following water resource development recommendations regarding conservation:

1) The District will develop fiscal incentives for entities implementing non-mandated conservation measures, such as the alternative water supply cost-share program.
2) The District will provide funding for Martin County and St. Lucie County Urban Mobile Irrigation Laboratory Programs, and possibly another Agricultural Mobile Irrigation Laboratory for the UEC Region if the need arises.
3) The District will promote water conservation for all users of water through use of higher efficiency irrigation systems and other water conservation measures.
4) The District will develop a cooperative approach, including financial incentives, with the NRCS to promote conversion of flood irrigation to micro-irrigation.

The advisory committee made the following water supply development suggestions regarding conservation:

1) Utilities and local governments should implement all public water supply mandatory conservation measures.
2) Seek funding for urban mobile irrigation laboratories in Martin and St. Lucie counties.
3) Implement higher efficiency irrigation systems and other conservation measures where effective.
4) Encourage the use of alternative water sources for nonpotable uses, versus using potable water.

## Wastewater Reuse

### Definition and Discussion

Reuse is the deliberate application of reclaimed water (treated wastewater that is reused) for a beneficial purpose. Potential uses of reclaimed water include landscape and agricultural irrigation, ground water recharge, industrial uses and environmental enhancement. In 1993, the 12 UEC Regional wastewater facilities treated 13.05 MGD of wastewater, of which 3.07 MGD was reused. In 1996, these facilities treated 13.32 MGD, of which 3.53 MGD was reused. Reuse included irrigation of golf courses and ground water recharge via rapid exfiltration basins and primarily occurred in urban Martin County and southern St. Lucie County.

Utility specific reuse applications can be found in the UEC Water Supply Plan Support Document and Appendices.

The results of the modeling indicate that current reuse in the UEC Planning Area, primarily irrigation of golf courses, has contributed to reduced potential resource impacts. Besides irrigation, reclaimed water could also be used to recharge wellfields, minimize drawdowns under wetlands, and reduce the potential of salt water intrusion. The advisory committee discussed encouraging alternative reclaimed water distribution systems other than piping such as using surface water systems as a conveyance system, as well as reuse projects that recharge wellfields and hydrate wetlands.

The committee also discussed ground water recharge that is occurring in the planning area via septic tank drainfields. In 1993 septic tank studies conducted by the Martin and St. Lucie County public health units (Kearney, 1993; Moses and Anderson, 1993), it was estimated that there are approximately 55,000 septic tanks in Martin and St. Lucie Counties (Martin–22,000; St. Lucie-33,000). The public health units estimate these systems process about 8 million gallons per day of wastewater. The effluent from these systems is disposed of via drainfields, resulting in ground water recharge. The studies also indicate that a majority of these systems are located within a quarter of a mile of the Indian River Lagoon (IRL) or its tributaries. Many of these systems have been identified as potential threats to the water quality of the IRL by these studies. In several of these areas, centralized wastewater collection is now being provided.

### Wastewater Reuse Estimated Costs

The costs associated with implementation of a wastewater reuse program vary depending on the type of reuse system (i.e., ground water recharge, public access irrigation, etc.), the size of the reclamation facility, the facility equipment needed, the extent of the reclaimed water transmission system, and the regulatory requirements. Cost savings include negating the need for or reducing the use of alternative disposal systems, negating the need for an alternate water supply by the end user, and a reduction in fertilization costs for the end user. These costs and savings are discussed further in the Support Document and Appendices.

### Quantity of Water Potentially Available from Wastewater Reuse

Regional wastewater utilities in the UEC Planning Area have projected wastewater flows to increase to approximately 43 MGD through the planning horizon. However, based on minimal increases in wastewater flows from 1993 to 1996, it is doubtful this projection will be realized within the planning horizon. In 1996, about 3.5 MGD (26 percent) of the 13 MGD processed by these facilities was reused. Assuming the projections of the utilities are realized, approximately 40 MGD of additional reclaimed water could be made available for reuse through the planning horizon.

### Wastewater Reuse Recommendations

The advisory committee suggested the District consider the following water resource development recommendations regarding wastewater reuse:

1) The District will develop regulatory (including wet weather disposal) and fiscal incentives for reuse.
2) The District will encourage reclaimed water system interconnects to increase reuse in potential problem areas.
3) The District will adopt rules implementing the requirements of Section 373.250, F.S. related to wastewater reuse and back-up sources.
4) The District will provide assistance for reclaimed water projects that involve ground water recharge and indirect potable reuse, and will assume the lead role for such projects that are of regional significance.
5) The District will discuss with FDEP, and participate in related rulemaking, standards for reclaimed water quality for ground water recharge and indirect potable reuse projects.

The advisory committee made the following water supply development suggestions regarding wastewater reuse:

1) Increase use of reclaimed water in areas where adequate wastewater streams are available.
2) Maximize benefits of water resource impacts when developing a reuse program.
3) Identify areas of highest priority for funding under the District's Alternative Water Supply Funding Program.

## Utility Interconnects

### Definition and Discussion

This option involves the bulk purchase of treated water from neighboring utilities in lieu of expanding an existing withdrawal and/or treatment facility. Also, interconnection of treated and/or raw water distribution systems between utilities can provide a measure of backup water service in the event of disruption of a water source, treatment facility, or distribution system. Interconnections could be with utilities outside the planning area or the District. The advisory

committee also suggested that interconnects between reclaimed water systems be evaluated to transfer reclaimed water from surplus areas to deficit areas.

Most of the utilities in the planning area have interconnects with adjoining utilities for emergency backup water service. Utilities that do not have interconnects with another utility are: Indiantown, Martin County Martin Downs, and Holiday Pines.

Utilities in the planning area that have interconnected with other utilities for the bulk transfer of water include St. Lucie County (serving North Hutchinson Island) from Fort Pierce Utilities Authority and the regional interconnection of Martin County's North, Port Salerno, and Tropical Farms Water Systems. Also, St. Lucie County has contracted with Indian River County Utilities for water to serve northern St. Lucie County, if needed.

Martin County has interconnected the reclaimed water distribution systems from their Tropical Farms and Port Salerno (Dixie Park) wastewater facilities.

### Quantity of Water Potentially Available from Utility Interconnects

The quantity of water that could be made available from utility interconnects needs to be evaluated on a project-by-project basis. It will decrease projected withdrawals of one utility and increase withdrawals for the other. The water available for transfer depends on the sources used by the supplying utility as well as the capacity of their facilities.

### Utility Interconnects Recommendations

The advisory committee suggested the District consider the following water resource development recommendations regarding utility interconnects:

1) The District will encourage potable water interconnections between utilities for emergency purposes, and evaluation of interconnections for water supply purposes, where appropriate.

The advisory committee made the following water supply development suggestions regarding utility interconnects:

1) Evaluate the potential of interconnections with adjoining utilities for emergency purposes and water supply where appropriate.
2) Evaluate the potential to interconnect reclaimed water systems to transfer reclaimed water from surplus areas to deficit areas.

## Ocean Water

### Definition and Discussion

This option involves using ocean water as a raw water source. The ocean appears to be an unlimited source of water from a quantity perspective; however, removal of the salts is required prior to use for potable or irrigation uses. To accomplish this, a desalination treatment technology would have to be used, such as distillation, reverse osmosis, or electrodialysis reversal (EDR).

### Ocean Water Estimated Costs

The cost of desalination of ocean water is estimated to cost four to eight times the cost of reverse osmosis of the Floridan aquifer. In addition, reverse osmosis and EDR facilities treating ocean water would be expected to have an efficiency of 25 percent, resulting in increased concentrate/reject water disposal needs compared to desalination of the Floridan.

### Quantity of Water Potentially Available from Ocean Water

The volume of water available from the ocean appears to be unlimited.

### Ocean Water Recommendations

The committee concluded that ocean water is a potential source of water, but at this time, is not a source of water that needs to be considered based on the projected water demands, other water sources that are available, and the cost of treating this source.

## Related Strategies

The advisory committee also recommended the District consider the following to implement the UEC Water Supply Plan. Most of these items recommend incorporation of the modeling assumptions used in development of this plan into the consumptive use permitting (CUP) program.

**Level of Drought.** The District will incorporate a uniform level of drought to determine the supplemental needs of all users in the UEC Planning Area in consumptive use permitting process. The statistical 1-in-10 dry rainfall event for the seven rainfall stations used in this plan should be used in this determination.

**Resource Protection.** The District will incorporate the resource protection criteria used in this plan, as may be modified/refined during the rulemaking process, into the consumptive use permitting program. The criteria used in this plan are:

(a) Wetlands. Ground water level drawdowns induced by pumping withdrawals in areas that are

classified as a wetland should not exceed 1 foot at the edge of the wetland for more than 1 month during a 12-month dry rainfall event that occurs as frequently as once every 10 years.

The ground water level drawdown resulting from withdrawal of the recommended maximum daily allocation for 90 days with no recharge from rainfall (90 day-no recharge) is currently utilized in the District's permitting program. The permitting guideline is that less than one foot of drawdown at the edge of the wetland will not result in adverse impacts to the wetland. In addition to this guideline, there are other approaches that may be utilized by the applicant to provide reasonable assurance that the proposed withdrawals will not cause adverse impacts. Comparisons of the 90 day-no recharge and 1-in-10 year drought event modeling scenarios by District staff indicate that the two approaches produce similar results. The advisory committee recommends the District continue the wetland drawdown study it initiated in 1995.

