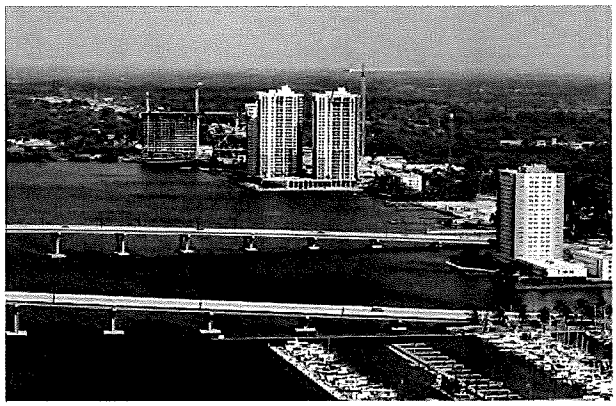
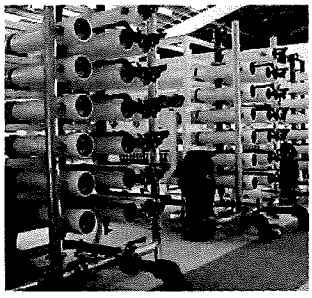
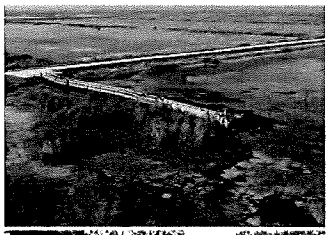
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Planning Document






LOWER WEST COAST
WATER SUPPLY PLAN UPDATE

2018

Acknowledgements

The South Florida Water Management District (SFWMD) recognizes and thanks the Water Resources Advisory Commission Regional Water Supply Workshop participants for their contributions, comments, advice, information, and assistance throughout the development of this plan update.

Furthermore, the SFWMD expresses appreciation to all SFWMD staff who contributed to the development and production of this plan update.

For further information about this document, please contact:

Linda Hoppes, AICP
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
Telephone: (561) 682-2213
Email: lhoppes@sfwmd.gov

Errata

The South Florida Water Management District's Governing Board approved this *2012 Lower West Coast Water Supply Plan Update* in November 2012. Since approval, the publication dates of two documents cited in this update have changed as follows:

- The *2011–2012 Water Supply Plan Support Document* (SFWMD 2012a) will be published as the *2011–2013 Water Supply Plan Support Document.*
- The *2012 Lower East Coast Water Supply Plan Update* (SFWMD 2012b) will be published as the *2013 Lower East Coast Water Supply Plan Update.*

Executive Summary

This plan update provides an assessment of the water supply for the South Florida Water Management District's (SFWMD's) Lower West Coast (LWC) Planning Area through 2030. The first *Lower West Coast Water Supply Plan*, completed in 1994, was updated in 2000 and again during 2005–2006. This plan update augments the knowledge and assumptions of past plans, including local and regional efforts completed since the last update. This current plan update presents water demand estimates, water supply issues and evaluations, water source options, and water resource and water supply development projects to ensure that future water supplies are adequate to support the region's growth while sustaining its natural systems.

This plan update concludes that the future water demands of the LWC Planning Area can continue to be met through the 2030 planning horizon with appropriate management and continued diversification of water supply sources. Several steps are needed to achieve this conclusion:

- Completion of water supply utility projects
- Evaluation of site-specific refinement of groundwater availability
- Completion of the Comprehensive Everglades Restoration Plan (CERP) Caloosahatchee River (C-43) West Basin Storage Reservoir Project

The water supply needs for natural systems are discussed in **Chapter 3,** and **Appendices G** and **H** and are considered a limitation on water available for allocation. These water supply needs are addressed through a variety of regulatory mechanisms and projects.

In the Lake Okeechobee Service Area portion of the planning region, local conditions limit the volume of available fresh water. Specifically, the Lake Okeechobee Waterbody, a defined source that includes hydraulic connections that receive water from the lake such as the Caloosahatchee River (C-43 Canal), is a limited source due to implementation of the 2008 Lake Okeechobee federal regulation schedule, referred to as 2008 LORS, and concerns regarding the lake's Minimum Flow and Level (MFL) criteria. Concerns about integrity of the Herbert Hoover Dike and the lake's ecology prompted in the United States Army Corps of Engineers (USACE) to implement the 2008 LORS. This schedule operates the lake at lower levels. Analysis associated with the 2008 LORS assessed impacts on water supply performance and projected a decline in the physical level of certainty of users reliant on lake water supplies. This level of certainty is projected to decline from experiencing water shortage restrictions only every 1-in-10 years to experiencing restrictions every 1-in-6 years while the lake is being operated under the 2008 LORS. Repairs to the dike are under way and are expected to be completed by 2030, which is the end of the planning horizon for this plan (current estimated schedule for completion is 2022 — S. Kaynor, USACE, personal communication). As a result of the impacts to water supply, the SFWMD enacted rules to limit future additional withdrawals from the Lake Okeechobee Waterbody in order to prevent further degradation of the level of certainty for existing legal users. Any increase in

the lake's regulation schedule as a result of the Herbert Hoover Dike repairs by the USACE would be evaluated by the USACE through a National Environmental Policy Act analysis. It is anticipated the additional water from Lake Okeechobee as a result of Herbert Hoover Dike repairs and a revised regulation schedule would return the lake from MFL recovery status to MFL prevention status, enhance the level of certainty to existing permitted users now receiving less than 1-in-10 level of certainty, and support environmental objectives.

Construction of the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project will allow capture and storage of surface water runoff from the C-43 Basin and Lake Okeechobee to provide a consistent flow of fresh water to the estuary. After construction and flow-through testing, operation of this project is expected to improve the Caloosahatchee Estuary's salinity balance by reducing a portion of the peak discharges during the wet season and providing essential flows during the dry season. The project is awaiting congressional authorization and appropriation of funds to start construction. The USACE anticipates the project authorization will occur in August 2013 with appropriation of funding to follow later. Once congressional funding has been appropriated, a timetable for the completion of the reservoir will be developed.

To meet the region's future water needs, this plan update advocates continued development of alternative water supplies, including increased use of the Floridan aquifer system and reclaimed water, as well as increased emphasis and implementation of appropriate water conservation practices and water storage for dry season use. In addition, continued construction of area-critical ecosystem restoration projects and studies to identify additional sources of water for agriculture are needed. Water users, including utilities and local governments, are recognized for their proactive efforts, including previous and ongoing development of alternative water sources. These contributions help to ensure that the water needs of this region will be met.

This plan update incorporates the water supply development projects proposed by Public Water Supply utilities to meet their future needs. Local governments, in coordination with utilities, will address these projects as they revise their 10-year water supply facilities work plans, which require submittal to the State of Florida Department of Economic Opportunity and reviewing agencies within 18 months of approval of this plan update.

This plan update was developed in an open public forum with water utilities, local governments, environmental organizations, agricultural interests, and other stakeholders through the SFWMD's Water Resources Advisory Commission. The process to develop the population and water demand projections began in 2009. It included many meetings with water users, local governments, industry representatives, agencies, and utilities. Workshops were also held during the plan development process to solicit input and provide information about planning results and progress.

This update includes this document, referred to as the Planning Document, as well as an accompanying Appendices, and the *2011–2012 Water Supply Plan Support Document* (SFWMD 2012a). All of these documents are available in PDF format from http://www.sfwmd.gov/watersupply.

Introduction (Chapter 1)

The LWC Planning Area includes all of Lee County, most of Collier County, and portions of Hendry, Glades, Charlotte, and mainland Monroe counties. The region generally reflects the drainage patterns of the Caloosahatchee, Imperial, Estero, and Cocohatchee river basins. This planning area includes numerous coastal and inland natural systems including Big Cypress Swamp, Fakahatchee Estuary and Picayune Strand State Forest, Estero Bay, Caloosahatchee River and Estuary, and Ten Thousand Islands. Big Cypress Basin and the Picayune Strand State Forest are extraordinary natural areas in south Florida, both containing a variety of wetlands and forest types specific to the region. Estero Bay is one of Florida's most significant natural watershed resources, and Estero Bay Preserve State Park was designated as the state's first aquatic preserve. The Rookery Bay National Estuarine Research Reserve encompasses 110,000 acres of native habitat located at the western edge of the Everglades.

The LWC Planning Area is currently home to nearly one million permanent residents who live mainly in the northwestern, coastal portions of the planning area. Information in this plan update reflects the influence of significant fluctuations in the economy, residential and commercial development, and agricultural commodity markets on water users and the projected water needs of the planning area.

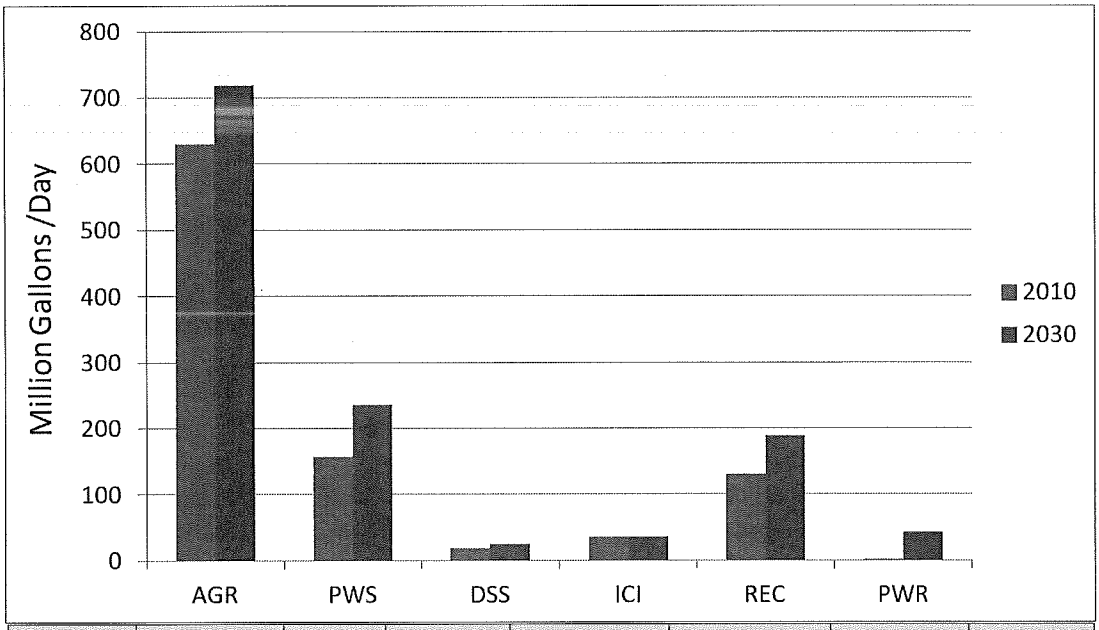
Demand Estimates and Projections (Chapter 2)

The population of an area greatly affects its water needs. The LWC Planning Area's population is projected to increase 51 percent over the 20-year planning horizon. This rise in population creates significant increases in water demands for Public Water Supply, Recreational/Landscape Self-Supply, and Power Generation Self-Supply uses.

In 2010, average annual gross water demands for all categories in the LWC Planning Area totaled 971.1 million gallons of water per day (MGD). By 2030, the projected total average annual gross water demands are estimated to range from 1,217.9 to 1,262.9 MGD, an increase of 25 to 30 percent. The figure on the next page shows the estimated 2010 gross demands and projected 2030 gross demands for all water use categories.

Agriculture remains the largest water user in the LWC Planning Area and is expected to continue as the dominant land use. Citrus is the area's primary crop. Agricultural acreage is predominantly located inland in north-central Collier, eastern Lee, Hendry, and Glades counties. Current lands used for agricultural operations are expected to remain in service during the planning horizon despite recent acreage losses due to economic challenges, lands needed for the CERP, hurricane damage, and citrus diseases. For this plan update, actively cultivated agricultural acreage is expected to range from 333,127 to 362,127 acres by 2030, with a gross water demand estimate of approximately 696 to 741 MGD.

Estimated daily gross demands for an average year by water use category for 2010 and 2030



	Agricultural Self-Supply	Public Water Supply	Domestic Self-Supply	Industrial/ Commercial/ Institutional Self-Supply	Recreational/ Landscape Self-Supply	Power Generation Self-Supply	Total
Estimated 2010 MGD	630.0	156.3	18.9	35.3	130.1	0.5	971.1
Projected 2030 MGD	695.9–740.90	232.1	24.0	35.3	188.5	42.1	1,217.9 – 1,262.9
Percent Change	10–18%	49%	27%	0%	45%	8,320%	25–30%
Percent of Projected 2030 Total	57–59%	19%	2%	3%	15%	3%	

Notes: The bar chart compares demands by use category in million gallons of water per day (MGD), and the table shows the percentage of growth in each category. Percent of Projected 2030 Totals other than Agricultural Self-Supply are calculated based on the upper range limit of demand (1,266.1 MGD).

Projected total 2030 gross water demands are 522 MGD for all water uses except Agricultural Self-Supply. Urban demand estimate and projection highlights for the planning area include the following:

- The greatest regional population growth is expected in Lee and Collier counties, where most of the planning area population currently lives.
- Public Water Supply and Domestic Self-Supply gross demands are projected to increase by 46 percent, from an estimated 175 MGD in 2010 to 256 MGD by 2030, representing at least 20 percent of the region's total gross demands by 2030.

- Recreational/Landscape Self-Supply gross demands are expected to increase from an estimated 130 MGD in 2010 to 188.5 MGD by 2030, a gain of 45 percent with most of the additional demand originating from areas other than golf course acreage.
- Power Generation Self-Supply demands are expected to increase from 0.5 MGD in 2010 to 42.1 MGD by 2030. Such an increase may occur to support new or expanded power generation facilities planned by Florida Power & Light, south Florida's major power supplier.

Issues and Evaluation (Chapter 3)

As a result of the water supply planning effort required to produce this plan update, the SFWMD has determined that the conclusions of previous evaluations are applicable to the current 20-year planning horizon. No additional numerical modeling was conducted.

The primary water supply issues influencing water supply planning efforts to meet 2030 projected water needs in the LWC Planning Area include the following:

- Increased withdrawals from the surficial aquifer system and the freshwater portion of the intermediate aquifer system are generally limited due to potential impacts on wetlands and existing legal water users including Domestic Self-Supply, the potential for saltwater intrusion, and the possibility of reaching the maximum developable limits of aquifers. New or increased allocations will be evaluated on an application-by-application basis to determine if the project meets consumptive use permitting criteria.
    - In some areas, Domestic Self-Supply cumulative withdrawals are having an effect on aquifer water levels.
- Surface water allocations from Lake Okeechobee and hydraulically connected surface waters are limited by the Lake Okeechobee Service Area Restricted Allocation Area criteria.
    - The results of the 2008 LORS process indicated that the level of certainty is projected to decline from the consumptive use permitting standard of experiencing water shortage restrictions every 1-in-10 years to experiencing restrictions every 1-in-6 years while the lake is operated under the 2008 LORS.
- Peak freshwater discharges during the wet season are affecting the health of the Caloosahatchee Estuary and additional storage is required in both the basin and the regional system to attenuate damaging peak flow events.
- Surface water availability and current storage capacity is insufficient for the Caloosahatchee River and Estuary during dry conditions.

The assessment contained in **Chapter 3** also confirms that historically used water sources alone are not adequate to meet the LWC Planning Area's growing water needs through 2030.

Over the past decade, water users have already made significant progress by diversifying supply sources and reducing reliance on the surficial and intermediate aquifer systems:

- The majority of coastal utilities within the planning area are using brackish water from the Floridan aquifer system to meet all or a portion of their future water demands. The following utilities use all or some of the Floridan aquifer system for production of their drinking water: Cape Coral, Fort Myers, Clewiston, Island Water, and Greater Pine Island.
- Reclaimed water use in the area has increased significantly, offsetting the use of groundwater.
- Conversion to more efficient irrigation systems and implementation of agricultural best management practices continue.

For Public Water Supply, continued development of the Floridan aquifer system and expansion of utility service areas to meet the growing needs for potable water show the most promise for satisfying future water demand. To meet landscape irrigation needs, increased use of reclaimed water and conservation are the region's best options. Agricultural irrigation uses surface water from primary canals supplemented with groundwater. Tailwater recovery systems are successful in reducing resource use, but adequate slope and drainage conditions are necessary and this does not meet the water needs in a drought. Increased water conservation is essential among all water users. However, some water resource problems can be solved only on an application-by-application basis due to the high variability of the water supply across the region.