The committee discussed the expense of developing alternative water source options to avoid harm to wetlands versus protecting small isolated wetlands. In some cases, it was concluded that it may be acceptable to impact a wetland (exceed resource protection criteria) and mitigate for the harm, versus developing an alternative water source option. Under the current consumptive use permitting program, mitigation for impacts to wetlands is not allowed. However, under the current Environmental Resource Permitting (ERP) program (surface water management system construction and dredge and fill activities), impacts to these same wetlands may be permitted if the impacts are determined to be unavoidable. The applicant is required to provide compensation for the loss of wetland functions, through mitigation. The advisory committee supports developing a similar wetland mitigation program to the ERP Program for water use permitting.

(b) Floridan Aquifer. Ground water 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 dry rainfall event that occurs as frequently as once every 10 years. This will be achieved by continuation of the current permitting criteria prohibiting pumps on flowing Floridan aquifer wells, except for short-term usage during extreme water shortages and freezes, and aquifer storage and recovery projects (ASR). Pumps on ASR wells shall be approved on a case-by-case basis.

**Cumulative Analysis.** The District will include a cumulative analysis as part of the consumptive use permitting analysis that contains flexibility to deal with local conditions and new technologies to accurately assess if the proposed use is permittable.

**Water Shortage Triggers.** Where necessary, the District will develop and adopt water shortage triggers to avoid causing significant harm to the resource, in conjunction with the implementation of the District's Water Shortage Plan (Chapter 40E-21, F.A.C.).

The purposes of the Water Shortage Plan are to protect the water resources of the District from harm; to assure equitable distribution of available water resources among all water users during times of shortage, consistent with the goals of minimizing adverse economic, social and health related impacts; to provide advance knowledge of the means by which water

apportionments and reductions will be made during times of shortage, and to promote greater security for water use permittees.

The plan's rules apply to all water users, including those exempt from permitting pursuant to Rule 40E-2.051. However, these rules shall not apply to users whose source of water is limited solely to reclaimed water or seawater. Thus, for each regulated source and type of use, it is the policy of the District to restrict water users uniformly, regardless of whether the user uses water from a public or private utility system, pursuant to a consumptive use permit issued under Chapter 40E-2, or from a private well for domestic or individual home use.

Resource protection criteria are designed to prevent harm to the resources up to an 1-in-10 drought event. For drought conditions greater than a 1-in-10 event, it may be necessary to decrease water withdrawals to avoid causing significant harm to the resource. Water shortage triggers, or water levels at which phased restrictions will be declared, are used to curtail withdrawals by water use types to avoid water levels declining to a minimum level where significant harm to the resource could potentially occur.

Even though water shortage triggers will be established, a case-by-case analysis for a given drought circumstance will continue to exist. Thus, prior to declaring a water shortage, the District will also analyze the factors listed in the Water Shortage Plan concerning such issues as: (1) whether or not sufficient water will be available to meet the estimated and anticipated user demands; and, (2) whether serious harm to the water resource will occur.

The District expects the water shortage triggers to address resource conditions related to: (1) the surficial aquifer; (2) the District canal system; and, (3) the Floridan aquifer. The resource conditions, which will be used as "triggers", will include saline water intrusion/upconing as well as aquifer impacts.

**Saltwater Intrusion.** The District will increase regulatory analysis in areas where vulnerability mapping indicates increased potential for saltwater intrusion. Existing and proposed withdrawals should be carefully evaluated by the user and the District during the CUP process with respect to saltwater intrusion, including the use of alternative sources of water. In addition to providing guidance for the CUP process, this information should be used as a planning tool in identifying future withdrawal locations. This analysis is generally consistent with the existing CUP requirements, and will not result in substantive changes to the permitting program.

**Wetland Mitigation.** The advisory committee discussed the importance and application of mitigation generated by projects in the UEC Region. In particular, the advisory committee wanted to make sure that any mitigation associated with projects in the region stay in the region. For example, if construction/development in the region were to cause impacts to wetlands, the associated mitigation would be used solely in the region. One possible mitigation option is to develop wetland areas in the shallow portions of RAFs or wetland buffers around RAFs, where the opportunity exists. The committee also concluded that incorporation of water supply benefits in mitigation programs should be encouraged, including consideration of ground water recharge in

land acquisition, and encouragement of mitigation in areas that incorporate both environmental and water supply (recharge) objectives.

**Coordination.** The District will continue coordination of the UEC Water Supply Plan with local governments/utilities, the SJRWMD, IRL Restoration Feasibility Study, the C&SF Comprehensive Review Study, and other related efforts to promote compatibility.

**Special Designations.** Three special designations in the UEC Planning Area contained in the CUP Program were reviewed based on the findings of this planning effort. Definitions of the designations and recommended changes, if any, are provided below.

(a) Reduced Threshold Areas. Reduced threshold areas (RTAs) are areas of the District where the volume of usage delineating a general permit from an individual permit has been reduced from 100,000 gallons per day (GPD) to 10,000 GPD average day demand. RTAs have typically been designated in resource depleted areas where there is an established history of substandard water quality, saline water movement or the lack of water availability to meet the projected needs of a region. Based on the results of the UEC Water Supply Plan, it is recommended that RTA designations (Stuart Peninsula, Lighthouse Point Peninsula, and the Savannas and Jensen Beach Peninsula) in the UEC Planning Area and the RTA concept be eliminated in the UEC Planning Area. The analyses did not indicate significant potential problems in these areas, and assessment determinations are conducted for all consumptive use applications. For withdrawals less than 100,000gpd, qualifying for a general permit versus an individual permit will be based on the potential cumulative impacts of the use.

(b) Water Resource Caution Areas. These areas were formerly referred to as Critical Water Supply Problem Areas and are described in Chapter 40E-23, F.A.C. Water Resource Caution Areas (WRCAs) are defined as areas that have existing water resource problems or areas in which water resource problems are projected to develop over the next 20 years. The entire UEC Planning Area is currently designated as a WRCA. Based on the analysis, it is recommended the designation in the UEC Planning Area be reduced to only incorporate the coastal areas in Martin and St. Lucie counties as indicated in Figure 11. This area generally reflects the service areas of the coastal utilities in the region and areas of planned utility service per local government comprehensive plans. Potential problems are projected in these areas if historically used sources of water are used to meet the growing water needs of the region. The analysis was based on current information and did not include minimum flows and levels.

(c) Restricted Allocation Areas. Restricted allocation areas are District designated areas where the water resources are managed in response to specific surface water and ground water sources for which there is a lack of water availability to meet the needs of the region. The UEC Planning Area contains three restricted allocated areas.

1. Projects located in the Eastern Okeechobee-Northwestern St. Lucie Basin withdrawing water from the Floridan aquifer are limited to 1.5 inches for the maximum month, with the balance of water needs being withdrawn from other sources.

2. Pumps designed to increase the withdrawal rate above that which occurs naturally are prohibited on all Floridan wells located in Martin and St. Lucie counties unless the pump was in place and operational on the well prior to March 2, 1974 or the applicant justifies that the pumping will not have an adverse impact on any existing legal use.

3. No additional water will be allocated from, or direct connections to, the C-23, C-24, or C-25 over and above existing allocations, until District investigations show that additional water is available for allocation.

Based on the analysis, it is recommended the District eliminate the 1.5 inch allocation restriction in northwest St. Lucie County (number 1 above). The modeling did not indicate any potential problems using full supplemental demand during a 1-in-10 drought condition. In addition, the District should continue the practice of prohibiting pumps on Floridan wells (number 2 above) except for short-term usage during extreme water shortages and freezes. Also, based on the surface budget analysis, the District should continue prohibiting new or expanded allocations from the C-23, C-24 or C-25 (number 3 above) until additional surface water is determined to be available through reassessment of the surface availability upon implementation of the IRL Restoration Feasibility Study solutions. The analysis indicated there is not sufficient surface water to support the demand on these canals during a 1-in-10 drought condition.

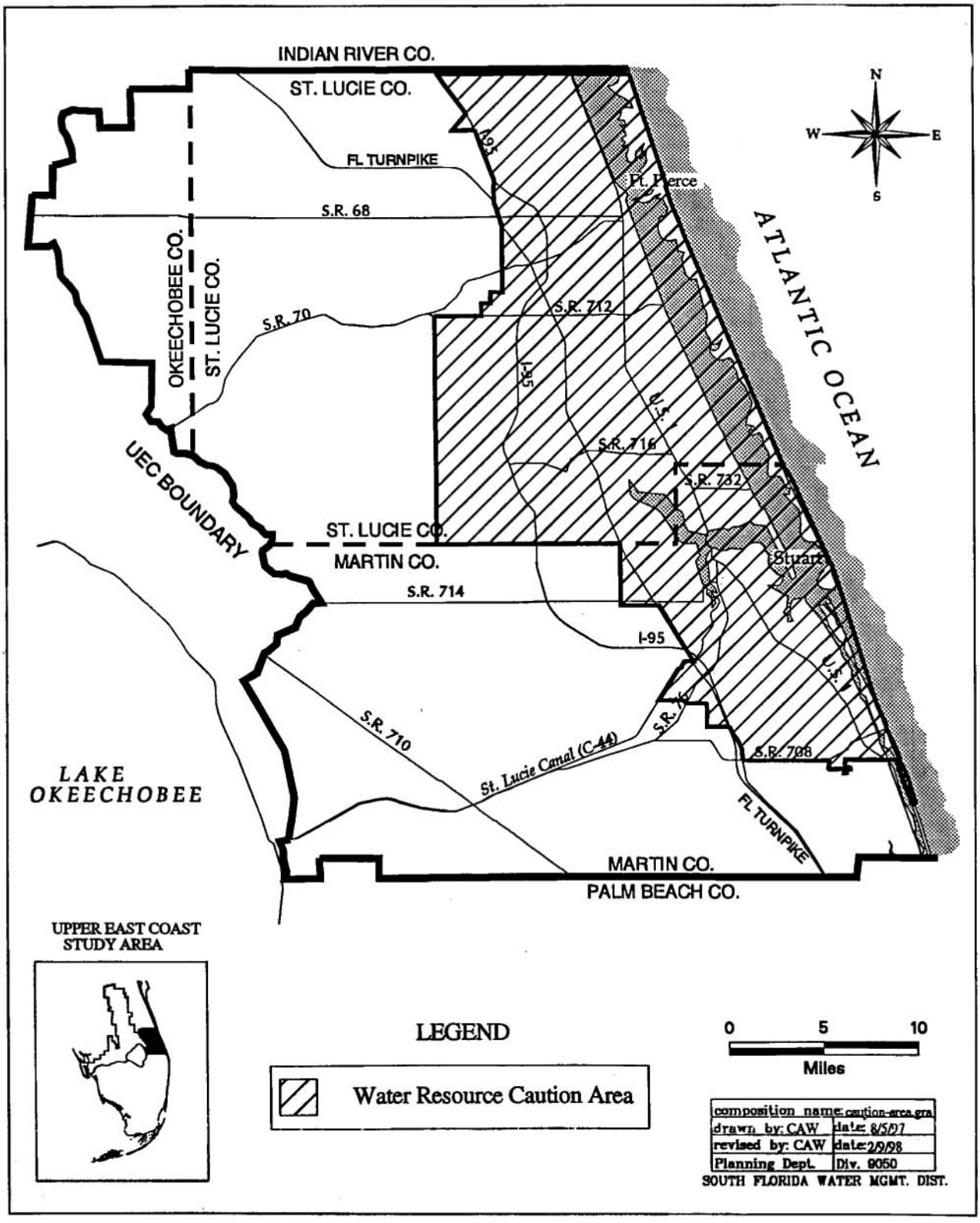


**Figure 11.** Proposed UEC Planning Area Water Resource Caution Areas (Generalized).

**Permit Duration.** House Bill 715 amended s.373.236, Duration of Permits. The new statute provides that:

> Permits shall be granted for a period of 20 years, if requested for that period of time, if there is sufficient data to provide reasonable assurance that the conditions for permit issuance will be met for the duration of the permit; otherwise permits may be issued for shorter durations which reflect the period for which such reasonable assurances can be provided.

The advisory committee recommends that requests for 20 year permits be consistent with the UEC Water Supply Plan prior to issuance. The conditions upon which a 20 year permit will be recommended will be defined as part of the rulemaking process.

**UECWSP Update**. The advisory committee recommends this UECWSP be updated following completion of the Indian River Lagoon Restoration Feasibility Study and the C&SF Comprehensive Review Study (Restudy). The intent of this recommendation is to allow incorporation of the results of those studies into the development of next UECWSP.

## MINIMUM FLOWS AND LEVELS FOR PRIORITY WATER BODIES

In addition to water resource and water supply development strategies, Chapter 373, F.S. requires the water management districts (WMDs) to establish minimum flows and levels (MFLs) for priority water bodies within their jurisdictions. Minimum flows represent the limit at which further withdrawals would be significantly harmful to the water resource or ecology of the area. Minimum levels are the level of ground water in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources. The statutes direct WMDs to prepare a priority list and schedule for the development of MFLs in November of every year. The UEC Planning Area contains two priority water bodies, which have been previously identified by the SFWMD: the St. Lucie Estuary (SLE) and the Floridan aquifer. The District Water Management Plan currently contains a year 2000 deadline for both water bodies. The District proposes to delete the Floridan aquifer from the District's 1997 priority list (see Floridan aquifer discussion below) and revise the completion date for the SLE to 2001 to reflect the revised definition for MFL establishment.

### St. Lucie Estuary

A description of the St. Lucie Estuary and Indian River Lagoon SWIM Plan is provided in Chapter 2. As the first step in developing a minimum flow for the SLE, District staff updated the inflow/salinity model database, and used a one-dimensional model to generate predictive inflow/salinity curves for the inner and middle estuary. The preferred salinity range for the SLE is based upon the salinity requirements for species of particular importance to the system; in this case primarily oysters, and secondarily seagrasses. This information, in combination with

historical oyster distributions, has been compared to the inflow/salinity curves to develop the preliminary "salinity envelope" for the SLE and has been described in the 1994 IRL SWIM Plan. The flow ranges associated with the salinity envelope include the combined flows from each contributing basin and from ground water.

Comparing the estimated mean monthly basin flows to the SLE salinity target indicates that freshwater flows from every basin frequently exceed the desirable range and that minimum base flows are also not sufficiently sustained. The effects of insufficient minimum flows, which translate into increased salinities, are varied according to the timing and duration of the event and the developmental stage of the target organism. High salinities have been documented to interfere with the successful development and settling of veliger larvae of oysters. High salinities also result in physiological stress in adult oysters, and the increased presence of oyster predators and diseases. The effects of high salinities on growth and reproduction of seagrasses are not as well understood.

Maximum flows also have a negative impact on the SLE. The development of the contributing watersheds has significantly increased the quantity and altered the timing of fresh water into the estuary. These changes degrade water quality by affecting the salinites and by increasing the amount of nutrients, suspended solids and toxins which are delivered from the watersheds along with the fresh water. The fresh water itself can directly harm seagrasses and oysters by exposing these sessile organisms to lower salinity levels than they can tolerate. The nutrients often cause algal blooms which result in unhealthy levels of dissolved oxygen and increased water color both of which are detrimental to many estuarine organisms. The suspended solids that are transported from upstream during larger storm events also affect water color and also contain organic material which flocculated out of the water column when the fresh water meets the brackish water. This results in the accumulation of muck deposits. The muck deposits which are found extensively in the SLE degrade oyster habitat and allow for the establishment of pollution tolerant benthic organisms.

The proposed process to define the minimum flow (and maximum flow) for the St. Lucie Estuary is as follows:

1. Develop a defensible definition of significant harm, in terms of minimum and maximum freshwater inflows based upon the harmful effects of alterations to the salinity regime, distribution, timing, duration and water quality, in relation to key estuarine species.
2. Define appropriate salinity range or "envelope" (minimum and maximum) for the St. Lucie Estuary based upon key species or Valued Ecosystem Components as defined by EPA. These species are those determined to be representative of a healthy estuarine ecosystem, and may include oysters, seagrasses, or regionally significant fisheries. This work effort has been accomplished through the IRL SWIM Program, although additional work is
   underway to more fully document the historic, current and potential locations of desirable species.
3. Determine required cumulative freshwater inflows to the inner estuary that maintain salinity within appropriate upper limits.

4. Apportion total estuary inflow among respective SLE basins, and determine respective dry season and wet season target volumes from each basin.
5. Identify the source, volume and timing of discharges that violate minimum and maximum flow target levels.
6. Evaluate strategies to manage the timing of discharges to the SLE to appropriate levels.
7. Select and implement watershed management projects to achieve the target minimum and maximum flows.

8. Develop Recovery or Prevention Strategy, as required by Section 373.0421, F.S.

In order to define the minimum and maximum flows at which "significant harm" to the ecosystem will occur, it will be necessary to review the salinity distribution patterns for the estuary and determine the timing, distribution, duration and reoccurrence of very low or no flow conditions. The salinities that result from these events will then need to be compared to published and ongoing experimental studies on the effects of high salinity on oysters and seagrasses. This work is currently underway through a series of contracts and field and laboratory experiments, scheduled for completion in 1998. Once the preliminary minimum flows have been established, the District will initiate rulemaking and public review and comment for the formal establishment of a minimum flow for the Estuary. Establishment of the MFL for SLE is not contingent on SWIM funding.

### Floridan Aquifer

The Floridan aquifer was originally listed as a priority for development of MFLs due to concerns about the water quality impacts of sustained substantial withdrawals from this source. During the planning process, a Floridan aquifer subcommittee was established to make recommendations associated with Floridan issues. Based on the subcommittee's recommendation that the current restrictions on the use of pumps for all uses be maintained, the analysis, and the belief on many members' part that use of the Floridan is essentially self-regulating, the advisory committee concluded that the Floridan aquifer no longer should be included on the immediate list for development of MFLs. The need to include the Floridan aquifer on future MFL priority lists will be reassessed during future updates to this plan.

## CONCLUSIONS

The results of this regional analysis indicate 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 drought condition. Potential impacts on wetlands, as well as the potential for saltwater intrusion, increase using estimated future demand levels. In addition, potential impacts were also simulated in some areas using 1990 water demand levels during a 1-in-10 drought condition. However, with diversification of supply sources (e.g., Floridan aquifer, wastewater reuse), the analysis indicated the existing and future water demands can be met with minimal potential impacts.

The results of the surface water budget analysis verify that the surface water availability during a 1-in-10 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 ground water sources, primarily the Floridan aquifer, was shown to be sufficient to meet the existing as well as future demands. There is a concern for water quality in the Floridan aquifer, and the long-term sustainability of the Floridan aquifer as source of water for irrigation of citrus. Development of alternate water source options and water conservation should be encouraged to conserve the Floridan aquifer in the agricultural areas. However, based on limited historic water quality information and projected water levels, significant changes in water quality are not anticipated. A comprehensive Floridan aquifer monitoring network should be established to collect the data necessary to establish the relationship between water use, water levels, and water quality.

At this time, the resource protection criteria used in this plan appear to be adequate for protecting the resources. However, existing and proposed data collection efforts and studies, such as the District's wetland study and Floridan aquifer monitoring network, should be conducted to refine the criteria.

The advisory committee agreed that freshwater discharges (minimums and maximums) are affecting the health of the St. Lucie Estuary and the Indian River Lagoon, as well as losing this water from the water supply inventory. The advisory committee recommends the IRL Feasibility Study be completed and implemented to address freshwater discharges to the St. Lucie Estuary and increase surface water availability for water use; and the Ten Mile Creek project and associated funding as well as similar projects, be pursued.