In 2001, the SFWMD established MFL criteria for the Caloosahatchee River and Estuary. Because the MFL criteria was projected to be exceeded until storage in the watershed was constructed, a recovery strategy was also established. An updated MFL recovery strategy is contained in **Appendix G.**

Evaluation of Water Source Options (Chapter 4)

In the LWC Planning Area, historical water sources include fresh groundwater from the surficial and intermediate aquifer systems, and surface water primarily from the Caloosahatchee River and canals. However, from a regional perspective, development of the surficial and intermediate aquifers for potable water has been generally maximized over time, and potential increases in production are limited, especially in coastal areas. The region's alternative water supply sources include brackish groundwater from the Floridan aquifer system, reclaimed water, and limited storm water captured and stored during the rainy season for later beneficial use. Water conservation is also an essential water source option for the planning area. In the LWC Planning Area, the Floridan aquifer system and portions of the intermediate aquifer system are brackish (slightly salty) water sources that require desalination treatment before potable use. In 2009, 42 percent (45 MGD) of the water used to meet drinking water needs originated from these brackish aquifers. Over the 20-year planning period, development of these brackish sources will far outpace development of freshwater sources. In this plan update, local governments propose 70 MGD of brackish water treatment capacity for the planning area by 2030. Agricultural Self-Supply

and Recreation/Landscape Self-Supply users continue to rely primarily on fresh water with stormwater retention ponds as supplemental water supply for crop irrigation.

Storage is an essential component of any water supply system experiencing fluctuation in supply and demand. Two-thirds of south Florida's annual rainfall occurs in the wet season, but without sufficient storage capacity, much of this water discharges to tide. In the LWC Planning Area, potential types of needed water storage include aquifer storage and recovery wells, off-stream reservoirs, and surface water impoundments and ponds.

Reclaimed water is a key component of water resource management in the planning area. Thirty-eight wastewater treatment facilities reuse all or a portion of their wastewater. Potential uses of reclaimed water include landscape and agricultural irrigation, groundwater recharge, industrial uses, and environmental enhancement. In the LWC Planning Area, the volume of reclaimed water used for beneficial purposes has doubled from 1994 to 2010. In 2010, over 77 MGD (91 percent) of the wastewater treated in the planning area was reused for a beneficial purpose, primarily for irrigation. However, 9 MGD of potentially reusable water was disposed of via deep well injection or discharged to surface waters. Wastewater flows are projected to increase to more than 139 MGD by 2030. To maximize the use of reclaimed water, utilities should continue to implement feasible options to extend their supply of reclaimed water, such as supplemental sources, metering for residential customers, tiered rate structures, limiting days of the week for landscape irrigation, and interconnects with other reclaimed water utilities.

Proactive, cooperative water conservation efforts among water users, utilities, local governments, and the SFWMD are also necessary to accomplish water savings. Efficient water use and conservation produces the most inexpensive water — water not wasted. It is possible to achieve significant potential water savings through increased water conservation efforts, such as retrofitting older plumbing fixtures with high efficiency fixtures in residential, industrial, commercial, and institutional units, and increased limitations on landscape irrigation. Goal-based water conservation plans allow utilities to achieve goals within their consumptive use permits to help meet future water supply needs. Water conservation plans should include general policies, such as water conservation ordinances, public education, and retrofits of indoor and outdoor devices.

Since 2003, the LWC Planning Area has implemented year-round landscape irrigation conservation measures. In March 2010, this was expanded throughout the SFWMD boundaries with the adoption of the Mandatory Year-Round Landscape Irrigation Conservation Measures Rule (Chapter 40E-24, Florida Administrative Code). Broadly, this rule limits landscape irrigation to two days per week, with a provision for irrigation up to three days per week in counties wholly located within the jurisdictional boundaries of the SFWMD, including Collier, Glades, Hendry, and Lee counties. The rule also provides local governments with the flexibility to adopt alternative landscape irrigation ordinances that are at least as stringent as the Mandatory Year-Round Landscape Irrigation Conservation Measures Rule. In the planning area, Lee County and the City of Cape Coral have adopted two-day-per-week irrigation limits.

Water Resource Development Projects and Water Supply Development Projects (Chapters 5 and 6)

Florida water law identifies two types of projects to meet water needs: water resource development projects and water supply development projects. Water resource development projects, such as regional modeling and data collection, are generally the responsibility of the SFWMD. Water users are generally responsible for water supply development projects.

In the LWC Planning Area, the SFWMD's corporate environmental database, DBHYDRO, for monitoring stations includes 298 surface water stations and 157 wells in Lee, Collier, Glades, and Hendry counties combined. A Floridan aquifer system monitor well network was established in the planning area to monitor water levels and quality. Water level and salinity monitoring is critical to assess the potential for movement of highly saline water from the deeper portions of the Floridan aquifer system or inland from the coast.

During 2011, the calibration of the Lower West Coast Floridan Aquifer System Model was completed and peer review recommendations based on the previously developed model were implemented. The completed model will be placed in the SFWMD's Library of Models for future application and to answer specific planning-level questions.

The Lower West Coast Surficial Aquifer System Model, a groundwater flow model, needs to be updated to include the intermediate aquifer system and will then require a peer review that is tentatively scheduled for Fiscal Year 2014. This model examines the potential impacts of existing and future groundwater withdrawals from the surficial aquifer system and intermediate aquifer system.

The SFWMD offers two cost-share funding programs to assist local water users with development of alternative water supplies and water conservation: the Alternative Water Supply Funding Program and the Water Savings Incentive Program, referred to as WaterSIP:

- The Alternative Water Supply Funding Program provides cost-share funding for conservation or alternative water supply sources including brackish water from the Floridan aquifer system, reclaimed water (treated wastewater), excess storm water during the rainy season, sources made available through the creation of new storage capacity, and any other sources designated as nontraditional. Between Fiscal Years 2007 and 2012, 78 water supply development projects were funded by the Alternative Water Supply Funding Program in the LWC Planning Area and have created a total of 104 MGD of new water capacity.

- Through the WaterSIP, the SFWMD provides matching funds up to $50,000 to water providers and users for non-capital water efficiency improvement projects. In the LWC Planning Area, between Fiscal Years 2007 and 2012, the SFWMD awarded $627,456 for 23 WaterSIP projects, representing a projected savings of 178 million gallons per year.

A table summarizing the implementation schedule and costs for districtwide water resource development projects through Fiscal Year 2014 is included in **Chapter 5**. The 36 multiphased Public Water Supply facility projects proposed for Fiscal Years 2012 through 2030 (**Chapter 6**) are anticipated to add 141.1 MGD of new capacity, which is more than sufficient to meet future projected Public Water Supply demands. These proposed projects include 17 potable and 19 non-potable water supply development projects.

The SFWMD's planning process is closely coordinated and linked to the water supply planning of local governments and utilities. In the LWC Planning Area, 24 utilities serve 17 local governments. A utility summary is included at the end of **Chapter 6** for each Public Water Supply utility supplying 0.1 MGD or greater to its service area. These summaries provide population and demand projections, proposed water sources, and specific Public Water Supply development projects.

Future Directions (Chapter 7)

The future direction of water supply for the LWC Planning Area includes further diversification of water sources to meet the needs of all water users, as well as water conservation, coordination, and monitoring to respond to rising sea levels. The SFWMD's guidance concerning water source options includes the following:

- Gaining an improved understanding of the impact of long-term, sustained withdrawals from the Floridan aquifer system. Upon completion of the Lower West Coast Surficial Aquifer System Model, the SFWMD intends to examine the potential impacts of existing and future groundwater withdrawals from the surficial aquifer system.
- To maximize the use of reclaimed water, utilities should continue to implement feasible options to extend their supply of reclaimed water, such as supplemental sources, metering for residential customers, tiered rate structures, limiting days of the week for landscape irrigation, and interconnects with other reclaimed water utilities.
- Continuing a strong emphasis on water conservation, the SFWMD suggests implementing user-specific water conservation plans and two-day-per-week irrigation ordinances where feasible.
- Regularly reviewing saltwater intrusion monitoring and revising monitoring regimes to address and respond to the effects of climate change.
- Construction of the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project and other CERP and local government projects to provide additional water storage. All of the water made available by the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project will be reserved. The SFWMD's objective is to ensure that all water contained in the reservoir is protected for the natural system. The SFWMD is currently in the process of developing a water reservation rule for the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project.

- Additional efforts to better understand the aquifer system, including the Sandstone aquifer and identification of areas of available fresh water, are needed to meet future needs, especially agriculture.
- Facilitate discussions with local governments to assist with a long-term water supply strategy for sustainable Domestic Self-Supply in the Lehigh Acres area.

The SFWMD concludes that the future water demands of the region can continue to be met through the 2030 planning horizon with appropriate management and continued diversification of water supply sources. Several steps are needed to achieve this conclusion:

- Completion of water supply utility projects
- Evaluation of site-specific refinement of groundwater availability
- Completion of the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project

Successful implementation of this plan update requires coordination with other regional and local government planning efforts and continued public participation in guiding the plan implementation process.

Table of Contents

List of Tables

List of Figures

Acronyms and Abbreviations

1994 LWC Plan	*1994 Lower West Coast Water Supply Plan* (SFWMD 1994)
2000 LWC Plan	*2000 Lower West Coast Water Supply Plan* (SFWMD 2000b)
2005–2006 LWC Plan Update	*2005–2006 Lower West Coast Water Supply Plan Update* (SFWMD 2006)
2008 LORS	2008 Lake Okeechobee Regulation Schedule
AFSIRS	Agricultural Field Scale Irrigation Requirements Simulation
AGR Self-Supply	Agricultural Self-Supply
ASR	aquifer storage and recovery
Basis of Review	*Basis of Review for Water Use Permit Applications within the South Florida Water Management District* (SFWMD 2010a)
BEBR	Bureau of Economic and Business Research
BMP	best management practice
CERP	Comprehensive Everglades Restoration Plan
cfs	cubic feet per second
CREW	Corkscrew Regional Ecosystem Watershed
DBHYDRO	South Florida Water Management District's corporate environmental database
DSS	Domestic Self-Supply
EQIP	Environmental Quality Improvement Program
ET	evapotranspiration
F.A.C.	Florida Administrative Code
FAS	Floridan aquifer system
FAWN	Florida Automated Weather Network
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FGUA	Florida Government Utility Authority
FPL	Florida Power & Light
F.S.	Florida Statutes
FY	Fiscal Year
GPD	gallons per day
IAS	intermediate aquifer system

ICI Self-Supply	Industrial/Commercial/Institutional Self-Supply
IFAS	Institute of Food and Agricultural Sciences
LWC Planning Area	Lower West Coast Planning Area
LWCFAS Model	Lower West Coast Floridan Aquifer System Model
LWCSAS Model	Lower West Coast Surficial Aquifer System Model
MDL	maximum developable limit
MFL	Minimum Flow and Level
MGD	million gallons of water per day
mg/L	milligrams per liter
MGY	million gallons of water per year
MIL	mobile irrigation laboratory
MODFLOW	Modular Three-dimensional Finite-difference Groundwater Flow Model
NA	not applicable
NGVD	National Geodetic Vertical Datum of 1929
PCUR	per capita use rate
psu	practical salinity unit
PWR Self-Supply	Power Generation Self-Supply
PWS	Public Water Supply
REC Self-Supply	Recreational/Landscape Self-Supply
RO	reverse osmosis
SAS	surficial aquifer system
SEAWAT	fully coupled or uncoupled density-dependent flow and transport model
SFWMD	South Florida Water Management District
Southwest Florida Feasibility Study	*Draft Southwest Florida Feasibility Study Integrated Feasibility Report and Environmental Impact Statement* (USACE and SFWMD 2009)
Support Document	*2011–2012 Water Supply Plan Support Document* (SFWMD 2012a)
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
Water CHAMP	Water Conservation Hotel and Motel Program
WaterSIP	Water Savings Incentive Program
WCAs	Water Conservation Areas
WRAC	Water Resources Advisory Commission

1 Introduction

The South Florida Water Management District (SFWMD) updates regional water supply plans to provide for current and future water needs, while protecting south Florida's water resources. This plan update assesses existing and projected water needs and water sources to meet those needs over a 20-year planning horizon from 2010 to 2030 for the Lower West Coast (LWC) Planning Area. The update presents current and projected populations, water demand, water resource and water supply development projects, and related water supply planning information. The plan also describes proposed water supply projects and regional project implementation strategies for Fiscal Year (FY) 2010 through FY 2030. This current plan is a five-year plan update of the *2005–2006 Lower West Coast Water Supply Plan Update* (2005–2006 LWC Plan Update; SFWMD 2006), which updated the *2000 Lower West Coast Water Supply Plan* (2000 LWC Plan; SFWMD 2000b).

TOPICS

- Population Projections and Water Demands
- Current Update
- Legal Authority and Requirements
- Need for Alternative Water Sources
- Water Supply Planning
- Planning Area Background
- Progress Since the 2005–2006 LWC Plan Update
- Outlook on Climate Change
- Water Supply Planning for the Next 20 Years

POPULATION PROJECTIONS AND WATER DEMANDS

Projections developed for this update estimate the LWC Planning Area's population will increase by over 51 percent, from approximately 993,000 residents in 2010 to more than 1.5 million residents by 2030. In contrast, the 2005–2006 LWC Plan Update projected the planning area's population to increase by 74 percent, with the total population reaching 1.5 million by 2025.

NAVIGATE

This update consists of this Planning Document, an Appendices, and the *2011–2012 Water Supply Plan Support Document* (SFWMD 2012a). These documents are available from the SFWMD's Water Supply website at http://www.sfwmd.gov/watersupply.

In this update, projected gross water demands for 2030 for the region's Public Water Supply (PWS) and Domestic Self-Supply (DSS) are 256.1 million gallons of water per day (MGD). This demand projection represents a 46 percent increase from 175.2 MGD in 2010.

While PWS and DSS are anticipated to be at least 20 percent of the LWC Planning Area's total gross demands by 2030, the Agricultural (AGR) Self-Supply use category is projected to remain the LWC Planning Area's single largest water user category in 2030. Agricultural gross water demand is projected to increase from 630 MGD in 2010 to approximately 696–741 MGD in 2030, representing at least 57 percent of the LWC Planning Area's total gross demands.

CURRENT UPDATE

This plan update reflects the influence of significant fluctuations in the economy, residential and commercial development, agricultural commodity markets, and sustainable use of natural resources on the projected water needs of the LWC Planning Area. **Chapter 2** of this update documents the population growth and water demand by each water use category. **Chapter 3** discusses changes to the water resources, their availability, and related issues facing the region. **Chapter 4** evaluates the planning area's various water source options. **Chapter 5** identifies water resource development projects while **Chapter 6** describes water supply development projects. **Chapter 7** provides future guidance and direction. A glossary and a reference section are provided at the end of the document.

LEGAL AUTHORITY AND REQUIREMENTS

The legal authority and requirements for water supply planning are included in Chapters 373, Florida Statutes (F.S.), with additional direction located in Chapters 403 and 187, F.S. In accordance with Florida's Water Protection and Sustainability Program, regional water supply plans and local government comprehensive plans must ensure adequate potable water facilities are constructed and concurrently available with new development.

LAW / CODE

Subsection 373.709(1), F.S. states the following:

The governing board of each water management district shall conduct water supply planning for any water supply planning region within the district identified in the appropriate district water supply plan under Section 373.036, F.S., where it determines that existing sources of water are not adequate to supply water for all existing and future reasonable-beneficial uses and to sustain the water resources and related natural systems for the planning period.

Consumptive Use Permitting

The SFWMD's Consumptive Use Permitting Program minimizes contention for water resources and plays an important role in resource protection. Consumptive use permitting protects the supply and quality of groundwater and surface water resources by ensuring that water use is reasonable, beneficial, and consistent with the public interest, and that it does not interfere with existing legal uses (see Chapter 40E-2, Florida Administrative Code [F.A.C.], and Section 373.223, F.S.).

GOAL

The SFWMD's strategic goal for all of its water supply planning efforts is to ensure an adequate supply of water to protect natural systems and meet all existing and projected reasonable-beneficial uses, while sustaining water resources for future generations. Specifically, the goals of this update are to identify enough sources of water to meet the needs of all reasonable-beneficial uses within the LWC Planning Area through 2030 during a 1-in-10 year drought event (a drought expected to have a return frequency of once in 10 years), and to sustain the region's water resources and natural systems.

Restricted Allocation Areas

Restricted Allocation Areas limit specific water resources from further allocation in various geographic areas. In October 2008, the SFWMD adopted Restricted Allocation Area criteria for the Lake Okeechobee Service Area. This criterion is provided in Section 3.2.1 of the *Basis of Review for Water Use Permit Applications within the South Florida Water Management District*, referred to as the Basis of Review (SFWMD 2010a). These criteria limit surface water withdrawals from Lake Okeechobee and all surface water hydraulically connected to the lake. By connection to the lake, the Caloosahatchee River (C-43 Canal) and the St. Lucie River (C-44 Canal) in the Upper East Coast Planning Area are subject to these Restricted Allocation Area criteria. By limiting the availability of surface water for new consumptive use allocations, these criteria protect the rights of existing legal users, as well as the region's water resources. For more information see the *2012 Lower East Coast Water Supply Plan Update* (SFWMD 2012b).

Water Reservations

A Water Reservation is a legal mechanism to set aside water from consumptive water use for the protection of fish and wildlife or public health and safety.

A Water Reservation in support of the Comprehensive Everglades Restoration Plan (CERP) Picayune Strand Restoration Project became effective in July 2009. This reservation sets aside water for the natural system

Picayune Strand

(Rule 40E-10.041, F.A.C.). It also affects the availability of surface water and groundwater in the Picayune Strand area of the LWC Planning Area as described in the Basis of Review (see also **Chapter 3** of this update).

NEED FOR ALTERNATIVE WATER SOURCES

The collective result of economic, commercial, and residential development, and market changes in the LWC Planning Area reinforces the need for local governments to develop alternative water supply sources to ensure adequate future water supplies. As stated in the 2005–2006 LWC Plan Update, traditional (historical water sources) fresh groundwater and surface water supplies are not expected to be adequate to meet projected water demands for the region. Meeting water supply demand projections over the 20-year planning horizon (2010–2030) requires a continued focus on water conservation and non-traditional water supply solutions.

As part of the 2005–2006 LWC water supply planning effort, local governments and water suppliers in the LWC Planning Area worked closely with the SFWMD to identify and develop potable water supply projects to meet projected water needs. Proposed projects were then included in local government comprehensive plans. Since the 2005–2006 LWC Plan Update, the SFWMD has continued to work closely with staff from PWS utilities to identify water supply development projects for this update. **Chapter 6** of this update discusses water supply development projects for the LWC Planning Area and **Appendix C** summarizes these projects.

WATER SUPPLY PLANNING

This update describes how anticipated water supply needs will be met in the LWC Planning Area for the 20-year planning horizon (2010–2030). This update also describes and meets existing statutory requirements, including listing proposed water supply projects and regional project implementation strategies for planners, policy makers, and utility directors. This update contains a list of water supply projects for FY 2010 through FY 2030. The majority of new water needs will be met through the development of alternative water supplies. Some traditional water supply development may be possible where appropriate local hydrologic conditions are present and regulatory requirements are met.

SFWMD

Role of the SFWMD

The SFWMD performs water supply planning for each region within its jurisdiction. The SFWMD's mission is to manage and protect the water resources of the region by balancing and improving water quality, flood control, natural systems, and water supply. The agency serves local governments by supporting efforts to safeguard existing natural resources and meet future water demands.

Consistent with the state's statutory requirements, as long as funding is available, the alternative water supply projects listed in this update are eligible for cost-sharing consideration through a separate annual funding process established by the SFWMD's Governing Board.

Planning Process

The planning process for developing this update is described in **Table 1** and **Figure 1**.

Table 1. Planning process for developing this update.

PLANNING PROCESS			
1	2	3	4
Planning and Assessment	**Data Collection of Population, Finished Water, and Proposed Projects; Analysis; and Issue Identification**	**Evaluation of Water Resources and Water Source Options**	**Identification of Water Resource and Water Supply Development Projects**
The development process for this plan update incorporated extensive public participation, including seven public workshops, as well as coordination with local governments, adjoining water management districts, and other state and federal agencies. A review of previous planning efforts in the region and documentation of activities since the approval of the 2005–2006 LWC Plan Update were key starting points of this process. Planning integrated development of 2030 demand projections; assessment of existing and projected resource conditions; and formulation of strategies to meet urban, agricultural, and environmental water needs.	Using the 2005–2006 LWC Plan Update as a foundation, this water supply plan update involved collecting the latest information about water resources, rainfall, natural resources, water demands, water conservation, and land use. Analyses, such as groundwater and surface water evaluations, regulatory information, mapping, wetland studies, and other related data, confirmed the validity of previously identified issues and helped identify new issues.	The next phase of the planning process involved reviewing existing solutions or developing new solutions to address the identified issues. In areas where projected demands exceed available supplies, solutions include alternative water supplies and water conservation. Source options were evaluated and appropriate responsibilities were identified.	Water supply projects intended to meet water needs for the next 20 years were identified, compiled, and evaluated by the SFWMD with input from stakeholders, the public, and other agencies. The projects have undergone initial screening for feasibility and has a likelyhood of being permitted. This information was used to create **Chapter 6**: Water Supply Development Projects, which evaluates existing and proposed supplies relative to projected future water demands.

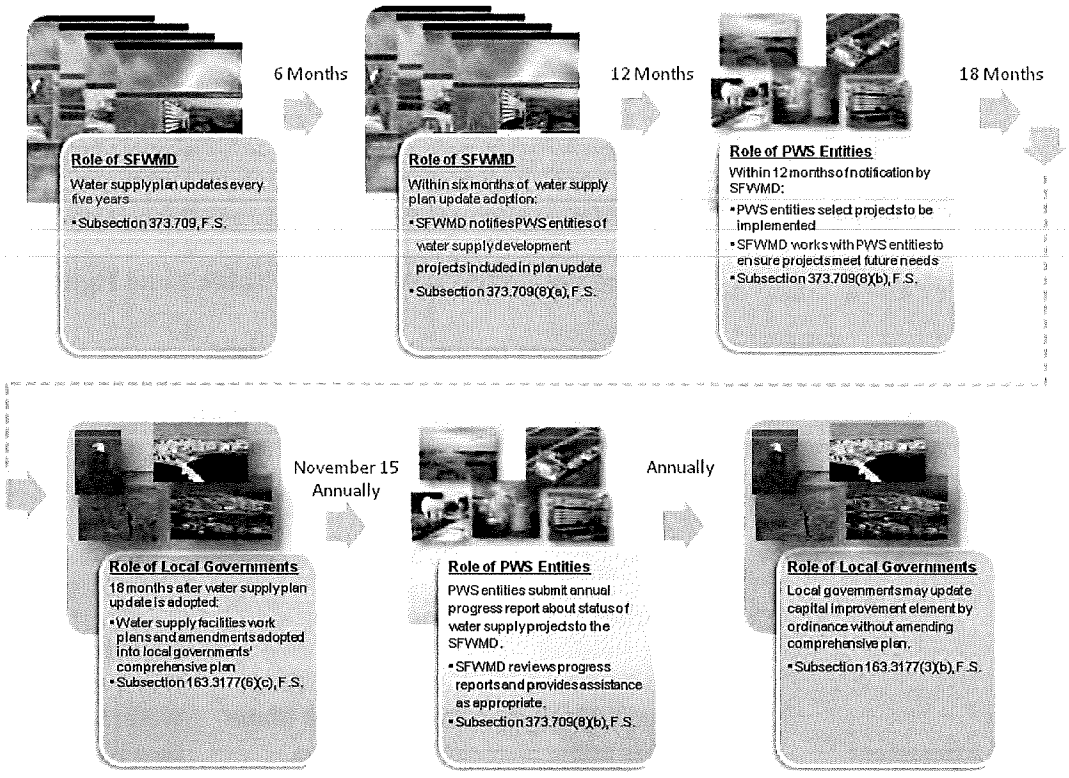


Figure 1. Linking regional water supply planning with local government comprehensive planning.

Regional Water Supply Plans

The SFWMD prepares regional water supply plans for each of the four planning areas in its jurisdiction (Kissimmee Basin, Upper East Coast, LWC, and Lower East Coast) to effectively support planning initiatives and address local issues. Updated every five years, each regional water supply plan encompasses a 20-year planning horizon. All local governments within each planning area are required to update their 10-year water supply facilities work plans, which identify water supply projects. Revisions to local government comprehensive plans must be adopted within 18 months following the approval of this update.

Each regional water supply plan update provides the following:

- Revised water demand estimates and projections
- An evaluation of existing regional water resources
- Identification of water supply-related issues
- A discussion of present water source options
- Water resource and water supply development components, including funding strategies
- Recommendations for meeting projected demands in the region

This update also includes a discussion of Minimum Flows and Levels (MFLs) established within the planning area, MFL recovery and prevention strategies where appropriate, Water Reservations adopted by rule, technical data, and supporting information.

Public Participation

The SFWMD established the Water Resources Advisory Commission (WRAC) to serve as an advisory body to the Governing Board. The WRAC is the primary forum for conducting workshops, presenting information, and receiving public input on water resource issues affecting south Florida. Commission members represent environmental, urban, and agricultural interests from all four of the SFWMD's water supply planning areas.

The SFWMD held WRAC issue workshops on the plan updates throughout the water supply planning process. Stakeholders representing a cross-section of interests in the region — agricultural, industrial, environmental protection, utilities, local government planning departments, and state and federal agencies — were invited to attend the workshops as well as the general public. During the workshops, participants reviewed and provided comments regarding projected demands and other key plan elements compiled by SFWMD staff. In addition to WRAC issue workshops, water demand projections were coordinated through individual meetings with local government planning departments, utilities, and agricultural industry representatives. Participants also reviewed and provided input on water supply issues, the condition of regional water resources, water source options, and other key aspects of the water supply plan update. Ultimately, the plan was presented to the SFWMD Governing Board for their consideration for approval at a publicly noticed meeting.

Goal and Objectives

The goal for this water supply plan update, derived from state statutes, is to identify sufficient water supply sources and future projects to meet existing and future reasonable-beneficial uses during a 1-in-10 year drought condition through 2030 while sustaining water resources and natural systems.

The objectives developed for the 2005–2006 LWC Plan Update were modified for this update. The following objectives for this update provide an overall framework for the planning process:

INFO

A **reasonable-beneficial use** is use of water in such quantity as is needed for economic and efficient use for a purpose, which is both reasonable and consistent with the public interest.

A **1-in-10 year drought** is of such intensity that it is expected to happen only once in 10 years. A drought of this magnitude results in an increase in water demand that would have a 10 percent probability of being exceeded during any given year.

- **Water supply.** Identify sufficient sources of water to meet reasonable-beneficial consumptive uses projected through 2030 under a 1-in-10 year drought event, without causing harm to natural systems.

- **Natural systems.** Enhance and protect wetland systems and the water resources from harm due to water use, including drawdowns and harmful movement of saline water.
- **Estuarine and riverine systems.** Protect and enhance estuarine and riverine systems through effective water deliveries and management of water resources.
- **Water conservation and alternative source development.** Encourage water conservation measures to improve the efficiency of water use, and support and promote the development of alternative sources.
- **Linkage with local governments.** Provide linkage between the update and local government water supply elements.
- **Compatibility and linkage with other entities.** Achieve compatibility with other related planning activities within the region and with adjacent water management districts.

INFO

A **natural system** is a self-sustaining living system that supports an interdependent network of aquatic, wetland-dependent, and upland living resources.

A **wetland** is an area inundated or saturated by surface water or groundwater with vegetation adapted for life under those soil conditions (e.g., swamps, bogs, marshes).

An **estuary** is the part of the lower end of a river where fresh water and salt water meet.

Water conservation is the permanent, long-term reduction of daily water use requiring the implementation of water saving technologies and measures that reduce water use while satisfying consumer needs.

Alternative sources include salt water, brackish water, groundwater, increased storage, and reclaimed water.

- **Floridan aquifer system (FAS).** Continue to encourage development of the FAS as an alternative to water sources that depend on local rainfall for recharge. Work with utilities and other water users for monitoring to describe the relationships of water use, water levels, and water quality.

PLANNING AREA BACKGROUND

The LWC Planning Area includes all of Lee County, most of Collier County, and portions of Hendry, Glades, Charlotte, and mainland Monroe counties (**Figure 2**). The region extends approximately 5,129 square miles, generally reflecting the drainage patterns of the Caloosahatchee, Imperial, Estero, and Cocohatchee river basins, and the Big Cypress Swamp. The LWC Planning Area also contains the SFWMD Big Cypress Basin, which has its own board of directors. The Big Cypress Basin encompasses all of Collier County and part of Monroe County.

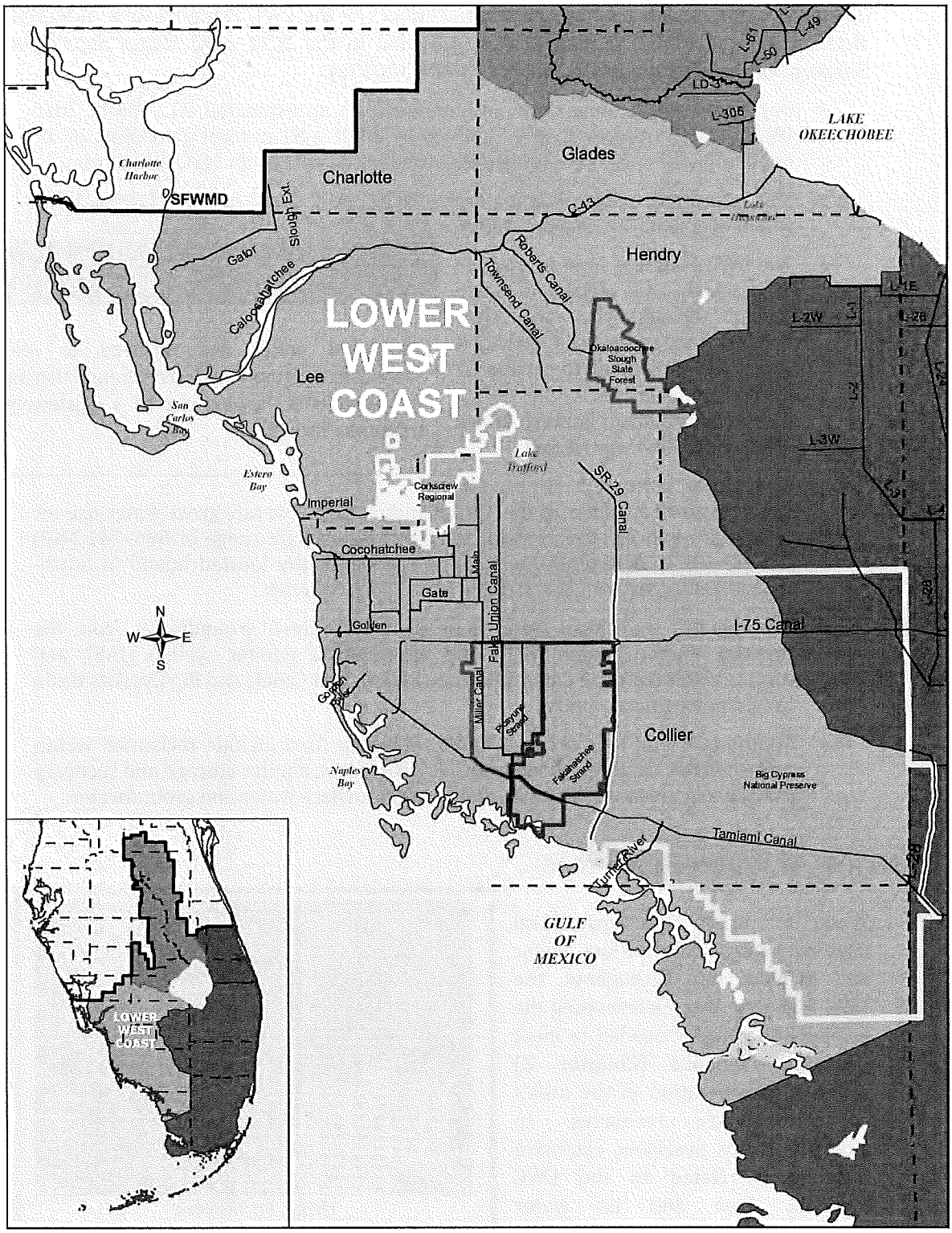


Figure 2. LWC Planning Area.

The following descriptions highlight characteristics of the LWC Planning Area. Additional detail about the LWC Planning Area is provided in the *2011–2012 Water Supply Plan Support Document* (Support Document) (SFWMD 2012a).

- Population projections show an increase from an estimated 992,486 in 2010 (BEBR 2009) to more than 1.5 million by 2030, a 51 percent gain. Most of the population is expected to remain clustered in coastal Lee and Collier counties.
- Most, if not all, of the planning area's 2030 net demand for PWS (192.0 MGD) will be met using alternative water sources, including water conservation.
- The LWC Planning Area is a leader in brackish and reclaimed water source development. In 2009, brackish water sources provided about 41 percent of the planning area's potable PWS. In 2010, 91 percent of the planning area's wastewater flow was reused.