The committee concluded the primary purpose of the Feasibility Study should be environmental restoration. Evaluations of increasing surface water availability for water supply purposes should strive for providing a 1-in-10 level of certainty from surface water as an optimal goal. However, it is recognized this may not be cost-effective.

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# Chapter 6

# PLAN IMPLEMENTATION AND FUNDING

There are seven water source options that provide opportunities to address water supply issues in the UEC Planning Area. These options reflect the goals of UEC Water Supply Plan Advisory Committee.

The seven water source options are:

- Surface Water Storage
- Aquifer Storage and Recovery
- Floridan Aquifer
- SAS Wellfield Expansion
- Conservation
- Wastewater Reuse
- Utility Interconnects

The advisory committee suggested that the District consider a number of water resource development recommendations. The District reviewed each one and presents the following recommendations. The recommendations associated with each option are organized into water resource development recommendations and strategies, and water supply development plan suggestions. Each water source option has a set of water resource development recommendations that are specific implementation strategies. These recommendations support water supply development and were determined by the advisory committee to be the responsibility of the District, whereas the plan suggestions in the water supply development category were determined to be the responsibility of local governments, water suppliers, and water users. Plan suggestions may be eligible for District funding assistance if they meet the statutory requirements explained later in this chapter.

Activities by the District include regulation; research and testing; operations and construction; and cooperative funding of water supply development projects with local governments and water users. Activities by local governments, water suppliers, and water users will be determined at the local level to more effectively meet individual needs.

Costs and funding sources are provided for each water resource development recommendation. Funding includes both monetary sources and human resources expressed in full-time equivalencies (FTEs). Monetary sources of funding are described in dollar amounts and include monies from the District and other agencies, while FTEs represent the estimated hours to be worked by District staff. The funding approach for the UEC Water Supply Plan as well as potential funding sources for water resource development recommendations and water supply development suggestions are described later in this chapter. The recommendations contained in this plan are subject to District Governing Board budgetary appropriation for future fiscal years.

## WATER RESOURCE DEVELOPMENT RECOMMENDATIONS AND STRATEGIES

The water resource development recommendations are introduced with estimates of the quantity made available for each water source option. The volume of water that could be withdrawn by any specific user must be determined through the District's consumptive use permitting program. Analyses indicate the options are sufficient to meet the needs of the UEC Region through the planning horizon.

### Surface Water Storage

Freshwater discharges from the C-23, C-24, and C-25 (1964-1995) and C-44 (1952-1995) canals averaged 304 billion gallons per year or 833 million gallons per day (MGD). These discharges are influenced primarily by rainfall and vary significantly over the period of record. Rainfall over this period averaged approximately 51 inches. In addition, discharges from the C-44 canal are influenced by regulatory discharges from Lake Okeechobee. These discharges may be less today based on changes in the Lake regulation schedule. Theoretically, a significant amount of the 833 MGD could be stored and made available for water supply, if sufficient volumes of storage were constructed. In addition to the urban and agricultural water supply needs, the needs of the environment (estuarine systems) have to be accounted for.

The advisory committee made the following recommendations to support water resource development through surface water storage:

1.1. Recommendation/Strategy: Complete the Indian River Lagoon Restoration Feasibility Study by 2001, pursuant to the project study plan. The basin storage figures from the Regional Attenuation Force Task Force should be used as preliminary volumes in the alternative evaluation phase of this study. Implementation of this study will result in additional water resource development projects and future expenditures.

Total Cost: $6.1 million

Funding Source: SFWMD ($3.05 million) and USACE ($3.05 million)

SFWMD share:

| Cost | FY96 | FY97 | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|---|---|
| Dollars ($1,000s) | $0 | $148 | $946 | $297 | $141 | $16 | $0 |
| In-kind Service* | $96 | $627 | $462 | $234 | $76 | $26 | $0 |

*In-kind service includes FTEs, contracts, equipment and overhead.
Source: Indian River Lagoon Restoration Feasibility Study - Project Study Plan, April 1996, Table 2 (Study Cost Estimate).

Implementing Agency: SFWMD and USACE

Subtasks:
1.1.a. Complete problem identification/initial plan formulation phase by October 1998.
1.1.b. Complete alternative plans evaluation phase by October 1999.
1.1.c. Complete engineering design and report preparation phase by March 2001.

1.2. Recommendation/Strategy: Where appropriate and feasible, identify, design, and construct other regional attenuation facilities. This may result in additional water resource development projects and future expenditures.

Total Cost: 0.20 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 |

Implementing Agency: SFWMD

Subtasks:
1.2.a. Upon completion of the Feasibility Study, determine if additional RAFs are needed by September 2000.

1.3. Recommendation/Strategy: The District will support the design and construction of the Ten Mile Creek Critical Restoration Project.

Total Cost: $30 million

Funding Source: SFWMD, St. Lucie County, other public and private interests ($15 million), USACE ($15 million)

SFWMD and others share:

| Cost | FY97 | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|---|
| Dollars ($1,000s) | $0 | $100 | $3,500 | $3,500 | $6,500 | $1,400 |

Implementing Agency: SFWMD and USACE

Subtasks:
1.3.a. Complete Corps application package and conceptual design by December 1997 - completed.

1.3.b. Complete options on land purchase by January 1998 - completed.
1.3.c. Complete vegetative and habitat surveys by April 1998.
1.3.d. Complete design by March 1999.
1.3.e. Receive permits by June 1999.
1.3.f. Purchase land by December 1999.
1.3.g. Begin construction by April 2000.

1.4. Recommendation/Strategy: The District will develop and adopt a minimum flow and level (which includes maximum discharges) for the St. Lucie Estuary, based on the salinity envelope concept. The desired salinity envelope will be met through managing freshwater discharges to the SLE. Based on the analysis to date, this would equate to an inflow range of 350 cfs to 1,600 cfs. The salinity envelope and associated inflows are being refined in the Feasibility Study and in development of the minimum flow and level for the SLE.

Total Cost**:** $110,000 plus 5.75 FTEs

Funding Source**:** SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| Dollars ($1,000s) | $100 | $10 | $0 | $0 | $0 |
| FTEs | 2.00 | 1.75 | 1.50 | 0.50 | 0.00 |

Implementing Agency: SFWMD and USACE

Subtasks:

1.4.a. Review data from oyster and seagrass survey and field and laboratory experiments (salinity tolerances) for input to model by October 1998.
1.4.b. Create a model that integrates biology (survey data on oyster, seagrass, fish, etc.) and hydrology (field and laboratory data on salinity tolerances) for the St. Lucie Estuary by October 1998.
1.4.c. Refine model with ongoing field and laboratory data (through 1999).
1.4.d. Evaluate how changes in freshwater inflows affect distribution and abundance of key estuarine species which help establish criteria for significant harm (through 1999).
1.4.e. Establish draft definition of "significant harm" by December 1999.
1.4.f. Draft MFL for peer review by March 2000.
1.4.g. Draft MFL for rulemaking by January 2001.
1.4.h. Develop Prevention or Recovery Strategy, as required by Section 373.0421.
1.4.i. Rule adoption by Governing Board by December 2001.
1.4.j. Implement Recovery Strategy, if necessary.

1.5. Recommendation/Strategy: The District will evaluate increasing storage and conveyance in C-canals through maintenance of canals (sediment control) and remove depositions where appropriate.

Total Cost: $1.08 million plus 4.15 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| Dollars ($1,000s) | $0 | $79 | $0 | $0 | $1,000 |
| FTEs | 0.00 | 0.15 | 0.00 | 0.00 | 4.00 |

Implementing Agency: SFWMD

Subtasks:

1.5.a. Initiate field investigation of canals to identify shoaling and bank erosion by February 1999.
1.5.b. Establish cross sections in problem areas by April 1999.
1.5.c. Perform hydraulic analysis of canal conveyance capacity by May 1999.
1.5.d. Evaluate results of analysis by June 1999.
1.5.e. Publish study results by July 1999.
1.5.f. Initiate removal of sediment depositions by October 2001.

## Aquifer Storage and Recovery

The volume of water that could be made available through aquifer storage and recovery (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 water that could be made available through ASR in the UEC Region. Typical storage volumes for individual wells range from 10 to 500 million gallons (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. There are potentially many different applications of ASR; however, all store sufficient volumes (adequate volumes to meet the desired need) during times when water is available and recover it from the same well(s) when needed. The storage time is usually seasonal, but can also be diurnal, long-term or for emergencies.

The advisory committee made the following recommendations to support water resource development through aquifer storage and recovery:

2.1. Recommendation/Strategy: The District and USACE will evaluate the potential of co-locating ASR and surface water storage to supplement storage or enhance water supply, if required and cost effective. If RAFs are identified as preferred alternatives, this co-location evaluation will be conducted in the Feasibility Study.

Total Cost: FTEs are included in the Feasibility Study

Funding Source: SFWMD and USACE

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | --- | --- | --- | --- | --- |

Implementing Agency: SFWMD and USACE

Subtasks: Not applicable

2.2. Recommendation/Strategy: The District will evaluate existing water quality data for canal water in District databases for use in evaluating the potential for surface water ASR, if ASR is incorporated into the Feasibility Study preferred alternative. The Feasibility Study will conceptually evaluate ASR, but will not include a site-specific analysis.
Total Cost: 0.03 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 |

Implementing Agency: SFWMD

Subtasks:
2.2.a. Collect and analyze data by July 2000.
2.2.b. Determine if water quality is suitable for surface water ASR by July 2000.

2.3. Recommendation/Strategy: The District will evaluate the potential of reactivating the District's Demonstration Project for Lake Okeechobee ASR well to collect data on surface water ASR. Also, the District will look at the potential of a public/private partnership for this project.