INFO

Reclaimed water has received at least secondary treatment and basic disinfection and is reused after flowing out of a wastewater treatment facility.

- Agriculture continues to be the largest water consumer in the LWC Planning Area. Overall, gross water use for agriculture is projected to stabilize at an approximate range of 696–741 MGD through 2030. Agricultural acreage is predominantly located inland in north-central Collier, eastern Lee, Hendry, and Glades counties.
- The region's traditional water sources include fresh groundwater from the surficial aquifer system (SAS) and intermediate aquifer system (IAS), and surface water from the Caloosahatchee River (C-43 Canal) and Big Cypress Basin canals and artificial ponds.
- Additional water sources in the LWC Planning Area include reclaimed water, surface water captured during wet-weather flows, aquifer storage and recovery (ASR) wells, surface reservoirs, and brackish surface water and groundwater.

Overview of Water Resources

Water for urban and agricultural uses originates from surface water and groundwater throughout the LWC Planning Area. Determining the availability of water needed to meet projected demands (**Chapter 2**) requires consideration of the area's available water resources. In addition to this overview, extensive information related to the LWC Planning Area and its water resources is contained in the Support Document.

Urban Fort Myers

Groundwater Sources

The LWC Planning Area uses water from the SAS, IAS, and FAS. These aquifer systems are shown in **Figure 3**.

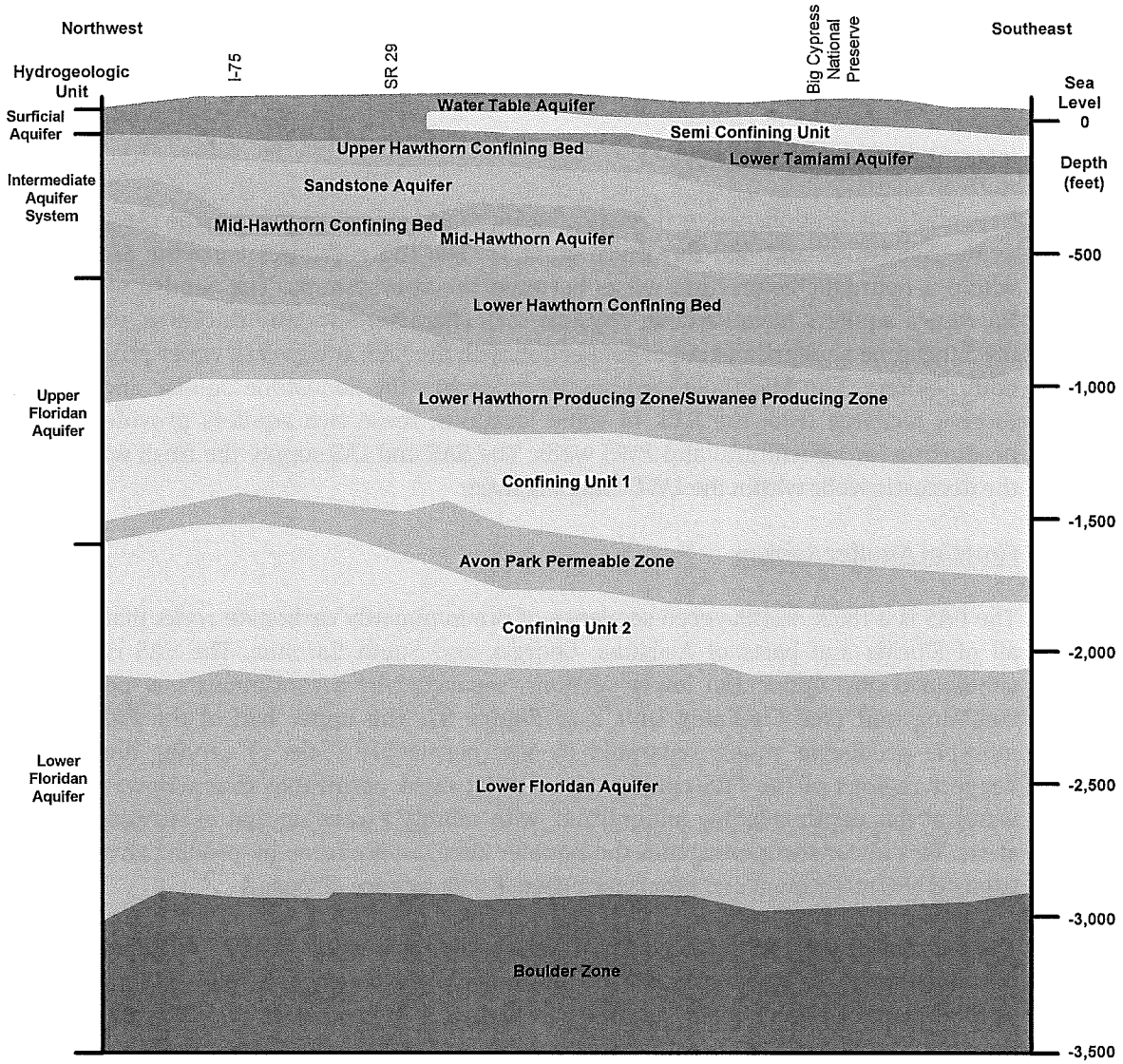


Figure 3. Generalized hydrogeologic cross-section of the LWC Planning Area (section extends from northwest Lee County through southeast Collier County).

Surficial Aquifer System

The SAS is the traditional source of water, including potable water, for urban uses within the LWC Planning Area. It is typically divided into two aquifers, the water table and Lower Tamiami, which are separated by leaky confining beds. In the northern portion of the LWC Planning Area, the Lower Tamiami aquifer thins and merges with the unconfined water table aquifer, or loses permeability and merges with confining material beneath the SAS. The water table aquifer is in direct contact with the atmosphere and receives rainfall recharge. Rainfall is the primary source of recharge to the SAS.

Intermediate Aquifer System

Depending on location, two or three producing zones are present within the IAS, referred to as the Sandstone and Mid-Hawthorn aquifers. The IAS recharges from the SAS in areas where a hydraulic connection exists between the two systems. The Sandstone and Mid-Hawthorn aquifers have variable physical rock characteristics and thickness, which affect the Sandstone aquifer's degree of connection with the SAS, and overall water production for both aquifers. The Mid-Hawthorn aquifer underlies the Sandstone aquifer and does not receive recharge from the SAS. In some locations, these two aquifers provide adequate production for agricultural and PWS wells. The SAS and IAS supply the fresh water for all the domestic wells within the LWC Planning Area.

Floridan Aquifer System

The FAS is a thick multilayered sequence of predominantly carbonate rocks that underlies all of Florida and parts of Alabama, Georgia, and South Carolina. The FAS is generally subdivided into upper and lower sections, separated by a continuous low permeability confining unit (see Confining Unit 2 in **Figure 3**). The upper half of the FAS contains multiple producing zones, separated by less permeable zones of varying degrees. The deepest regions of the FAS contain some of its most permeable zones. However, native water at this depth is highly mineralized, with salinity exceeding that of seawater in some areas. This lower section includes the Boulder Zone, where brine by-products from reverse osmosis (RO) treatment and other permitted discharges are disposed.

The portion of the FAS targeted for water supply production in the LWC Planning Area includes the Lower Hawthorn and the Suwannee producing zones, referred to collectively as the Upper Floridan aquifer, as shown in **Figure 3**. In general, productivity in the Lower Hawthorn section of the Upper Floridan aquifer is slightly higher than in the Suwannee, and salinity differences are common. For these reasons, many wells are constructed to isolate the Lower Hawthorn producing zone.

In the LWC Planning Area, the FAS is not hydraulically connected to any freshwater source at the surface. Freshwater recharge must come from outside the LWC Planning Area, but use of the Floridan aquifer north of the planning area effectively intercepts the southward migration of fresh water. The lack of freshwater recharge limits long-term availability of slightly brackish water from the FAS.

Surface Water Sources

Surface water bodies in the LWC Planning Area include canals, lakes, and rivers, which provide storage and conveyance of surface water. These canals and rivers drain into Estero Bay, the Caloosahatchee River and Estuary, or the Gulf of Mexico. Although Lake Trafford and Lake Hicpochee are the two largest lakes within the LWC Planning Area, neither lake is considered a good source of water supply.

INFO

Surface water is water above the soil or substrate surface, whether contained in bounds, created naturally or artificially, or diffused. Water from natural springs is classified as surface water when it exits from the spring onto the earth's surface.

Canals

Most of the canals in the LWC Planning Area were constructed as surface water drainage systems. The Caloosahatchee River (C-43 Canal) is a key source of fresh water for irrigation and the estuary. Dredged as a canal to connect the Caloosahatchee River to Lake Okeechobee, the C-43 Canal is the freshwater portion of the Caloosahatchee River and extends eastward from the Franklin Lock and Dam to Lake Okeechobee. Three lock and dam structures control flows and water levels in the lake and canal: 1) S-77 at Moore Haven, 2) S-78 at Ortona, and 3) S-79 (Franklin Lock and Dam) at Olga, the latter of which serves as a saltwater barrier. The operation schedules for these structures are adopted by the United States Army Corps of Engineers (USACE) and consider a variety of factors.

Rivers

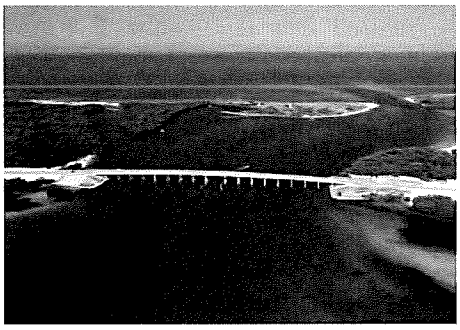
- The **Caloosahatchee River and Estuary** is the most important source of surface water in the region, extending across seven of the ten drainage basins in the LWC Planning Area. The river receives inflows from Lake Okeechobee and runoff from within its own watershed. West of the S-79 structure, the river mixes freely with estuarine water as it empties into the Gulf of Mexico.
- The **Estero and Imperial rivers** drain southern Lee, northern Collier, and southwestern Hendry counties, covering approximately a 400-square mile area. The watershed includes significant wetlands, such as Imperial Marsh, Flint Pen Strand, Corkscrew Swamp, and portions of the Corkscrew Marsh.
- The **Gordon and Cocohatchee rivers** connect to a canal system in western Collier County that serves primarily as a drainage network, directing flows into Naples Bay and the Gulf of Mexico located within the Big Cypress Basin. Because the primary source of water for these rivers is rainfall, the rivers have little or no flow during the dry season.

Other Major Water Bodies

- **Lake Okeechobee** is a key component of the south Florida hydrologic system. The 2008 Lake Okeechobee Regulation Schedule, referred to as 2008 LORS (USACE 2007) is designed to maintain Lake Okeechobee water levels one foot

lower than the previous schedule to attain a water level of 12.5–15.5 feet National Geodetic Vertical Datum of 1929 (NGVD). **Chapter 3** of this document and **Chapter 4** of the Support Document provide additional information about the 2008 LORS. Lake Okeechobee has many functions, including flood protection, urban and agricultural water supply, navigation, fisheries, and wildlife habitat. The lake is critical for flood control during wet seasons and water supply during dry seasons. In the LWC Planning Area, outflows from the lake are received primarily by the Caloosahatchee River (C-43 Canal). For more information see the *2012 Lower East Coast Water Supply Plan Update* (SFWMD 2012b).

- **Estero Bay** is a long, narrow, and very shallow body of water with barrier islands separating it from the Gulf of Mexico. The bay's watershed includes central and southern Lee County and parts of northern Collier County. Estero Bay is one of Florida's most significant natural watershed resources, and Estero Bay Preserve State Park was designated as the state's first aquatic preserve.


Estero Bay

- **Naples Bay** originates at the mouth of the Gordon River in downtown Naples. Fresh water flows into Naples Bay from the Golden Gate Canal, Gordon River, Rock Creek to the north, Haldeman Creek to the east, and runoff from the urban areas surrounding the bay.

Wetlands

The LWC Planning Area contains 1,779,772 acres of wetlands (USFWS 2010). Key wetlands in the LWC Planning Area include Big Cypress National Preserve, Corkscrew Regional Ecosystem Watershed (CREW), Okaloacoochee Slough, Picayune Strand State Forest, and Fakahatchee Strand Preserve State Park.

PROGRESS SINCE THE 2005–2006 LWC PLAN UPDATE

The 2000 LWC Plan and the 2005–2006 LWC Plan Update identified several main regional issues concerning water conservation, groundwater resources, reclaimed water, the regional irrigation distribution system, seawater, storage, surface water, and related implementation strategies. Annual progress is summarized in the *Five-Year Water Resource Development Work Program* contained in Chapter 5A of SFWMD's *2012 South Florida Environmental Report* (Martin 2012) available from http://www.sfwmd.gov/sfer.

Since the 2005–2006 LWC Plan Update, the following activities and programs have been implemented in the LWC Planning Area to enhance the region's water resources, water supply, and natural systems.

Water Conservation

- In September 2008, the SFWMD adopted a Comprehensive Water Conservation Program to establish proactive water savings through demand management throughout the SFWMD boundaries.
- The Mandatory Year-Round Landscape Irrigation Conservation Measures Rule became effective in March 2010 (Chapter 40E-24, F.A.C.), consistent with the Comprehensive Water Conservation Program.
- The Water Savings Incentive Program (WaterSIP) provides up to 50-50 cost-sharing funds to utilities, municipalities, property owner associations, and large water users for non-capital projects; specifically the purchase and installation of high efficiency indoor plumbing fixtures and outdoor irrigation retrofits. From FY 2007 to FY 2012, the SFWMD awarded $627,456 for 23 LWC Planning Area WaterSIP projects, representing a projected savings of 178 million gallons per year (MGY). For more information about water conservation see **Chapter 4** and **Appendix E** of this plan update.

Modeling and Studies

- In 2005, the SFWMD and United States Geological Survey (USGS) began a cooperative study to measure evapotranspiration (ET) in south Florida using the eddy-covariance method. Spatially extensive plant communities within Big Cypress National Preserve were studied individually, including dwarf cypress, cypress swamps, pine uplands, wet prairies, and marsh as mapped by Duever et al. (1986). In 2007, the USGS installed two ET monitoring sites within differing vegetation communities in the Big Cypress National Preserve and completed the construction of three towers. The fieldwork was completed in 2010. Results from this study are published in Shoemaker et al. (2011), which is available from http://pubs.usgs.gov/sir/2011/5212/. This study provides the first quantitative measurements of ET for the major natural plant communities in south Florida. The ET data from this study will be used to improve hydrologic models.
- An independent peer review panel reviewed the original version of the density-dependent Lower West Coast Floridan Aquifer System Model (LWCFAS), and the panel's recommendations were incorporated into a new model. During FY 2010, a revised steady-state model was created to represent estimated predevelopment conditions in the FAS. In FY 2011, the model was recalibrated to transient conditions. The LWCFAS Model is designed to evaluate future effects of the proposed use of the aquifer system, and will be available for future plan updates.
- The USACE and the SFWMD completed the *Draft Southwest Florida Feasibility Study Integrated Feasibility Report and Environmental Impact Statement*, referred to as the Southwest Florida Feasibility Study (USACE and SFWMD 2009), which examines potential resource restoration projects for the entire southwest Florida area. The study provides a comprehensive watershed master plan, including marine/estuary restoration and protection, environmental quality, flood protection, water supply, and other water-related purposes.

- An integrated surface water–groundwater model of southwest Florida (SDI Environmental Services, Inc. et al. 2008) was developed as part of the Southwest Florida Feasibility Study. The model examines the influences of proposed environmental projects on surface water hydrology and shallow groundwater systems.
- The Lower West Coast Surficial Aquifer (LWCSAS) Model was developed by the SFWMD to simulate groundwater flow and levels to represent existing and potential future hydrologic conditions in the LWC Planning Area. The model will be updated to include simulation of the IAS, and following this, a peer review of the updated model will be conducted in FY2014.

Regulatory Protection and Water Quality Efforts

- The SFWMD's first Water Reservation rule was adopted for the support of the CERP Picayune Strand Restoration Project and Fakahatchee Estuary on July 2, 2009 (Chapter 40E-10, F.A.C.). (See the *Water Reservations* section of this chapter and **Chapters 3** and **5**).
- In October 2008, the SFWMD adopted rule criteria for the Lake Okeechobee Service Area to limit allocations from Lake Okeechobee and connected surface waters including the Caloosahatchee River (C-43 Canal) and St. Lucie River (C-44 Canal) to historical condition water uses that occurred from April 1, 2001 to January 1, 2008 (see the *Restricted Allocation Areas* section of this chapter and **Chapters 3** and **5**, and **Appendix I**). For more information see the *2012 Lower East Coast Water Supply Plan Update* (SFWMD 2012b).

The Dispersed Water Management Program is a collective and collaborative entity effort designed to encourage property owners to retain water on their land rather than drain it, accept regional excess runoff for storage, or both. The program uses three different approaches: cooperative projects, easements, and payment for environmental services. Based on data from initial pilot projects, the SFWMD expanded participation in the program. Since 2005, through a combination of dispersed water management and regional projects, landscape storage has increased a total of 138,016 acre-feet throughout the Everglades system, including the Caloosahatchee Estuary and St. Lucie Estuary watersheds, and sites north and south of Lake Okeechobee. Currently, six dispersed water management cooperative projects are occurring within the Caloosahatchee Watershed: 1) Nicodemus Slough Water Retention Project, 2) South Lake Hicpochee, 3) BOMA Site Interim Project, 4) C-43 Reservoir Site Interim Project, 5) Caloosahatchee River Estuary water farming pilot projects (locations to be determined), and 6) Northern Everglades Payment for Environmental Services Solicitation projects (locations to be determined). See **Appendix I** for more information.

The SFWMD is funding a pilot water farming study in the planning region to assess the overall feasibility of water farming citrus lands that are currently fallow. Primary goals are to identify costs associated with on-site construction, infrastructure improvements, environmental assessments, and facility maintenance. The objective is to determine the cost-benefits and other benefits associated with water farming as a means of increasing local/regional storage and improving water quality to benefit both the natural system and

the agricultural industry. Water farming has the potential to reduce environmental impacts and provides an opportunity to improve water quality for the Caloosahatchee River and Estuary.

Water Storage

- Over the past five years, the Big Cypress Basin Board of Directors funded a program to improve the water control infrastructure and management operations of its 44 water control structures. The reconstructed Faka Union Canal Weir 4 provides the ability to store 3 billion gallons of water during the dry season. Reconstructed weirs in the Corkscrew Canal have increased average annual groundwater storage by approximately 424 million gallons. The retrofitted Golden Gate Weirs 2 and 3 have increased groundwater levels from 0.1 feet to 1.5 feet between Weirs 2 and 3, and provide annual average surface water storage of 1.6 billion gallons.
- The purpose of the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project is to improve the quantity, timing, and distribution of freshwater flows to the Caloosahatchee River and Estuary. This planned reservoir project will capture and store surface water runoff from the C-43 Basin and Lake Okeechobee to provide a more natural and consistent flow of fresh water to the estuary. After construction and flow-through testing, operation of this project is expected to improve the Caloosahatchee Estuary's salinity balance by reducing a portion of the peak discharges during the wet season and providing essential flows during the dry season. To date, land has been cleared and designs for construction are permitted. The project is awaiting congressional authorization and appropriation of funds to start construction. The USACE anticipates project authorization to occur in August 2013 with appropriation of funding to follow at a later date. Once congressional funding has been appropriated, a timetable for the completion of the reservoir will be developed.

Restoration

- The first phase of the CERP Picayune Strand Restoration Project is complete. The initial phase filled or plugged seven miles of Prairie Canal and removed 65 miles of adjacent roadways, restoring 13,000 acres of the 55,000 acres in the project area. The SFWMD's Water Reservation for the Picayune Strand and Fakahatchee Estuary supports this restoration project.

Water Supply Development Projects

- Water supply development in the LWC Planning Area included both traditional (fresh and surface water and groundwater) and alternative sources. Through the Alternative Water Supply Funding Program, the SFWMD assisted water users in the development of alternative water projects, including reclaimed water, water reclamation facilities, brackish water wellfields, RO treatment facilities, and ASR well systems (see **Chapters 5** and **6**). For the 2007–2012 period, the SFWMD, in cooperation with the State of Florida, provided more than

$123 million in alternative water supply funding for 212 projects, with 78 projects occurring in the LWC Planning Area.

- Between FY 2007 and FY 2012, water supply development projects funded by the Alternative Water Supply Funding Program in the LWC Planning Area have created a total of 104 MGD of new water capacity. The new sources of this water include 37 MGD of brackish water, 33 MGD of reclaimed water, 16 MGD of Hawthorn aquifer water, 3 MGD of ASR water, and 15 MGD of surface water/storm water and other projects.

OUTLOOK ON CLIMATE CHANGE

Southwest Florida is particularly vulnerable to the effects of climate change and sea level rise. The topography of the area is generally flat, naturally poorly drained, and has an average elevation of 16 feet above mean sea level. The regional economy has major investments within close proximity of the coast or lake water bodies (SWFRPC and CHNEP 2009).

As sea level rises, low elevation coastal areas will be increasingly subject to flooding, especially during spring and fall high tides, storms, and strong onshore winds (Murley et al. 2008). The canal networks of the SFWMD in much of the LWC Planning Area are typically maintained at predetermined water levels to reduce the potential for saltwater intrusion into the PWS wellfields and to provide flood protection. Projected sea level rise may reduce the flood discharge capacity of coastal structures, thus affecting flood protection in urban areas (SFWMD 2009a).

Other changes, such as increased ET, and changes in weather patterns, are less predictable. If temperatures and ET increase as many experts expect, both PWS and AGR Self-Supply water demands may increase. More frequent intense rainfall events with longer interim dry periods could increase total annual rainfall, but decrease effective rainfall, as more water may be lost to runoff or tide (see **Chapters 3** and **7**).

In 2010, Lee County developed a climate change resiliency strategy to guide the county plans and strategies relating to specific vulnerabilities and priorities of the county. Previously, the Southwest Florida Regional Planning Council had prepared the *Comprehensive Southwest Florida/Charlotte Harbor Climate Change Vulnerability Assessment* (SWFRPC and CHNEP 2009). The Southwest Florida Regional Planning Council indicated that this study would be used to facilitate the work of local government elected officials and staff to consider sea level rise when planning for public facility expansions and reconstruction after hurricane damage or due to old age (SWFRC and CHNEP 2009).

WATER SUPPLY PLANNING FOR THE NEXT 20 YEARS

The stronger statutory link between local governments' comprehensive plans and the SFWMD's regional water supply plans, data sharing, and collaborative planning are all

credited with improving the water supply planning process. Moreover, SFWMD staff responsible for water supply development closely coordinate with SFWMD staff responsible for managing the Consumptive Use Permitting Program during the water supply planning process. This continued coordination will only improve by fulfilling the guidance provided by the Florida Department of Environmental Protection (FDEP) to the water management districts. Water suppliers are not required to choose a water supply development project identified in a regional water supply plan. However, if a water supply project included in the LWC Plan Update is pursued, consumptive use permit applicants should have confidence that the project has undergone initial screening for feasibility and has a likelihood of being permittable. In early 2012, SFWMD staff did an initial screening for feasibility of the proposed water supply development projects included in this water supply plan. The proposed projects have not been analyzed to the level of detail required to determine if the proposed project meets the conditions for consumptive use permit issuance; however, the proposed projects are likely permittable. Additionally, in 2012, FDEP launched a statewide effort, known as CUPcon to improve consistency in the Consumptive Use Permitting Programs implemented by the water management districts. Updates to local governments' water supply facilities work plans and the next SFWMD's five-year water supply plan update will continue to refine 20-year demand estimates and projections.

2

Demand Estimates and Projections

This chapter discusses water demand estimates and projections for the Lower West Coast (LWC) Planning Area. The development of water demand projections is a complex process accomplished in coordination with staff from local governments, utilities, other agencies, and stakeholder groups. Data collection and analysis to support the projections included in this plan began in summer 2009.

TOPICS

- Water Use Categories
- Population and Water Use Trends
- Net Water Demands
- Gross Water Demands
- Demand Projections in Perspective

After publication of the *2005–2006 Lower West Coast Water Supply Plan Update* (2005–2006 LWC Plan Update; SFWMD 2006), a national economic downturn occurred and population growth in the LWC Planning Area slowed significantly, leading to a reduced rate of increase in future urban water demands.

In this chapter, water demands for the water use categories established by the Florida Department of Environmental Protection (FDEP) are projected for a 20-year planning horizon of 2010 through 2030. Water demands are described in two ways, gross and net. Both gross water demands and net water demands are calculated in million gallons of water per day (MGD). The demands discussed in this chapter do not address natural system water supply needs. The water supply needs for natural systems are discussed in **Chapter 3** and **Appendices G** and **H** and are considered a limitation on water available for allocation. These water supply needs are addressed through a variety of regulatory mechanisms and projects.

Gross water demand is also called raw water demand. Gross or raw water demand is the amount of water withdrawn from the water resource to meet a particular need of a water user or customer. Gross demand is the amount of water allocated in a consumptive use permit. In the Public Water Supply (PWS) use category, net water demands are commonly termed finished water demands. Net demand is the volume of water needed by an end user or customer, after deducting treatment and process water losses, and system inefficiencies. Gross demands are usually higher than net demands as most uses lose water through the treatment and/or transport of the water, in system inefficiencies, or irrigation delivery.

A PWS facility that uses brackish water as one of its sources and employs reverse osmosis (RO) treatment is a good example to demonstrate the difference between net and gross water demands. While customer need for finished water may be 10 MGD (net demand), 13.5 MGD of raw water (gross demand) must be withdrawn from the water source to account for water losses in the treatment process. A 75 percent efficiency factor is assumed because, typically, for every 100 gallons pumped and treated through RO, the process results in 75 gallons of finished water and 25 gallons of reject water and water lost in transit.

This chapter provides demand projections in terms of average annual rainfall conditions and anticipated growth in the LWC Planning Area through 2030. As water demands may be significantly impacted by weather, particularly rainfall, gross and net demands for 1-in-10 year drought conditions are estimated and projected in **Appendix A.**

LAW / CODE

A 1-in-10 year drought event is a rainfall deficit that would have a 10 percent probability of occurring during any given year. Paragraph 373.709(2)(a), F.S., states the level-of-certainty planning goal associated with identifying demands shall be based on meeting demands during a 1-in-10 year drought event. Droughts generally create an increased water demand.

Demand projections in the 2005–2006 LWC Plan Update were determined using 2000 baseline data. For this plan update, a new baseline incorporating 2005 data was established to estimate demand projections. The 2005 baseline was developed from a variety of data sources including permanent population estimates, land use, crop production, irrigation systems, historical water use, and climatic conditions. Data from 2005 were also used to develop water use factors, such as finished water per capita use rates (PCURs) by utility, and irrigation system efficiency by crop type. These factors, along with projected variables, such as population and irrigated acres, were used to project future water demands for the 2010 to 2030 planning horizon. The future water demands were based on historical rainfall conditions. Uncertainty about the degree of future climate change precluded projecting possible deviations in rainfall and evapotranspiration (ET).

Appendix A provides a full description of the methods used to estimate water use for each major use category, and includes estimates of both the customer demands discussed here and the raw water withdrawals. This appendix also provides both gross and net water demand projections for average year and 1-in-10 year drought conditions, as well as additional information about water demand within each water use category. For agriculture, irrigated acreage and demands by crop type are included. For PWS, permanent population and demands by utility are provided. Although not quantified in this chapter, environmental demands are addressed during the water supply planning process using resource protection criteria.

DESCRIPTIONS OF WATER USE CATEGORIES

Gross and net water demands for 2005 and projections through 2030 are estimated in five-year increments for each of the six water use categories established by the FDEP (see **Appendix A**):

- **Agricultural (AGR) Self-Supply.** Water used for commercial crop irrigation, livestock watering, and aquaculture.
- **Public Water Supply (PWS).** Water supplied by water treatment facilities for potable use (drinking quality) with projected average pumpages equal to or greater than 100,000 gallons per day (GPD) or 0.1 MGD.
- **Domestic Self-Supply (DSS).** Water used by households served by small utilities (less than 0.1 MGD) and private wells.
- **Industrial/Commercial/Institutional (ICI) Self-Supply.** Self-supplied water consumed by business operations and institutions, such as schools, hospitals and prisons that have demands of 0.1 MGD or greater.
- **Recreational/Landscape (REC) Self-Supply.** Water used for irrigation of golf courses, parks, cemeteries, large common areas such as homeowner associations and commercial developments, and other self-supplied irrigation uses with demands of 0.1 MGD or greater.
- **Power Generation (PWR) Self-Supply.** Water consumed by power plants in the production of electricity, excluding use of seawater sources.

Urban demands are the combined total of PWS, DSS, ICI Self-Supply, REC Self-Supply, and PWR Self-Supply user demands. By 2030, these use categories are expected to account for at least 47 percent of the LWC Planning Area's total net water demands, with PWS net demands expected to increase by 60.6 MGD (46 percent) from the 2010 estimated net demand.

Agricultural water use is projected to remain the LWC Planning Area's single largest water use category in 2030. Estimates indicate AGR Self-Supply gross water demand will represent at least 57 percent of the planning area's total gross demands by 2030.

The *Net Water Demands* section discusses the average year net demand projections for PWS and DSS. The *Gross Water Demands* section discusses the average year gross demand projections for AGR Self-Supply, ICI Self-Supply, REC Self-Supply, and PWR Self-Supply. The water supply development projects proposed to meet LWC Planning Area demands are in **Chapter 6**.

POPULATION AND WATER USE TRENDS

Population estimates for the LWC Planning Area include the permanent populations of Collier and Lee counties and portions of Hendry, Glades, and Charlotte counties. The LWC Planning Area's population is expected to increase by 51 percent from 2010 to 2030, with

Collier and Lee counties attracting the greatest number of new residents. While this projection represents a significant population increase, it is a slower rate of growth than projected in the 2005–2006 LWC Plan Update (**Figure 4**). The portion of Charlotte County within the South Florida Water Management District (SFWMD) is expected to experience the highest rate of growth, due primarily to the Town and Country Utilities' service area, which includes Babcock Ranch.

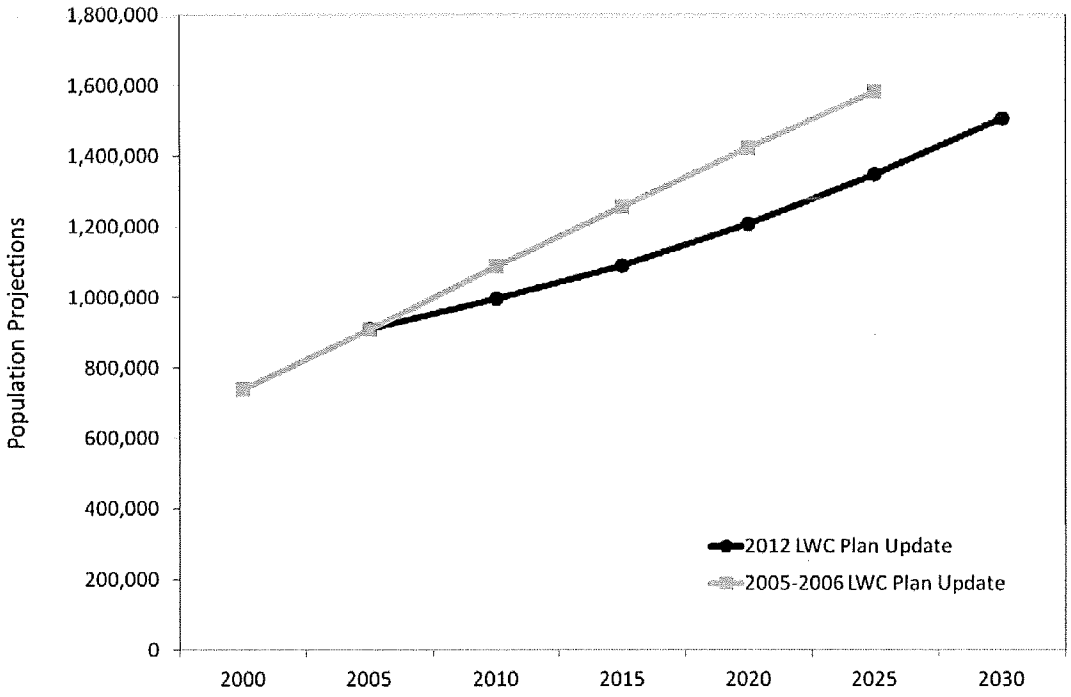


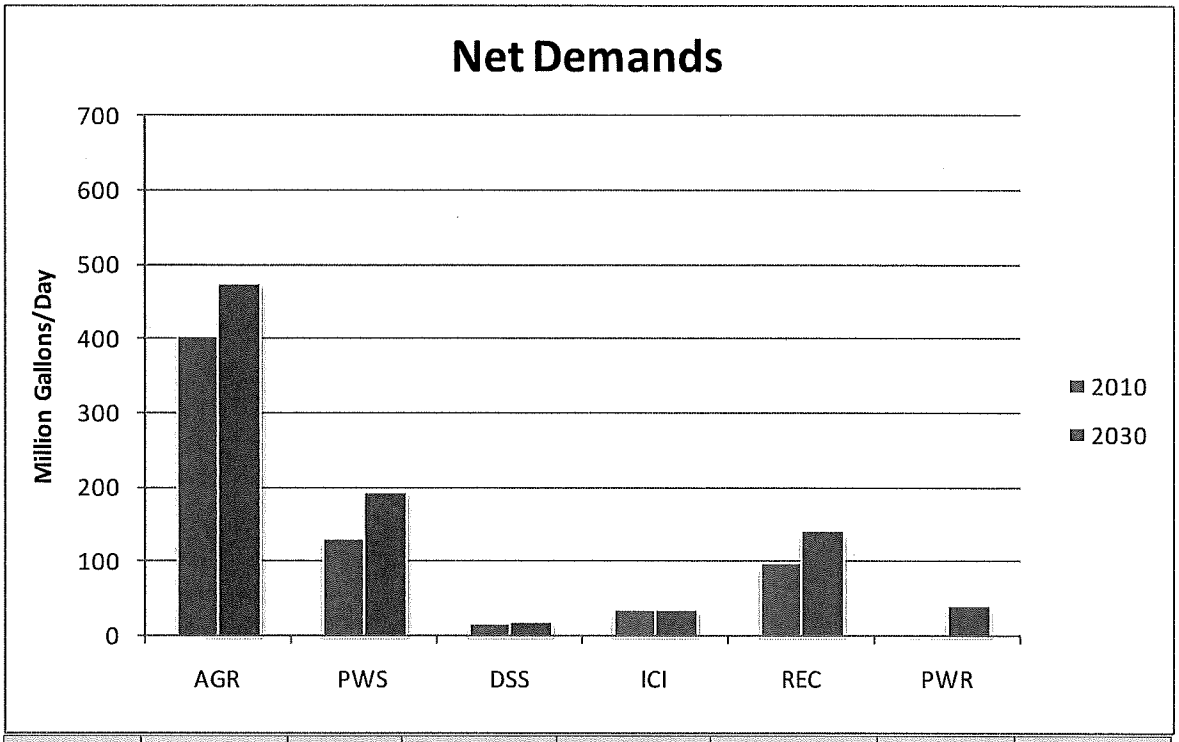
Figure 4. Population projections, 2005–2006 LWC Plan Update versus this plan update.