Total Cost: $10,000 plus 0.06 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| Dollars ($1,000s) | $0 | $10 | $0 | $0 | $0 |
| FTEs | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 |

Implementing Agency: SFWMD

Subtasks:
2.3.a. Evaluate current condition of facility by June 1999.
2.3.b. Determine cost to reactivate facility by July 1999.
2.3.c. Determine cost effectiveness of reactivating versus closing facility by July 1999.
2.3.d. Document recommendations by August 1999.

2.4. Recommendation/Strategy: The District will continue working with EPA and FDEP to explore rule changes in federal and state underground injection control program to allow for (and facilitate) injection of untreated surface and ground water with ASR.

2.5.

Total Cost: 0.02 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |

Implementing Agency: SFWMD, EPA, and FDEP

Subtasks: Not applicable.

2.5. Recommendation/Strategy: The District will develop rules to address potential conflicts associated with the application of ASR and the existing use of the Floridan aquifer for water supply.

Total Cost: Cost incorporated in Recommendation 7.1 of Related Strategies

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | --- | --- | --- | --- | --- |

Implementing Agency: SFWMD

Subtasks: See Recommendation 7.1 of Related Strategies

2.6. Recommendation/Strategy: The District will evaluate the feasibility of injecting excess surface water into the Floridan aquifer for recharge where appropriate. The Feasibility Study will conceptually evaluate ASR, but will not include a site-specific analysis.

Total Cost: FTEs are included in the Feasibility Study

Funding Source: SFWMD and USACE

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | --- | --- | --- | --- | --- |

Implementing Agency: SFWMD and USACE

Subtasks: Not applicable

2.7 Recommendation/Strategy: The District will evaluate injection of surface water, and other sources of water, to increase freshwater head along the coast to decrease the potential of saltwater intrusion, where regional benefits are identified where appropriate. The Feasibility Study will conceptually evaluate injection of surface water, but will not include a site-specific analysis.

Total Cost: FTEs are included in the Feasibility Study

Funding Source: SFWMD and USACE

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | --- | --- | --- | --- | --- |

Implementing Agency: SFWMD and USACE

Subtasks: Not applicable

## Floridan Aquifer

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

The advisory committee made the following recommendations to support water resource development through use of the Floridan aquifer:

3.1. Recommendation/Strategy: The District will remove the Floridan aquifer from the MFL priority list in the Water Management Plan.

Total Cost: 0.05 FTEs

Funding Source: SFWMD

| Cost | FY97 | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|---|
| FTEs | 0.04 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |

Implementing Agency: SFWMD

Subtasks:

3.1.a. Peform regional Floridan aquifer runs to reveal any water use related exceedances of the Floridan aquifer protection criterion by March 1997 - completed.

3.1.b. Discuss recommendation to remove the Floridan aquifer from the MFL priority list with Florida Department of Environmental Protection by October 1997- completed.

3.1.c. Remove Floridan aquifer from MFL priority list in the Water Management Plan by November 1997 - completed.

3.2. Recommendation/Strategy: The District will develop and implement a comprehensive regional Floridan aquifer monitoring network to collect the necessary information to develop relationships between water use, water quality, and water levels.

Total Cost:

Option A: In-house cost: $159,400 plus 5.73 FTEs
Option B: Contracted cost: $323,000 plus 4.33 FTEs

Funding Source: SFWMD

| Cost* | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| Option A: In-house costs | | | | | |
| Dollars ($1,000s) | $0 | $0 | $78 | $64 | $18 |
| FTEs | 0.11 | 1.15 | 2.52 | 1.25 | 0.70 |
| Option B: Contracted costs | | | | | |
| Dollars ($1,000s) | $0 | $0 | $112 | $199 | $12 |
| FTEs | 0.11 | 1.15 | 1.62 | 0.75 | 0.70 |

*Assumes 70 total network wells, including 5 new wells constructed by SFWMD staff using District equipment.

Implementing Agency: SFWMD

Subtasks:
3.2.a. Define information needs by March 1999.
3.2.b. Design monitoring network and document data collection procedures by May 1999.
3.2.c. Initiate establishment of the monitoring network by October 1999.
3.2.d. Initiate annual sampling and analysis by April 2000.

3.3. Recommendation/Strategy: The District will develop options for a volunteer or incentive-based Floridan well abandonment program.

Total Cost: $148,000 plus 0.10 FTEs

Funding Source: SFWMD ($37,000) and NRCS ($111,000)

SFWMD share:

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| Dollars ($1,000s) | $37 | $0 | $0 | $0 | $0 |
| FTEs | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |

Implementing Agency: SFWMD and NRCS

Subtasks:

3.3.a. Develop statement of work for use of current budgeted monies by March 1998.

3.3.b. Continue to evaluate options for a volunteer or incentive-based well abandonment program such as the Alternative Water Supply Funding Program.

3.4. Recommendation/Strategy: The District will work with FDEP and EPA to explore alternative desalination concentrate disposal options.

Total Cost: 0.03 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 |

Implementing Agency: SFWMD

Subtasks: Not applicable

3.5. Recommendation/Strategy: 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.

Total Cost: Costs associated with this recommendation will be incorporated into the scope of the Kissimmee Basin Water Supply Plan

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | --- | --- | --- | --- | --- |

Implementing Agency: SFWMD

Subtasks: Not applicable

## Surficial Aquifer System Wellfield Expansion

Analyses indicated that expansion of SAS withdrawals for public water supply, residential self supplied, commercial and industrial self supplied, and recreational self supplied beyond existing demands (66 MGD) is limited, especially along the coast. This assumes withdrawals will be obtained from existing wells, and where information was available, from proposed wells. However, there may be limited expansion potential on a project-by-project basis. The advisory committee made no recommendations.

## Conservation

A 10 percent reduction (4 MGD) in projected public water supply and residential self supplied water use is estimated with implementation of the mandatory conservation measures through the planning horizon. There are also retrofit (incorporation of current water conservation measures into existing projects) opportunities in both agricultural and urban areas. Retrofitting the approximately 40,000 remaining acres of citrus that currently use flood irrigation to micro-irrigation could result in a reduction in water use of up to 25 MGD (actual savings may be less due to cooperative use of water within 298 Districts) in water demands. Approximately 100,000 acres have been retrofitted to micro-irrigation. In urban areas, the following water savings could occur per 10,000 units installed: toilet, 0.24 MGD; showerhead, 0.50 MGD; and rain switches, 5.73 MGD. It is also estimated an urban mobile irrigation lab visiting 200 homes could reduce outdoor water usage by 0.12 MGD. These potential water savings are based on average rainfall conditions; greater water savings should be realized during drought conditions.

The advisory committee made the following recommendations to encourage efficient use of the resource through conservation:

4.1 Recommendation/Strategy: 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.

Total Cost: Costs are associated with the Alternative Water Supply Funding Program

Funding Source: SFWMD and local sponsor

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| Dollars ($1,000s) | --- | --- | --- | --- | --- |

Implementing Agency: SFWMD

Subtasks:
4.1.a. Solicit indoor water conservation measures (toilet and showerhead retrofit).
4.1.b. Solicit outdoor water conservation measures (higher efficiency irrigation systems).
4.1.c. Develop a cooperative approach with the NRCS to promote conversion of flood irrigation to micro-irrigation, including financial incentives.

4.2. Recommendation/Strategy: The District will provide cost-share funding for Martin County and St. Lucie County urban mobile irrigation laboratory programs and possibly another agricultural mobile irrigation laboratory for the UEC region if the need arises.

Total Cost: $325,000 per year ($75,000 for urban lab and $250,000 for agricultural lab)

Funding Source: SFWMD (urban - $50,000, agricultural - $100,000) and local sponsors (urban - $25,000, agricultural - $150,000)

SFWMD share:

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| Dollars ($1,000s) | $25* | $150 | $150 | $150 | $150 |

*Co-funded with NRCS for Martin County urban mobile irrigation laboratory only.

Implementing Agency: SFWMD and local sponsors

Subtasks:
4.2.a. Seek local sponsors for future cost-share funding.

## Wastewater Reuse

Regional wastewater utilities in the UEC Planning Area have projected wastewater flows to increase to approximately 43 MGD through the planning horizon. However, based on minimal increases in wastewater flows from 1993 to 1996, it is doubtful this projection will be realized within the planning horizon. In 1996, about 3.5 MGD (26 percent) of the 13 MGD processed by these facilities was reused. Assuming the projections of the utilities are realized, approximately 40 MGD of additional reclaimed water could be made available for reuse through the planning horizon.

The advisory committee made the following recommendations to support water resource development through wastewater reuse:

5.1. Recommendation/Strategy: The District will develop regulatory and fiscal incentives, such as the Alternative Water Supply Funding Program, for reuse in the UEC Planning Area. Reuse projects that can expand the regional water resources may be considered as a water resource development project.

Total Cost: Costs are associated with the Alternative Water Supply Funding Program

Funding Source: SFWMD and local sponsor

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| Dollars ($1,000s) | --- | --- | --- | --- | --- |

Implementing Agency: SFWMD

Subtasks:
5.1.a. Solicit reuse projects for the Alternative Water Supply Funding Program.

5.2. Recommendation/Strategy: The District will encourage utilities to evaluate reclaimed water system interconnects to increase reuse in potential problem areas.

Total Cost: 0.05 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |

Implementing Agency: SFWMD

Subtasks: Not applicable

5.3. Recommendation/Strategy: The District will adopt rules implementing the requirements of Section 373.250, F.S. related to wastewater reuse and back-up sources.

Total Cost: Cost incorporated in Recommendation 7.1 of Related Strategies

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | --- | --- | --- | --- | --- |

Implementing Agency: SFWMD

Subtasks: See Recommendation 7.1 of Related Strategies

5.4. Recommendation/Strategy: The District will provide assistance for reclaimed water projects that involve ground water recharge and indirect potable reuse, and will assume the lead role for such projects that are of regional significance.