NET WATER DEMANDS

PWS and DSS are discussed in this section. All other water use categories are discussed in the *Gross Water Demands* section. The PWS and DSS use categories are presented in net water demand terms because they are generally focused on finished (treated) water. The use of net or finished water demands allows utilities to compare actual water delivered from the treatment facility even as they change source waters that require different treatment processes. By using net demands for PWS, water losses occurring during water treatment and transport are eliminated. The change in net demands for the 20-year planning horizon for all water use categories is presented in **Figure 5.**

INFO

Net Water Demand or User/Customer Water Demand is the water demand of the end user after accounting for treatment and process losses and inefficiencies. When discussing PWS, the term "finished water demand" is commonly used to denote net demand.



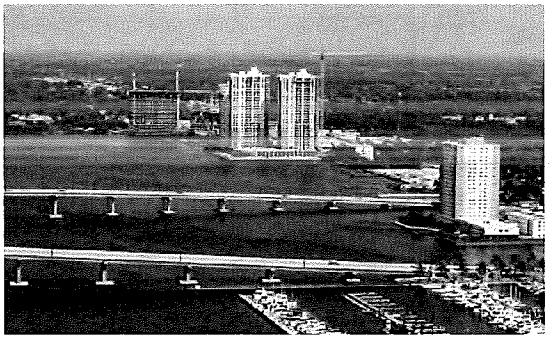
	Agricultural Self-Supply	Public Water Supply	Domestic Self-Supply	Industrial/ Commercial/ Institutional Self-Supply	Recreational/ Landscape Self-Supply	Power Generation Self-Supply	Total
Estimated 2010 MGD	403.1	131.4	15.7	35.3	97.5	0.5	683.5
Projected 2030 MGD	442.4–477.4	192.0	19.9	35.3	141.5	42.1	873.2-908.2
Percent Change	10–18%	46%	27%	0%	45%	8,320%	28-33%
Percent of Projected 2030 Total	50–52%	21%	2%	4%	16%	5%	

Note: The bar chart compares demands by use category in MGD, and the table shows the percentage of growth in each category. Percent of Projected 2030 Totals other than AGR Self-Supply are calculated based on the upper range limit of demand (908.2 MGD).

Figure 5. Estimated average year net demands by water use category for 2010 and 2030.

Public Water Supply and Domestic Self-Supply

PWS is the water supplied by water treatment facilities for potable use (drinking quality) to users, such as homes, office and retail facilities, schools, and institutions. The PWS use category comprises utilities with projected average pumpages equal to or greater than 0.1 MGD through 2030. Water used by households or facilities served by small utilities (less than 0.1 MGD) or private wells are categorized as DSS.


Fort Myers/Caloosahatchee River Estuary

Development of the water demand projections for the LWC Planning Area was a multistep process. The process began with the medium-range population projections established by the University of Florida's Bureau of Economic and Business Research (BEBR) for each county and finished water use data as reported to the FDEP. These data were used to establish 2005 population and PCUR estimations (BEBR 2006). The 2009 BEBR data (BEBR 2009) were then used in conjunction with information from 10-year water supply facilities work plans and local government comprehensive plans adopted by the Florida Department of Economic Opportunity, SFWMD's consumptive use permits, metropolitan planning organizations, traffic analysis zones, and FDEP-permitted PWS capacity.

To prepare draft population and water demand projections for the PWS and DSS categories within the LWC Planning Area, a status check of active and inactive development of regional impact orders was conducted through the local planning councils. Throughout the process, draft projections were discussed with each utility and local government planning department to coordinate the final projections published in this plan update.

It is important to note that the BEBR projections use permanent population projections and do not include seasonal residents, tourists, and migrant workers. Several areas in the LWC Planning Area have a large number of seasonal residents, which are considered in PCURs. The PCURs reflect all usage, because they are based on finished water as reported by each utility to the FDEP, including the water used by permanent and seasonal residents, as well as tourists and migrant workers. A per capita figure is the total use divided by the permanent population. This approach produces higher PCURs for utilities with large seasonal populations than other approaches that include a factor for seasonal residents. Projected demands for each utility service area assume a constant PCUR for the 20-year planning horizon.

Three primary sources were used to calculate population projections for PWS. The 2009 BEBR county population projections were examined as an overall control for each county. To obtain the detailed distributions needed for the utility estimates and projections, historical and projected populations from traffic analysis zones were used. Traffic analysis

zones, which are based on 2000 United States census data, are defined by the Florida Department of Transportation and local metropolitan planning organizations. A compound annual growth rate is used to distribute the projected population from 2010 to 2030 in five-year intervals for each utility service area.

DSS projections are based on a countywide average PCUR from the utilities. Water conservation measures were not factored into the demand projections used in this chapter. Rather, water conservation is considered a water source option (see **Chapter 4**).

Table 2 provides a summary of the population estimates for the counties or portions of counties located in the LWC Planning Area, and **Table 3** lists the projected net water demands from the base year, 2005, through the planning horizon, 2030. During the next 20 years, the LWC Planning Area population is projected to increase from an estimated 992,486 in 2010 to more than 1.5 million by 2030 (**Table 2**). PWS demands increase significantly through the 2030 projection horizon, primarily due to this anticipated population increase (**Table 3**). DSS demand growth is less significant, as most new potable water demand will be served by PWS systems. In some counties, DSS decreases due to expansion of PWS distribution systems into areas that are currently DSS.

Table 2. Projections of permanent population in the LWC Planning Area, 2010–2030.

County Area	2010			2030		
	Projected Population[a]	Public Water Supply	Domestic Self-Supply	Projected Population	Public Water Supply	Domestic Self-Supply
Collier	341,565	310,952	30,613	471,999	410,126	61,873
Lee	606,949	542,432	64,517	957,100	917,012	40,088
Hendry (portion in LWC Planning Area)[b]	37,493	24,279	13,214	51,023	28,793	22,230
Glades (portion in LWC Planning Area)[b]	6,413	2,857	3,556	8,413	3,776	4,637
Charlotte (portion in SFWMD boundaries)[b]	66	0	66	14,166	13,948	218
LWC Planning Area Total	992,486	880,520	111,966	1,502,701	1,373,655	129,046

a. Source: BEBR 2009

b. Sources: U.S. Census Bureau 2001, BEBR 2009

Table 3. Net PWS and DSS water demands in the LWC Planning Area, 2005–2030.

LWC Water Demands Summary (in MGD)						
Net Water Demands	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Public Water Supply	121.5	131.4	142.6	156.7	173.0	192.0
Domestic Self-Supply	15.0	15.7	16.6	17.8	19.3	19.9
LWC Planning Area Total	136.5	147.1	159.2	174.5	192.3	211.9

GROSS WATER DEMANDS

Gross water demand is the amount of raw water needed for a specific use. Gross water demand differs from net water demand in that water lost during treatment, transport, or irrigation delivery is included in gross water demand values but not in net water demand values. This section reviews the gross water demands of the AGR, ICI, REC, and PWR Self-Supply water use categories.

INFO

Gross Water Demand or Raw Water Demand is the amount of water withdrawn from the water resource to meet a particular need of a water user or customer. Gross demand is the amount of water allocated in a consumptive use permit. Gross or raw water demands are nearly always higher than net or user/customer water demands.

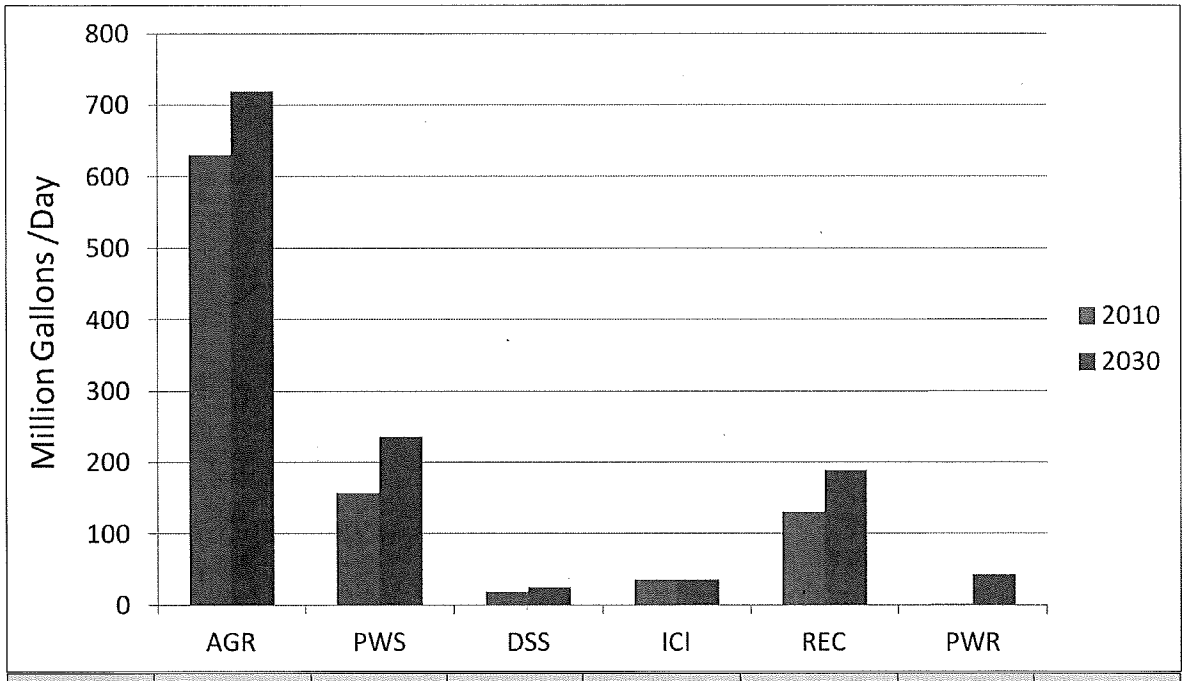
As mentioned earlier, there is generally a difference between gross and net water demands. Variations in treatment, distribution, and irrigation methods can increase or decrease the gross demand. The difference between gross and net demands can be reduced through water conservation practices that, in turn, reduce demands on the water resource.

In 2010, average annual gross water demands for all categories in the LWC Planning Area totaled 971.1 MGD. By 2030, the projected total average annual gross water demands are estimated to range from 1,217.9 to 1,262.9 MGD, an increase of 25–30 percent (**Figure 6**).

Average annual estimates are used to demonstrate general projected trends, including these key highlights:

- AGR Self-Supply gross demands represent agricultural lands that are regularly irrigated to produce crops and water for livestock. These demands are projected to increase from an estimated 630 MGD in 2010 to 695.9–740.9 MGD by 2030. This accounts for 57–59 percent of the region's gross water withdrawal demands by 2030.
- PWS and DSS gross demands are projected to increase by 47 percent, from an estimated 175 MGD in 2010 to 256 MGD by 2030, representing at least 21 percent of the region's total gross demands by 2030 (see also the *Net Water Demands* section of this chapter).
- ICI Self-Supply gross demand is anticipated to remain unchanged.
- REC Self-Supply gross demands are expected to increase from an estimated 130 MGD in 2010 to 188.5 MGD by 2030, a gain of 45 percent.
- PWR Self-Supply gross demands are expected to increase from 0.5 MGD in 2010 to 42.1 MGD by 2030. Such an increase may occur to support new or expanded power generation facilities proposed by Florida Power & Light (FPL), south Florida's major power supplier. The increase in demand for this category is lower than the 2005–2006 LWC Plan Update's 2025 estimate of 67 MGD.

Figure 6 shows the estimated 2010 gross demands and projected 2030 gross demands for all water use categories.



	Agricultural Self-Supply	Public Water Supply	Domestic Self-Supply	Industrial/ Commercial/ Institutional Self-Supply	Recreational/ Landscape Self-Supply	Power Generation Self-Supply	Total
Estimated 2010 MGD	630.0	156.3	18.9	35.3	130.1	0.5	971.1
Projected 2030 MGD	695.9–740.9	232.1	24.0	35.3	188.5	42.1	1,217.9–1,262.9
Percent Change	10–18%	49%	27%	0%	45%	8,320%	25–30%
Percent of Projected 2030 Total	57–59%	19%	2%	3%	15%	3%	

Notes: The bar chart compares demands by use category in MGD, and the table shows the percentage of growth in each category. Percent of Projected 2030 Totals other than AGR Self-Supply are calculated based on the upper range limit of demand (1,262.9 MGD).

Figure 6. Estimated daily gross demands for an average year by water use category for 2010 and 2030.

Agricultural Self-Supply


Low-volume Drip Irrigation

AGR Self-Supply includes water used for commercial crop irrigation, livestock watering, and aquaculture. Agriculture is a key industry in southwest Florida and is expected to remain the dominant land use in the region despite economic challenges and damage from hurricanes and diseases, such as citrus canker and greening. The importance of the region's agricultural industry is reflected in projections that show it will continue to be the leading water use category. Agricultural acreage and associated water demands are challenging to project because of the various economic, weather, and disease issues that impact production. In addition, market-driven factors affect the crops grown and volume of water used. Therefore, to estimate future gross water demand, it was deemed appropriate to use ranges for future acreage and demand projections.

Gross irrigation requirements are the amount of water that must be withdrawn from the source in order to be delivered to the plant root zone. The volumes in **Table 4** account for soil type and irrigation system efficiency. Net demands reflect an estimate of the amount of water that farmers need to place into the root zones of crops. **Appendix A** presents both net and gross irrigation demands by crop type under average year and 1-in-10 year drought conditions from the 2005 baseline through the 2030 planning horizon.

Table 4. Estimated irrigated agricultural acreages and average year gross demands by crop type for 2010 and 2030.

Category	2010 Acres	2010 Demand (MGD)	2030 Acres	2030 Demand (MGD)
Citrus	118,065	182.8	123,177–152,177[a]	190.8–235.8
Field Crops – Sugarcane	94,426	232.6	111,479	274.9
Field Crops – Other	3,322	8.6	3,322	8.6
Vegetables, Melons, and Berries	82,202	181.4	82,202	181.4
Sod	3,867	11.9	8,524	26.1
Greenhouse/Nursery	3,569	11.9	3,855	13.3
Other Fruits and Nuts	568	0.8	568	0.8
Total	**306,019**	**630.0**	**333,127–362,127**	**695.9–740.9**

a. Includes 29,000 acres of transitional land.

Note: Perceived discrepancies in totals between this chapter and **Appendix A** are due to rounding.

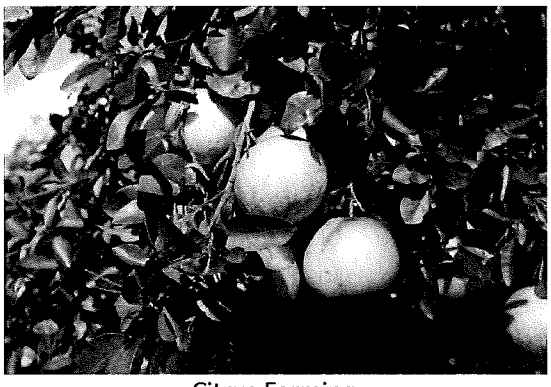
For 2005 and 2010, estimates of active cultivated acreage with irrigation are based on various industry statistical surveys, including the United States Department of Agriculture (USDA), citrus industries, and information from the following sources:

- USDA – National Agricultural Statistics Service
- Florida Department of Agriculture and Consumer Services (FDACS)
- Gulf Citrus Growers Association, Inc.
- Local agricultural extension offices
- University of Florida's Institute of Food and Agricultural Services (IFAS)
- Florida Farm Bureau and SFWMD agricultural stakeholders
- SFWMD Water Use Regulatory Database
- Southwest Florida Water Management District
- Southwest Florida Feasibility Study geographic information system land use layers (SDI Environmental, Inc. 2008, Liebermann 2006)

For this plan update, actively cultivated agricultural acreage is expected to increase from 306,019 in 2010 to 333,127–362,127 acres by 2030 (**Table 4**). Acreage projections by crop are provided for each county in **Appendix A**. In terms of gross demands, water use is expected to increase to 695.9–740.9 MGD by 2030.

The 2010 cultivated and irrigated acreage of 306,019 is significantly less than the 2005 acreage reported in the 2005–2006 LWC Plan Update. The difference between acreage estimates is attributed to many factors, including acreage loss due to hurricanes; citrus canker and greening; a decline in sod and landscape nurseries due to the economic downturn; changes in commodity markets; and clearing of about 10,000 acres for the Comprehensive Everglades Restoration Plan (CERP) Caloosahatchee River (C-43) West Basin Storage Reservoir Project.

The total agricultural acres listed in the 2005–2006 LWC Plan Update used the best information available at that time for the 2025 planning horizon, which did not reflect the loss of citrus acres caused by hurricanes or disease. As a result of the challenges occurring in the citrus industry, the USDA is preparing annual citrus inventories to monitor the industry's growth. The citrus acres included in this plan update are based on the USDA reports of these inventories (USDA–NASS 2004, 2006, 2008, 2009).



Citrus Farming

Within the region, there are local declines in cultivated acreage in Hendry County and increases in cultivated acreage in Charlotte and Glades counties. Lee County's cultivated agricultural acreage levels are projected to remain stable. Based on input from agricultural industry and agricultural agency representatives, the SFWMD anticipates most agricultural land will remain in agriculture use within the LWC Planning Area. As future markets warrant, either historical crops will be replanted or the land will be converted for use with new crops.

Projections in this plan update include approximately 29,000 acres of transitional land not assigned within a specific county. The SFWMD's stakeholders anticipate this land will remain in agricultural production and will likely be used for citrus crops.

The LWC Planning Area experienced the loss of about 34,000 acres of citrus between 2004 and 2009 due to hurricane damage and the proliferation of canker and greening diseases. In addition, about 10,000 acres were permanently taken out of production when the land was cleared for the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project.

Researchers are evaluating options to manage the occurrence of disease, develop disease-resistant rootstock, and establish production practices, such as the advanced production and open hydroponic systems. The outcome of this research will help determine the crops grown on the region's agricultural land; that is, whether the land will continue to be farmed in citrus or will transition to another crop.

Agricultural industry and agency representatives indicate that peaches, blueberries, strawberries, and plants for biofuel or landscape material are viable crop alternatives for transitional LWC Planning Area agricultural lands (see **Appendix A**). In addition, the agricultural community anticipates regional movement of some crops from northern counties because of issues related to freezes, freeze protection water, and varying restrictions in other regions.

The FDACS indicates that Florida's climate is well suited for production of biofuel. The growing season positions Florida to become a leader in cellulosic ethanol production. Significant research is under way to evaluate biofuel crops best suited for Florida and several pilot projects have begun. Biofuel crops could be significant in the future within the LWC Planning Area (see **Appendix A**).

Agricultural water demand reflects projected irrigated acreage, crop and soil types, growing seasons, and irrigation system types and strategies. AGR Self-Supply demand calculations for this plan update applied results from the Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) Model (Smajstrla 1990). The model calculates average and 1-in-10 year drought conditions water demands using 35 years of daily rainfall and evaporation records.

Acreage projections are based on the data and methods contained in the land use projection analysis completed by the SFWMD to support this plan update. Agricultural acreage estimates from the USDA and the SFWMD Water Use Regulatory Database were also used to

confirm or revise previous analyses. In addition, agricultural industry experts provided input on agricultural acreage estimates, which were considered in the overall analysis.

The increase in actively cultivated agricultural acreage from 2010 to 2030 is expected to range from 27,108 to 56,108 acres. The acres dedicated to citrus, sugarcane, greenhouse /nursery, and sod, are all expected to increase during the planning horizon. Estimated agricultural irrigated acreages and average year gross demands by crop type for 2010 and 2030 are presented in **Table 4**. Current (2010) agricultural water use accounts for 65 percent of the region's total gross demands. By 2030, the LWC Planning Area's total gross agricultural demands are projected to increase 10–18 percent.

Industrial/Commercial/Institutional Self-Supply

ICI Self-Supply demands through 2030 are not projected to exceed the projections used in the 2005–2006 LWC Plan Update. In this region, the major industrial water use is limerock production, which was at a peak in 2005 and 2006. For this production process, water is continually recirculated; therefore, an increase in limerock production does not necessarily relate to an increase in water use. Although several proposed limerock mines are planned during the next 20 years, the production of rock and resulting water use are not expected to be any more than the 2005 production levels.

Citrus and sugar processing are other industrial water uses in the region. These industries strive to maintain consistent production that, in turn, results in consistent annual water use.

Many other ICI Self-Supply facilities receive water from PWS and are, therefore, included in PWS use. Reports from the SFWMD Water Use Regulatory Database in 2005 were used to calculate ICI Self-Supply water use demands. Individual self-suppliers for commercial and institutional facilities typically have demands less than 0.1 MGD. Finally, because this demand category is a composite of different use types such as those previously discussed, and historical water use data do not demonstrate clear trends, the demands are held constant through the 20-year planning horizon. Gross and net water demands are not distinguished for this use category, as most of the water withdrawn is recycled.

Recreational/Landscape Self-Supply

Gross demand for REC Self-Supply is projected to increase by 45 percent from the estimated 130.1 MGD in 2010 to 188.5 MGD in 2030. REC Self-Supply demands supplied by PWS utilities are included in the PWS net demands. REC Self-Supply water use projections include landscape and golf course irrigation demands, as well as water needs for parks; communities and homeowner associations with large common areas and consolidated irrigation systems; and areas with large green spaces, such as ball fields, stadiums, and cemeteries.

Estimated landscape and golf course acreage was based on the total number of landscape and golf course consumptive use permits registered in the SFWMD Water Use Regulatory Database. Future year demands were projected using county population growth rates and information provided by local planning officials. Based on input received from golf course stakeholders and planning staff, golf course water demands are expected to increase minimally during the next 20 years.

Landscape acres are projected to increase based on population growth rates calculated in the plan update for each county. The estimated 2005 acreage and projected gross demands were calculated using acreage and the AFSIRS Model. The AFSIRS Model calculates the net irrigation requirements of a landscape and its irrigation system. Details regarding the future acreage projections for permitted landscape irrigation for each county are available in **Appendix A**.

Power Generation Self-Supply

The need for additional power supplies is expected to grow as the population in the LWC Planning Area and other portions of south Florida grow (see **Table 2**). FPL, which provided input for this plan update, utilizes an assessment method incorporating environmental, economical, and technical feasibility when selecting power generation and cooling technologies most appropriate for site-specific conditions, including water supply and wastewater disposal. The different technologies may require and utilize traditional (fresh) and alternative water sources.

More power generation facilities are expected to be added to the south Florida system, which may potentially expand its Fort Myers Plant Facilities or begin new generation projects. If an expansion occurs at the Fort Myers Plant, PWR Self-Supply water demands are projected to increase from 0.5 MGD in 2010 to 42.1 MGD by 2030 (**Figures 5** and **6**). These projections represent the fresh and brackish water needed to support all power generating capacity increases in the LWC Planning Area at this time.

DEMAND PROJECTIONS IN PERSPECTIVE

The demand projections presented in this plan update are based on the best information available. However, these projections reflect trends, circumstances, and industry intentions that change over time. For example, this plan update expects slower population growth than was anticipated in the 2005–2006 LWC Plan Update (**Table 5**). However, anticipated growth remains large enough to require infill and redevelopment of existing urban areas, as well as development outside of current urban service boundaries, to accommodate this growth. The location of new development and the extent to which such growth may include historically rural portions of the LWC Planning Area (especially in Charlotte, Glades, and Hendry counties) are important planning considerations.

Table 5. Gross demands projected in the 2005–2006 LWC Plan Update versus this update.

Water Use Category	Projected 2025 Demand (MGD)	Projected 2030 Demand (MGD)
Agricultural Self-Supply	729.2	695.9–740.9
Public Water Supply	272.2	232.1
Domestic Self-supply	31.1	24.0
Industrial/Commercial/Institutional Self-Supply	28.9	35.3
Recreational/Landscape Self-Supply	167[a]	188.5
Power Generation Self-Supply	66.9	42.1
Gross Demands Total LWC Planning Area	1,295.3	1,217.9–1262.9

a. Adjusted from 62.2 MGD to 167 MGD to account for landscaping.

In addition, there are a number of proposed comprehensive plan amendments that have been approved by the Florida Department of Economic Opportunity for large developments that may not be reflected in current BEBR projections. For example, in Hendry County approved developments such as Rodina, Gardinier, and South LaBelle Village represent significantly greater 2030 population growth than the latest BEBR projections. These additional proposed developments will likely require a significant water supply initiative in this area, which is not included in the demand projections in this update. It should be noted that BEBR updates their projections based on key events and expectations for anticipated growth given changes in economic cycles and migration patterns. As the target dates for building these developments comes closer and the anticipated level of growth changes, future BEBR population projections will capture the latest growth expectations and reflect the expected demand for housing. To account for dynamic growth patterns, water supply plans are updated every five years in order to plan and depict increases and decreases in growth and water supply demands. The SFWMD will continue to work closely with local governments and water supply facilities to monitor growth decisions in these areas and ensure that adequate and sustainable water supplies are identified to support these developments.

In summary, the overall projected gross demands for 2030 (**Table** 5) have decreased slightly (less than 3 percent) compared to the 2025 projections. The LWC Planning Area's total population growth of approximately 510,000 residents from 2010 (992,486) through 2030 (1,502,701) is slightly less than the population growth projection of 674,042 residents from 2000 to 2025 in the 2005–2006 LWC Plan Update.

Since we began the development of this plan update, the 2010 United States Census Bureau population numbers were released (U.S. Census Bureau 2010) and the 2010 medium BEBR population projections were released (BEBR 2011). In reviewing the census population numbers, it was found there was less than a one percent lower difference in the census population from the 2010 population in the plan. The 2011 medium BEBR 2030 population projections decreased slightly by three percent from the plan's 2030 population projections.

In summary, in this plan update, 2010 and 2030 population numbers are still reflective of the best available data.

Projected 2030 urban gross water demands (for all water uses except AGR Self-Supply) for this plan update are 522.0 MGD. Urban demand estimate and projection highlights for the LWC Planning Area include some of the following:

- The growth in Lee County is projected to increase 58 percent from 607,000 in 2010 to approximately 957,000 in 2030.
- Growth in the portion of Collier County within LWC Planning Area is projected to increase by 38 percent from approximately 342,000 in 2010 to 472,000 in 2030.
- 2030 PWS gross demands are expected to increase by 49 percent from 156.3 MGD in 2010 to 232.1 MGD by 2030.
- 2030 REC Self-Supply gross demand are projected to increase from 130.1 MGD in 2010 to 188.5 MGD by 2030. The majority of future landscaped areas will be associated with residential developments.
- PWR Self-Supply demands are expected to increase from 0.5 MGD in 2010 to 42.1 MGD by 2030.

Analyses, strategies, options, and development projects to meet these water demand estimates and projections are described in the following chapters. For the 20-year planning horizon in this plan update, PWS demands are to be met by the proposed water supply development projects identified in **Chapter 6**.

3
Issues and Evaluations

This chapter reviews water resource issues that affect the Lower West Coast (LWC) Planning Area and past and ongoing water resource evaluations. The issues identified in this chapter potentially affect the use of existing water resources and development of new supplies to meet projected water demands for 2030 within the planning area. Evaluations and analyses are discussed in the context of water resource issues. A brief summary of the resource protection tools available under Florida law is also provided. This chapter builds on resource evaluation efforts described in the *2005–2006 Lower West Coast Water Supply Plan Update* (2005–2006 LWC Plan Update; SFWMD 2006). Additional water resource information can be found in the *2011–2012 Water Supply Plan Support Document* (Support Document; SFWMD 2012a).

TOPICS

APPROACH

In addition to utilizing the work done for the earlier LWC water supply plans and updates, analysis and projects completed since the 2005–2006 LWC Plan Update, current population and demand projections, and local government comprehensive planning documents were reviewed as part of this update. The sources used to identify and evaluate water resource issues include the following:

- Input from the planning area stakeholders and the public
- Analysis and results from previous LWC Planning Area water supply plan efforts
- Water supply facilities work plans and capital improvements elements for the local governments in the planning region
- Consumptive use permits and permit applications
- Water supply demand projections for 2030
- Data from the Comprehensive Everglades Restoration Plan (CERP) Caloosahatchee River (C-43) West Basin Storage Reservoir Project's preconstruction test cells
- Data from the aquifer storage and recovery (ASR) pilot test at the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project

- Analyses performed in conjunction with the 2008 Lake Okeechobee Regulation Schedule (2008 LORS) and the development of adaptive protocols for Lake Okeechobee (see **Appendix H**) in support of the revised lake schedule.

Based on the input, it was concluded that issues identified in the 2005–2006 LWC Plan Update are still valid. A review of the projected water demands in this update are similar to those previously analyzed, and the findings of the previous plans are representative of current and 2030 scenarios. Therefore, new modeling was deemed unnecessary for this current update.

SUMMARY OF ISSUES IDENTIFIED FOR 2030

Primary freshwater sources in the LWC Planning Area may not be sufficient to meet 2030 projected water use demands. Past analysis (SFWMD 2000b) indicated that fresh water in the surficial aquifer system (SAS) and intermediate aquifer system (IAS), and surface water in the Caloosahatchee River (C-43 Canal) Watershed are not adequate to meet the growing needs of the LWC Planning Area during 1-in-10 year drought conditions. The water supply issues continuing to influence water supply planning efforts to meet 2030 projected water needs in LWC Planning Area are as follows:

- Increased withdrawals from the SAS and the freshwater portion of the IAS are generally limited due to potential impacts on wetlands and existing legal water users including Domestic Self-Supply (DSS), the potential for saltwater intrusion, and the possibility of reaching the maximum developable limits (MDLs) of aquifers. New or increased allocations will be evaluated on an application-by-application basis to determine if the project meets consumptive use permitting criteria.
  - In some areas DSS cumulative withdrawals are having an effect on aquifer water levels.
- Surface water allocations from Lake Okeechobee and hydraulically connected surface waters are limited by the Lake Okeechobee Service Area Restricted Allocation Area criteria.
  - The results of the 2008 LORS process indicated that the level of certainty is projected to decline from the consumptive use permitting standard of experiencing water shortage restrictions every 1-in-10 years to experiencing restrictions every 1-in-6 years while the lake is operated under the 2008 LORS.
- Peak freshwater discharges during the wet season are affecting the health of the Caloosahatchee Estuary and additional storage is required in both the basin and the regional system to attenuate damaging peak flow events.
- Surface water availability and current storage capacity is insufficient for the Caloosahatchee River and Estuary during dry conditions.

Previous LWC water supply plans identified a variety of alternative water supply development projects to avoid water resource impacts and competition between water users as well as provide a sustainable supply of water. Projects include

increased water conservation, reuse of reclaimed water, storage of water using ASR wells, and development and use of brackish water sources. The implementation of these projects is well under way.