Total Cost: 0.05 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |

Implementing Agency: SFWMD

Subtasks: Not applicable

5.5. Recommendation/Strategy: The District will discuss with the FDEP, and participate in rulemaking, standards for reclaimed water quality for ground water recharge, indirect potable reuse projects, and wet weather disposal.

Total Cost: 0.16 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 |

Implementing Agency: SFWMD

Subtasks:

5.5.a. Continue to participate in rulemaking activities associated with Chapter 62-610, F.A.C. Reuse of Reclaimed Water and Land Applications.
5.5.b. Continue to participate on the statewide Reuse Coordinating Committee.
5.5.c. Continue to conduct regular coordination meetings with FDEP.

## Utility Interconnects

The quantity of water that could be made available from utility interconnects needs to be evaluated on a project-by-project basis. It will decrease projected withdrawals of one utility and increase withdrawals for the other. The water available for transfer depends on the sources used by the supplying utility as well as the capacity of their facilities.

The advisory committee made the following recommendations to support water resource development through utility interconnects:

6.1. Recommendation/Strategy: The District will encourage potable water interconnections between utilities for emergency purposes and evaluation of interconnections for water supply purposes.

Total Cost: 0.05 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |

Implementing Agency: SFWMD

Subtasks: Not applicable

## Related Implementation Strategies

The advisory committee also recommended the following strategies to implement the UEC Water Supply Plan. Most of these strategies involve incorporation of the modeling assumptions used in development of this plan into the consumptive use permitting program, through a subsequent rulemaking effort.

7.1. Recommendation/Strategy: The District will incorporate the following 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:

(a) Incorporate a uniform level of drought in the consumptive use permitting program to determine the supplemental needs of all users in the UEC Planning Area. The statistical 1-in-10 drought condition for the seven rainfall stations used in this plan should be utilized in this determination.

(b) Incorporate the resource protection criteria used in this plan, as may be modified/refined during the rulemaking process, into the District's consumptive use permitting program.

The criteria used in this plan are:

1. Wetlands. Cumulative ground water level drawdowns induced by pumping withdrawals in areas that are classified as a wetland should not exceed 1 foot at the edge of the wetland for more than 1 month during a 12-month dry rainfall event that occurs as frequently as once every 10 years.

2. Floridan Aquifer. Cumulative ground water 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 dry rainfall event that occurs as frequently as once every 10 years. This criterion does not apply to ASR projects. Criteria for ASR projects will be developed during the rulemaking process.

(c) A cumulative analysis be employed as part of the consumptive use permitting analysis that contains flexibility to deal with local conditions and new technologies to accurately assess if the proposed use is permittable.

(d) Develop and adopt appropriate water shortage triggers for resource protection, where necessary, to be used in conjunction with implementation of the District's Water Shortage Plan (Chapter 40E-21, F.A.C.).

(e) Modify the following special designations:

1. Reduced Threshold Areas (RTAs). Delete RTA designations (Stuart Peninsula, Lighthouse Point Peninsula, and the Savannas and Jensen Beach Peninsula) in the UEC Planning Area.

2. Water Resource Caution Areas (WRCAs). Modify WRCA designation in the UEC Planning Area to only incorporate the coastal areas in Martin and St. Lucie counties.

3. Restricted Allocation Areas. (1) Eliminate the existing 1.5 inch allocation restriction in northwest St. Lucie County; (2) Continue prohibition of no additional water being allocated from, or direct connections to, the C-23, C-24, and C-25 canals over and above existing allocations until District investigations show that additional water is available for allocation; and, (3) Continue the prohibition of pumps on Floridan wells, except for short-term usage during extreme water shortages and freezes.

(f) Increase regulatory analysis, including ground water monitoring, in areas where vulnerability mapping indicates increased potential for saltwater intrusion.

(g) Through rulemaking, define the conditions upon which a 20-year permit may be issued.

Total Cost: 2.15 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | 0.00 | 0.90 | 1.25 | 0.00 | 0.00 |

Implementing Agency: SFWMD

Subtasks:
7.1.a. Request Governing Board authorization for rule development by April 1999.
7.1.b Present draft rule to Governing Board to initiate rulemaking by December 1999.
7.1.c. Present final rule to Governing Board for adoption by April 2000.

7.2. Recommendation/Strategy: The District will continue coordination of the UEC Water Supply Plan with local governments/utilities, the SJRWMD and the Feasibility Study.

Total Cost: 0.25 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |

Implementing Agency: SFWMD

Subtasks:

7.2.a. Continue meeting with local governments, utilities, and other agencies throughout the plan implementation period.

7.3. Recommendation/Strategy: Continue ongoing District wetland drawdown study.

Total Cost: $532,000

Funding Source: SFWMD

| Cost | FY96 | FY97 | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|---|---|
| Dollars ($1,000s) | $75 | $208 | $82 | $55 | $56 | $56 | $0 |

Implementing Agency: SFWMD

Subtasks:

7.3.a. Establish long-term monitoring sites at wetlands in the UEC Planning Area by July 1996 - completed.

7.3.b. Complete installation and instrumentation of monitoring wells at UEC sites by February 1997 - completed.

7.3.c. Complete analysis of historical aerial photography for UEC study areas by April 1997 - completed.

7.3.d. Complete installation of weather stations at UEC study areas by May 1997 - completed.

7.3.e. Complete biological inventories of UEC sites by June 1997 - completed.

7.3.f. Complete analysis and evaluation of hydrologic data from first wet-dry cycle by July 1998.

7.3.g. Complete intensive study of wetland-aquifer interactions in UEC sites by August 1998 (Initiated 8/97).

7.3.h. Complete intensive pilot-scale biological monitoring in UEC sites by September 1998.

7.3.i. Convene scientific workshop to review findings to date and make recommendations for wetland drawdown rules or further research and monitoring by December 1998.

7.3.j. Continue hydrobiological monitoring at all sites through at least October 2001.

7.4. Recommendation/Strategy: 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 region.

Total Cost: 0.02 FTEs

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| FTEs | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 |

Implementing Agency: SFWMD

Subtasks: Not applicable

7.5. Recommendation/Strategy: The District should fund implementation of the UEC Water Supply Plan. It should be recognized that several of these recommendations will result in water resource development projects, especially Recommendation 1.1, implementation of the Indian River Lagoon Restoration Feasibility Study.

Total Cost: Indicated in previous recommendations

Funding Source: SFWMD

| Cost | FY98 | FY99 | FY00 | FY01 | FY02 |
|---|---|---|---|---|---|
| Dollars ($1,000s) | --- | --- | --- | --- | --- |

Implementing Agency: SFWMD

Subtasks: Indicated in previous recommendations

## Summary of Water Resource Development Recommendation Costs

A summary of the water resource development recommendation costs is included in Table 23. Costs are described in terms of both dollars and full-time equivalencies (FTEs). In most cases, dollars do not include the cost of District staff. Where cooperative efforts with other agencies are involved, the dollars in the table reflect only the District's share. FTEs represent the estimated hours to be worked by District staff.

Dashes appear in the table where the associated costs or FTEs are included within the scope of another recommendation or program. Three examples of this are:

(1) The costs or FTEs are within the scope of another study. There are three examples in the table (2.1, 2.6, and 2.7) where the dashes indicate that the costs are within the scope of the Feasibility Study. The overall cost of the Feasibility Study is captured in Recommendation 1.1. In addition, Recommendation 3.5 will be incorporated into the scope of the Kissimmee Basin Water Supply Plan.

(2) The costs or FTEs will be funded through the Alternative Water Supply Funding Program. There are two examples of this in the table (4.1 and 5.1).

(3) The costs or FTEs will be incorporated into the rulemaking process. There are two examples of this in the table (2.5 and 5.3) where the costs and subtasks are captured in Recommendation 7.1, which outlines the rulemaking process.

The total cost of the plan recommendations varies, depending on whether Recommendation 3.2 (Floridan aquifer monitoring network) is implemented in-house or contracted to a consultant. If implemented in-house, the total cost of the plan recommendations would be $20.62 million and 18.85 FTEs. If, on the other hand, Recommendation 3.2 were to be contracted out, the total cost of the plan recommendations would be $20.79 million and 17.45 FTEs. Although contracting out would be more expensive, the wells could be constructed by FY 2000 - approximately two years earlier than if done in-house.

**Table 23.** Summary of Water Resource Development Recommendation Costs.

| Rec. | Previous Costs ($1,000s) and FTEs | | | | Plan Implementation Period Costs ($1,000s) and FTES | | | | | | | | | | Total Cost | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FY96 | | FY97 | | FY98 | | FY99 | | FY00 | | FY01 | | FY02 | | | |
| | $ | FTE | $ | FTE | $ | FTE | $ | FTE | $ | FTE | $ | FTE | $ | FTE | $ | FTE |
| Surface Water Storage | | | | | | | | | | | | | | | | |
| 1.1*†▲ | $96 | 0.00 | $775 | 0.00 | $1,408 | 0.00 | $531 | 0.00 | $217 | 0.00 | $42 | 0.00 | $0 | 0.00 | $3,069 | 0.00 |
| 1.2▲ | | | | | $0 | 0.00 | $0 | 0.00 | $0 | 0.20 | $0 | 0.00 | $0 | 0.00 | $0 | 0.20 |
| 1.3† | | | $0 | 0.00 | $100 | 0.00 | $3,500 | 0.00 | $3,500 | 0.00 | $6,500 | 0.00 | $1,400 | 0.00 | $15,000 | 0.00 |
| 1.4 | | | | | $100 | 2.00 | $10 | 1.75 | $0 | 1.50 | $0 | 0.50 | $0 | 0.00 | $110 | 5.75 |
| 1.5 | | | | | $0 | 0.00 | $79 | 0.15 | $0 | 0.00 | $0 | 0.00 | $1,000 | 4.00 | $1,079 | 4.15 |
| Subtotal | $96 | 0.00 | $775 | 0.00 | $1,608 | 2.00 | $4,120 | 1.90 | $3,717 | 1.70 | $6,542 | 0.50 | $2,400 | 4.00 | $19,258 | 10.10 |
| Aquifer Storage and Recovery | | | | | | | | | | | | | | | | |
| 2.1 | | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2.2 | | | | | $0 | 0.00 | $0 | 0.00 | $0 | 0.03 | $0 | 0.00 | $0 | 0.00 | $0 | 0.03 |
| 2.3 | | | | | $0 | 0.00 | $10 | 0.06 | $0 | 0.00 | $0 | 0.00 | $0 | 0.00 | $10 | 0.06 |
| 2.4 | | | | | $0 | 0.02 | $0 | 0.00 | $0 | 0.00 | $0 | 0.00 | $0 | 0.00 | $0 | 0.02 |
| 2.5 | | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2.6 | | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2.7 | | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Subtotal | $0 | 0.00 | $0 | 0.00 | $0 | 0.02 | $10 | 0.06 | $0 | 0.03 | $0 | 0.00 | $0 | 0.00 | $10 | 0.11 |
| Floridan Aquifer | | | | | | | | | | | | | | | | |
| 3.1 | | | | | $0 | 0.04 | $0 | 0.01 | $0 | 0.00 | $0 | 0.00 | $0 | 0.00 | $0 | 0.05 |
| 3.2.A | | | | | $0 | 0.11 | $0 | 1.15 | $78 | 2.52 | $64 | 1.25 | $18 | 0.70 | $160 | 5.73 |
| 3.2.B | | | | | $0 | 0.11 | $0 | 1.15 | $112 | 1.62 | $199 | 0.75 | $12 | 0.70 | $323 | 4.33 |
| 3.3† | | | | | $37 | 0.02 | $0 | 0.02 | $0 | 0.02 | $0 | 0.02 | $0 | 0.02 | $37 | 0.10 |
| 3.4 | | | | | $0 | 0.02 | $0 | 0.01 | $0 | 0.00 | $0 | 0.00 | $0 | 0.00 | $0 | 0.03 |
| 3.5 | | | | | -- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Subtotal with 3.2.A | $0 | 0.00 | $0 | 0.00 | $37 | 0.19 | $0 | 1.19 | $78 | 2.54 | $64 | 1.27 | $18 | 0.72 | $197 | 5.91 |
| with 3.2.B | $0 | 0.00 | $0 | 0.00 | $37 | 0.19 | $0 | 1.19 | $112 | 1.64 | $199 | 0.77 | $12 | 0.72 | $360 | 4.51 |

*See Recommendation 1.1 for cost breakdown between dollar costs and in-kind services.

†Cost-shared/cooperative effort with other agencies.

▲Potential water resource development capital projects and expenditures following completion of the IRL Feasibility Study.

**Table 23.** (Continued).

| Rec. Cost | Previous Costs ($1,000s) and FTEs | | | | Plan Implementation Period Costs ($1,000s) and FTEs | | | | | | | | | | Total Cost | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FY96 | | FY97 | | FY98 | | FY99 | | FY00 | | FY01 | | FY02 | | | |
| | $ | FTE | $ | FTE | $ | FTE | $ | FTE | $ | FTE | $ | FTE | $ | FTE | $ | FTE |
| Conservation | | | | | | | | | | | | | | | | |
| 4.1 | | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4.2† | | | | | $25 | 0.00 | $150 | 0.00 | $150 | 0.00 | $150 | 0.00 | $150 | 0.00 | $625 | 0.00 |
| Subtotal | $0 | 0.00 | $0 | 0.00 | $25 | 0.00 | $150 | 0.00 | $150 | 0.00 | $150 | 0.00 | $150 | 0.00 | $625 | 0.00 |
| Wastewater Reuse | | | | | | | | | | | | | | | | |
| 5.1 | | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.2 | | | | | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.05 |
| 5.3 | | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.4 | | | | | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.05 |
| 5.5 | | | | | $0 | 0.04 | $0 | 0.03 | $0 | 0.03 | $0 | 0.03 | $0 | 0.03 | $0 | 0.16 |
| Subtotal | $0 | 0.00 | $0 | 0.00 | $0 | 0.06 | $0 | 0.05 | $0 | 0.05 | $0 | 0.05 | $0 | 0.05 | $0 | 0.26 |
| Utility Interconnects | | | | | | | | | | | | | | | | |
| 6.1 | | | | | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.05 |
| Subtotal | $0 | 0.00 | $0 | 0.00 | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.01 | $0 | 0.05 |
| Related Implementation Strategies | | | | | | | | | | | | | | | | |
| 7.1 | | | | | $0 | 0.00 | $0 | 0.90 | $0 | 1.25 | $0 | 0.00 | $0 | 0.00 | $0 | 2.15 |
| 7.2 | | | | | $0 | 0.05 | $0 | 0.05 | $0 | 0.05 | $0 | 0.05 | $0 | 0.05 | $0 | 0.25 |
| 7.3 | $75 | 0.00 | $208 | 0.00 | $82 | 0.00 | $55 | 0.00 | $56 | 0.00 | $56 | 0.00 | $0 | 0.00 | $532 | 0.00 |
| 7.4 | | | | | $0 | 0.01 | $0 | 0.01 | $0 | 0.00 | $0 | 0.00 | $0 | 0.00 | $0 | 0.02 |
| 7.5 | | | | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Subtotal | $75 | 0.00 | $208 | 0.00 | $82 | 0.06 | $55 | 0.96 | $56 | 1.30 | $56 | 0.05 | $0 | 0.05 | $532 | 2.42 |
| **Total with 3.2.A** | **$171** | **0.00** | **$983** | **0.00** | **$1,752** | **2.34** | **$4,335** | **4.17** | **$4,001** | **5.63** | **$6,812** | **1.83** | **$2,568** | **4.83** | **$20,622** | **18.85** |
| **with 3.2.B** | **$171** | **0.00** | **$983** | **0.00** | **$1,752** | **2.34** | **$4,335** | **4.07** | **$4,035** | **4.73** | **$6,947** | **1.38** | **$2,562** | **4.83** | **$20,785** | **17.45** |

†Cost-shared/cooperative effort with other agencies.

## WATER SUPPLY DEVELOPMENT PLAN SUGGESTIONS

During the planning process, the advisory committee identified numerous opportunities for the plan to provide guidance to local governments and utilities on ways to address water supply development opportunities. The committee and staff decided to break out these suggestions into a separate section of this chapter and call it "Plan Suggestions." These are intended to identify projects or studies that local governments or utilities can undertake to further water supply goals. They also include considerations that should be incorporated into water supply development projects.

### Surface Water Storage

1.1. Plan Suggestion: Water supply benefits (recharge) should be considered when designing storm water storage/treatment areas. Consideration for funding should be given to projects incorporating surface water storage meeting predevelopment runoff.

1.2. Plan Suggestion: Chapter 298 Districts should be encouraged to incorporate water supply in their Water Control Plans to the extent practicable.

1.3. Plan Suggestion: Prioritize storm water projects that have beneficial ground water recharge.

1.4. Plan Suggestion: Identify developments that lower the ground water table.

1.5. Plan Suggestion: New or widening roadway projects should include retention/ detention, and ground water recharge/water supply design elements without compromising the structural integrity of the road.

1.6. Plan Suggestion: Participate in and support the Restudy Joint Coordination Committee (Martin and St. Lucie counties), which is charged with being involved in the Feasibility Study, and making reports to both counties and agencies.

### Aquifer Storage and Recovery

2.1. Plan Suggestion: Explore treated and untreated water ASR, among other options, to supplement existing water supply sources in order to meet future demands.

2.2. Plan Suggestion: Continue working with EPA and FDEP to explore rule changes in federal and state underground injection control program to allow for (and encourage) injection of untreated surface and ground water with ASR.

## Floridan Aquifer

3.1. Plan Suggestion: Evaluate potential of using Floridan aquifer to meet future demands, where appropriate.

3.2. Plan Suggestion: Evaluate desalination concentrate disposal options.

3.3. Plan Suggestion: Local users should coordinate their plans with adjoining utilities, as well as the UEC Water Supply Plan.

## Surficial Aquifer Expansion

4.1. Plan Suggestion: The potential of using the Surficial Aquifer System for new and expanded uses should be evaluated on a project by project basis.

4.2. Plan Suggestion: Encourage development of alternative water sources that reduce the reliance on the Surficial Aquifer System.

## Conservation

5.1. Plan Suggestion: Utilities and local governments should implement all public water supply mandatory conservation measures.

5.2. Plan Suggestion: Seek funding for urban and agricultural mobile irrigation laboratories in Martin and St. Lucie counties.

5.2. Plan Suggestion: Implement higher efficiency irrigation systems and other conservation measures where effective.

5.4. Plan Suggestion: Encourage use of alternative water sources for nonpotable uses, versus using potable water.

### Wastewater Reuse

See Example Projects under Water Supply Development later in this chapter.

### Utility Interconnects

6.1 Plan Suggestion: Utilities should evaluate the potential to interconnect reclaimed water systems to transfer reclaimed water from surplus areas to deficit areas.

## FUNDING

This section addresses the funding approach for the Upper East Coast Water Supply Plan. The approach takes into account recent changes made to the state water law during the 1997 legislative session, feedback and comments from the UECWSP Advisory Committee members, and input from District staff.

In general, the funding approach is divided into two major categories: water resource development and water supply development. The water resource development category deals with the funding approach for projects that are primarily the responsibility of the South Florida Water Management District. Water supply development projects, on the other hand, are primarily the responsibility of local governments, utilities, and other users.

### Water Resource Development

The 1997 Florida legislature provided the following definition for water resource development in the amendments made to Chapter 373, F.S:

> "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 program; the construction, operation, and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and ground water recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities (Section 373.019(19)).

The amended statute goes on to state that the water supply plan must contain a water resource development component that includes a listing of water resource development projects. In

addition, each listed project must include, among other things, sources of funding and funding needs (Section 373.0361(2)(b)).

Chapters 5 and 6 of this plan identify a series of proposed water resource development projects. These projects are primarily the responsibility of the District, and each recommendation/strategy includes an estimated cost and funding source. Table 24 identifies a series of potential water resource development funding options originally established in the Governor's Water Supply Development and Funding Report (1997). It appears that most of the recommendations in this plan can be funded through existing sources, except for specific projects that may be recommended by ongoing studies.

The amended statute also requires each water management district governing board 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. Therefore, the advisory committee strongly recommends that the District Governing Board refer to this plan during each annual budget to identify priority projects to be included in the District's annual budget.

**Table 24.** Potential Water Resource Development Funding Options.

| Option | Who collects | Who Pays? | Who Spends? | Estimated Amount | Requirements |
|---|---|---|---|---|---|
| Allocate portion of doc stamp | County tax Collector to DOR | Real estate & loan financing customers | Legislature | 96/97 total-826M 188.6M to Gen Rev potentially available for water resource development | Legislative reallocation |
| Statewide removal of sales tax exemption on bottled water | State (DOR) | Public (end consumers and water users) | WMDs | Not yet determined | Legislative authorization |
| Increase WMD ad valorem tax statutory caps<br><br>*NWFWMD constitutional cap limit | County tax collector to WMDs | Property owners in the district | WMDs | $87.5M/yr for all 5 districts based on legislative cap.<br>****<br>$101.6M state wide in addition to 87.5M above based on constit. cap. | Legislative authorization May impact funding of existing projects that require future increases in funding. e.g.- Everglades Required legislative authorization to constit. cap. |
| New ad-valorem tax | County tax collectors to WMDs and/or local govt. | Property owners in WMD | WMDs and/or local govt. | To be determined | Constitutional amendment |
| Water Use fee | WMDs | Consumptive use permit holders | WMDs | Depends on rate per 1000 gal. Assessed e.g. $.25/1000 gal if all dist levied generated $266.9M/yr for public supply | Legislative authorization |
| Water use fees unmetered | | | | | |
| Statewide removal of sales tax exemption on wells and utilities water sales | State (DOR) | Public (end consumers and water uses) | WMDs | 270M/yr (est at 6%) | Legislative authorization |
| State wide gross receipts tax on water | State (DOR) | Utility – is passed on to customers | WMDs | Depends on rate. If 2.5% is used, could be 110M/yr. | Legislative authority |
| Regulatory fees | State or Co. | Permit recipient | State or Co. | Estimated amount minimal | Legislative authorization and/or county ordinance |
| Franchise fees | State or local govt. | Franchise passed to customer | State or local govt. | To be determined | Legislative authorization and/or contract agreement |
| New taxes general revenue | DOR | Citizens | Legislature | To be determined | Legislative authorization and approp. Congressional appropriation |
| Congressional appropriation | IRS | Citizens of the U.S. | State/WMD | To be determined could be substantial | Congressional authorization and approp. |

Source: Governor's Water Supply Development and Funding Report (1997).

## Water Supply Development

Water supply development was defined by the 1997 Florida legislature as:

> "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 (Section 373.019(21)).

The statute goes on to state 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" (Section 373.0831(2)(c)).

It is not the intent of the legislature for regional water supply plans to 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.

This plan addresses the funding of water supply development projects in three ways: (1) general plan suggestions to local governments and utilities; (2) the District sponsored and funded Alternative Water Supply Funding Program, and (3) other potential funding sources.

### Plan Suggestions

Plan suggestions provide guidance to local governments and utilities on ways to address water supply development opportunities. These are intended to identify projects or studies that local governments or utilities can undertake to further water supply goals. They also include considerations that should be incorporated into water supply development projects.

### Alternative Water Supply Funding Program

In response to recent legislative requirements and in recognition of ongoing District efforts, the District established an Alternative Water Supply Funding Program. Funding for this program comes from a dedicated portion of the District's ad valorem generated budget. The focus and intent of the program is to provide financial assistance to local governments, public or private utilities, and other users for implementation of projects that are consistent with regional water supply plans.

The Alternative Water Supply Funding Program is a cost-share program meaning that any participating agency or group must provide a portion of the funding for the project. The District publishes guidelines for implementing this program that are consistent with the statutory

language provided below. These guidelines, which are available at the District's service centers, address the application and review process, ranking criteria, and the time frame for implementation.

To support the Alternative Water Supply Funding Program and to provide further direction on how the program should be applied in the Upper East Coast region, this water supply plan does two things: First, it provides the statutory requirements for administering the program. Second, examples of the types of projects that would be considered consistent with the program and this water supply plan are identified. The intent of identifying example projects is not to guarantee funding for these projects, nor is the intent to limit funding for only these specific projects. Instead, the intent is to give examples of the types of projects that might be eligible for funding under the Alternative Water Supply Funding Program and that are consistent with this water supply plan.

**Statutory Requirements.** The District has been engaged in cooperative funding programs for alternative water supply projects since the mid-1980s. These programs were formalized by the Florida Legislature in 1995 when it enacted the Alternative Water Supply Funding Act. The intent of this legislation was to encourage water management districts to share a portion of their ad valorem revenues with water users and provide for the development of alternative water supplies. In 1997, the Legislature further refined the District's funding program by distinguishing between water resource development and water supply development in House Bill 715. For purposes of the District's Alternative Water Supply Funding Program, the following statutory language provides the framework for guidelines and criteria:

Alternative Water Supply Funding Act

The following requirements for funding eligibility are codified in Section 373.1961(2):

- The project must be consistent with local government 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 the capital or infrastructure costs for the construction for alternative water supply systems
- The project must service one or more water resource caution areas
- The project must fall within guidelines established by the district

House Bill 715:

The following requirements were established by House Bill 715 and are now contained in Section 373.0831(4)(a):

Water supply development projects which are consistent with the relevant regional water supply plans and which meet one or more of the following criteria shall receive priority consideration for state or water management district funding assistance:

- The project supports establishment of a dependable, sustainable supply of water which is not otherwise financially feasible;
- The project provides substantial environmental benefits by preventing or limiting adverse water resource impacts, but require funding assistance to be economically competitive with other options; or
- The project significantly implements reuse, storage, recharge, or conservation of water in a manner that contributes to the sustainability of regional water sources.

"Water supply development projects which meet the criteria in paragraph (a) and also bring about replacement of existing sources in order to help implement a minimum flow or level shall be given first consideration for state or water management district funding assistance" (Section 373.0831(4)(b)).

**Example Projects.** Following is a list of example projects that might be considered for participation in the District's Alternative Water Supply Funding Program. These examples were compiled from advisory committee meetings and staff discussions. It is important to reemphasize that the list is not intended to guarantee that these projects would be approved for District funding, nor does the list imply that funding is limited to only these projects. Instead, the list is intended to provide guidance to local governments and public and private utilities on the types of projects that would be eligible for participation in the program.

- Development of wastewater reuse programs.
- Development of aquifer storage and recovery (ASR) technology to supplement water supply.
- Development of alternative desalination concentrate disposal options.
- Implementation of water supply conservation measures.
- Implementation of utility interconnects for water supply and emergency purposes.
- Construction of stormwater retention/detention systems to minimize excess runoff, and thereby increase ground water recharge, by incorporating maximum volume discharges along with maximum rate discharges.
- Development of alternative water source options, such as the Floridan aquifer and reverse osmosis treatment.

## Other Funding Sources

The third and final way that this plan addresses funding of water supply development projects is by identifying other potential funding sources. The Governor's Water Supply Development and Funding Report (1997) provides an excellent listing of potential funding options for water supply development. This listing is presented in Table 25.

**Table 25.** Potential Water Supply Development Funding Options.

| Option | Who Collects | Who Pays? | Who Spends? | Estimated Amount | Requirements |
|---|---|---|---|---|---|
| *Water conservation rate structure | Government owned and privately owned water utilities | Utility customer | Local govt./utilities | Could be designed to generate any targeted $$ amount needed | Legislative authority to PSC for Investor owned utilities. Local ordinance by governing body for implementation |
| *Statewide removal of sales tax exemption on bottled water | State (DOR) | Public (end consumer and water users) | WMDs | Not yet determined | Legislative authorization |
| *Local option removal of sales tax exemption on wells and utilities water sales | State (DOR) | Public (end consumer) | Government owned and privately owned water utilities | $270 M/yr (est at 6% statewide). Local amounts would vary based on local implementation) | Legislative repeal exemption from 6% sales tax on water, bottled water and utility provided water |
| *Local option gross receipts tax on water | State (DOR) | Utility – is passed on to customers | Government owned and privately owned water utilities | Depends on rate. If 2.5% is used, could be 10M/yr | Legislative authorization |
| Private investment | Investor owner utilities | Private investors or private/public partners | IOUs and partners | Unlimited | |
| Special assessments | Local govt. | Property owners in affected area | Local govt. | To be determined | Local ordinance/referendum |
| Water rate increases | Local govt. | End consumers and water users | Local govt. | To be determined | Local govt. decision |

*New sources of funding.
Source: Governor's Water Supply Development and Funding Report (1997).

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