While the development of fresh groundwater in many areas of the LWC Planning Area has been maximized, fresh groundwater may be available in some places. It is not the intent of this update to require water users, including Rural Areas of Critical Economic Concern, to use alternative water supplies when fresh water is available. As urban growth occurs, it is anticipated that some agricultural land will transition to urban community uses. These existing agricultural areas likely have consumptive use permits for use of traditional groundwater for crop irrigation. While consumptive use permits cannot be directly transferred from one land use type to another, the conversion of these lands from agriculture to another land use may result in available fresh groundwater for the new land use. It is important to note that there are different considerations for different water use categories, based on specific needs. These considerations are discussed in more detail in the *Resource Protection* section later in this chapter.

Since the 2005–2006 LWC Plan Update was published, changes have occurred that affect the Caloosahatchee River and Estuary. These include operational, regulatory, and planning changes such as the following:

- The Lake Okeechobee Regulation Schedule was changed in 2008 to, in general, lower lake levels to address concerns regarding integrity of the Herbert Hoover Dike stability and the ecological impacts of high lake levels on the lake's ecosystem. The new Lake Okeechobee Regulation Schedule, 2008 LORS, has a variety of consequences that were analyzed by the United States Army Corps of Engineers (USACE) and described in the *Final Supplemental Environmental Impact Statement Including Appendices A through G – Lake Okeechobee Regulation Schedule* (USACE 2007). The environmental impact statement provides the following:
    - The USACE addressed the interim nature of 2008 LORS and provided the schedule formulated to address specific conditions existing in 2007. As circumstances change, the USACE will adapt its Lake Okeechobee operations accordingly. The USACE expects to operate under 2008 LORS until the earlier of either 1) the implementation of a new Lake Okeechobee schedule as a component of the systemwide operating plan to accommodate the CERP Band 1 projects or 2) the completion of the seepage berm construction or equivalent (USACE 2007). Herbert Hoover Dike repairs for reaches 1, 2 and 3. The occurrences of these events are expected to allow for greater operational flexibility, potentially including higher lake levels for increased water storage. In balancing the multiple project purposes, the USACE, will timely shift from the interim LORS to a new schedule with the intent to complete any necessary schedule modifications or deviations concurrent with completion of (1) or (2) (USACE 2007).
    - The environmental impact statement analyses indicated that LORS is projected to adversely impact water supply at low lake levels with the

current South Florida Water Management District (SFWMD) water supply triggers (USACE 2007).

- Analyses associated with 2008 LORS assessed impacts on water supply performance and projected a decline in the physical level of certainty of users reliant on lake water supplies. This level of certainty is projected to decline from experiencing water shortage restrictions only every 1-in-10 years to experiencing restrictions every 1-in-6 years while the lake is being operated under the 2008 LORS.
- Repairs to the Herbert Hoover Dike are under way and are estimated to be completed by 2022 (S. Kaynor, USACE, personal communication).

- Adaptive protocols for Lake Okeechobee were updated in 2010, with a key goal to improve water supply, flood protection, and ecosystem benefits within the constraints of the 2008 LORS and the *Central and Southern Florida Project Water Control Plan for Lake Okeechobee and Everglades Agricultural Area* (USACE 2008). For further discussion of these changes, see **Appendix H**.

As a result of the impacts to water supply, SFWMD enacted rules to limit future additional withdrawals from the Lake Okeechobee Waterbody in order to prevent further degradation of the level of certainty for existing legal users and to address the lake's Minimum Flow and Level (MFL) criteria and Everglades restoration. For further discussion of the effects of 2008 LORS, see **Appendix H** and the *2012 Lower East Coast Water Supply Plan Update* (SFWMD 2012b) for more information.

Surface Water Availability is Limited

Traditionally, surface water has been the primary source of water supply for the agricultural industry in the Caloosahatchee River (C-43 Canal) Watershed. As described above, surface water availability from the existing canal and storage networks alone is insufficient to meet agricultural water use demands and environmental needs during 1-in-10 year drought conditions (SFWMD 2000a). Past analyses concluded that additional storage was necessary to provide adequate resources to meet existing legal user and natural system needs in the LWC Planning Area (SFWMD 2000b).

The lack of storage within the Caloosahatchee River (C-43 Canal) Watershed contributes to the following:

- The discharge of large volumes of water to tide, which adversely impacts estuarine ecosystems due to sudden declines in salinity during major storm events
- The discharge of water to tide during the wet season so it is no longer available to the ecosystem during the dry season or for use by consumptive users
- The lack of sufficient dry season flows, which causes elevated salinity within the estuary

Reduced dry season base flows to the estuary adversely affect habitats and organisms dependent on brackish or freshwater areas during their life cycle. High volume surface

water discharges to the Caloosahatchee River and Estuary from local basin runoff, which are sometimes coupled with Lake Okeechobee releases, produce rapid salinity fluctuations. The resultant changes in estuarine aquatic communities are indicated by a reduction in oysters and marine seagrasses at high flows, and mortality of tape grass in the upper estuary at low flows.

Construction of the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project includes development of surface water storage for the watershed. The main objective of this project is to enhance dry season flows to the Caloosahatchee Estuary. Additional reservoirs or water storage solutions are needed to increase water storage capacity. Currently, water supplies from the Caloosahatchee River (C-43 Canal) are dependent on Lake Okeechobee for supplemental water during the dry season.

Fresh Groundwater Availability Is Limited

Surficial Aquifer System

Throughout the LWC Planning Area, the SAS historically served as the major source of fresh groundwater for Public Water Supply (PWS), Recreational/Landscape (REC) Self-Supply, and Agricultural (AGR) Self-Supply. However, past and present analyses of the SAS indicate it is a limited water resource in many areas. Previous analyses demonstrated that the SAS did not have the capacity to be the primary source for projected urban water demands beyond 1990 base year demand levels. Although the number of SAS withdrawals has increased since the 1990s, withdrawal quantities remain limited. Increases in withdrawals from the SAS will continue to be constrained by saltwater intrusion, wetland impacts, impacts to existing legal users, and other regulatory considerations. Additional supplies may be developed and permitted from these traditional (historical) sources depending on the quantities required, local resource conditions, changing land use, and the viability of other supply options.

In 2010, treatment capacity of water from the SAS accounted for approximately 48 percent of the region's PWS. By 2030, the treatment capacity of SAS water for PWS is projected to decrease to 34 percent, as infrastructure to develop additional alternative water sources, such as brackish groundwater and reclaimed water, increase. Further development of the SAS may be accomplished by relocating production wells further from wetlands and existing legal users to maximize use and minimize negative impacts. Changes in land use/land cover also affect potential development of the SAS. However, new or increased allocations from the SAS will be evaluated on an application-by-application basis to determine if the project meets consumptive use permitting criteria. Additional study is needed to identify potential sources of fresh water for uses such as agriculture.

Saltwater intrusion is an ongoing concern resulting from continued use of shallow groundwater sources near the coast and potential sea level rise as well as the upward movements of saline water from the deeper aquifers. Coordination with utilities and other water users assists with comprehensive data collection and monitoring.

Intermediate Aquifer System

Historically, the Sandstone and Mid-Hawthorn aquifers within the IAS have been important freshwater sources for portions of Lee and Hendry counties. However, these local aquifers are not fresh or productive throughout the LWC Planning Area. Analyses indicate these localized aquifers are limited water sources in portions of the planning area due to the cumulative effects of withdrawals by all water users, which decrease water levels in the IAS and could cause harm to the resource or saltwater intrusion. MDLs have been adopted for the IAS. Proposed allocation increases from the IAS in Lee and Hendry counties will continue to be evaluated on an application-by-application basis to determine if the project meets consumptive use criteria`. Additional data is needed to help identify areas where water is potentially available.

RESOURCE PROTECTION

A goal of Chapter 373, Florida Statues (F.S.), is to ensure the sustainability of Florida's water resources. Various water resource protection standards have been developed to accomplish this goal. The levels of harm — harm, significant harm, and serious harm — are relative resource protection terms, each playing a role in the ultimate goal of achieving a sustainable water resource. For instance, programs regulating surface water management and consumptive use permitting must prevent harm to the water resource. The conceptual relationship among the various harm standards and associated conditions and water shortage severity is shown in **Figure 7**.

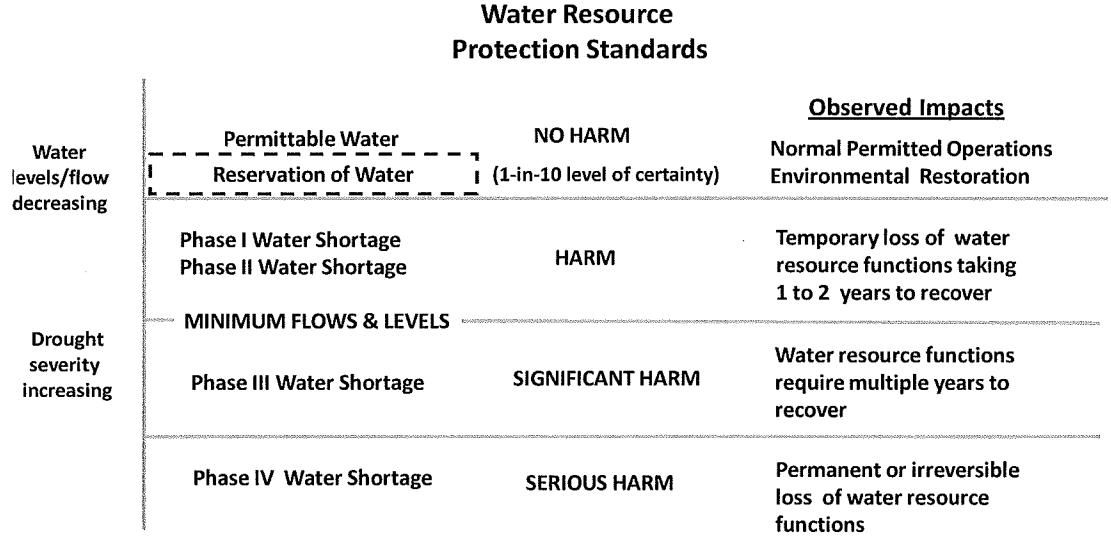


Figure 7. Conceptual relationship among the harm, significant harm, and serious harm water resource protection standards.

To ensure the sustainability of Florida's water resources, Chapter 373, F.S., provides the water management districts with several tools to protect water resources:

- The Consumptive Use Permitting Program protects the water resources from harm by ensuring water use is reasonable-beneficial, does not interfere with existing legal users, and is consistent with the public interest (Sections 373.219 and 373.223, F.S.). Harm is the temporary loss of water resource functions that results from a change in surface or groundwater hydrology, and takes a period of one to two years of average rainfall conditions to recover (Rule 40E-8.021(9), Florida Administrative Code [F.A.C.]).
- MFL criteria define the point at which additional withdrawals will result in significant harm to the water resources or ecology of an area (Sections 373.042 and 373.0421, F.S.). Significant harm is the temporary loss of water resource functions that results from a change in surface water or groundwater hydrology that takes more than two years to recover, but which is considered less severe than serious harm (Rule 40E-8.021(31), F.A.C.).
- Water Reservations set aside water for the protection of fish and wildlife or public health and safety so that water cannot be allocated for consumptive use permitting (Subsection 373.223(4), F.S.).
- Water shortage restrictions are used to limit water use when sufficient water is temporarily unavailable to meet user needs or when conditions require temporary reduction in use to prevent serious harm to water resources (Sections 373.175 and 373.246, F.S.). Serious harm is the long-term loss of water resource functions resulting from a change in surface water or groundwater hydrology (Rule 40E-8.021(30), F.A.C.).

Table 6 summarizes the statutory resource protection tools and definitions. **Table 7** summarizes definitions of other resource protection terms.

Consumptive Use Permitting

Consumptive use permitting protects the water resources from harm by ensuring water use is reasonable-beneficial, does not interfere with existing legal users, and is consistent with the public interest. The *2000 Lower West Coast Water Supply Plan* (2000 LWC Plan; SFWMD 2000b) recommended incorporation of resource protection criteria, level of certainty, special designations, and permit durations into the consumptive use permitting criteria. A series of rulemaking efforts was completed in September 2003, resulting in amendments to Chapters 40E-1, 40E-2, 40E-5, 40E-8, 40E-20, and 40E-21, F.A.C. and the *Basis of Review for Water Use Permit Applications within the South Florida Water Management District* referred to as the Basis of Review (SFWMD 2010a). Among the most significant changes were the amendments to permit duration, permit renewal, wetland protection, supplemental irrigation requirements, saltwater intrusion, ASR, and model evaluation criteria.

The renewal process for irrigation class consumptive use permits in the LWC Planning Area began in 2004 and was mostly complete in 2006. Many of the permits for PWS utilities were

renewed with 20-year durations. The processing of permit renewals, modifications, and new applications has assisted in the evaluation of conditions for this plan update.

Table 6. Summary of statutory resource protection tools.

Tool	Description
Consumptive Use Permitting	The right to use water is authorized by permit. The conditions of permit issuance are more specifically enumerated in Chapters 40E-2 and 40E-20, F.A.C. In order to provide reasonable assurances that the conditions of permit issuance are met, applicants must meet consumptive use permitting criteria. The technical criteria used to evaluate the purpose, quantity, and source of proposed water to be used include the following: • Saltwater intrusion • Wetland and other surface water body impacts • Pollution • Impacts to off-site land uses • Interference with existing legal users • MFLs • Regulatory components of MFL prevention and recovery strategies, including aquifer MDLs.
Minimum Flows and Levels	MFLs are the flows or levels at which the specific water body would experience significant harm if further withdrawals are authorized. If water flows or levels are below the MFL, or projected to fall below the MFL within the next 20 years, the SFWMD must expeditiously implement a recovery or prevention strategy (Subsection 373.0421(2), F.S.). These strategies may include the construction of new or improved water storage facilities, development of additional water supplies, implementation of water conservation, etc. The strategy is to be developed in concert with the water supply planning process and coincide with the 20-year planning horizon for the area.
Water Reservations	A Water Reservation sets aside water for the protection of fish and wildlife or public health and safety. When a volume of water is reserved, it is not available for allocation to consumptive uses. Water reservations can be developed based on existing water availability and/or consideration of future water supplies made available by water resource projects. Water provided by CERP projects under the Water Resources Development Act of 2000 require the SFWMD to reserve or allocate the water for the natural system identified for each CERP project.
Water Shortage	Water shortages are declared by the SFWMD's Governing Board when available groundwater or surface water is not sufficient to meet users' needs or when conditions require temporary reduction in total use within the area to protect water resources from serious harm. The SFWMD's Water Shortage Plans are contained in Chapters 40E-21 and 40E-22, F.A.C. The purposes of the plans are to protect the water resources of the SFWMD from serious harm; 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; provide advance knowledge of the means by which water apportionments and reductions will be made during times of shortage; and promote greater security for consumptive use permittees.

Table 7. Other resource protection terms.

Term	Description
Level of Certainty	Section 373.709, F.S., requires regional water supply plans to identify the water supply needs of existing and future reasonable-beneficial uses based upon meeting those needs for a 1-in-10 year drought event. A 1-in-10 year dought is a below average rainfall year of such intensity it is expected to have a return frequency of once in 10 years. It results in an increase in water demand to a magnitude that would have a 10 percent probability of being exceeded during any given year. The SFWMD has incorporated this level of certainty into its consumptive use permitting program. When determining whether the permit applicant has provided reasonable assurances the conditions for permit issuance are met, the SFWMD will consider the projected impact of the proposed withdrawal, along with impacts from any existing legal uses and other pending applications under conditions up to and including a 1-in-10 year drought event. The level of certainty is a concept providing a probability of certainty that, given a specific drought event, demands for reasonable-beneficial uses of water will be fully met and that the water resource will be protected from harm.
Restricted Allocation Areas	Restricted Allocation Areas are those areas designated within the SFWMD for which allocation restrictions are applied with regard to the use of specific sources of water. The water resources in these areas are managed in response to specific sources of water in the area for which there is a lack of water availability to meet the projected needs of the region from that specific source of water. The criteria governing Restricted Allocation Areas are contained in Section 3.2.1 of the Basis of Review. Restricted Allocation Area criteria have been developed as the regulatory components of the MFL recovery strategies for the Lake Okeechobee Waterbody, the Everglades, and the Northwest Fork of the Loxahatchee River.

Minimum Flows and Levels

MFLs define the point at which additional withdrawals will result in significant harm to the water resources or ecology of the area. These criteria are applied individually to affected water bodies and define flow, duration of flow, or water stage. When setting a MFL, changes and structural alterations to watersheds, surface waters, and aquifers and the effects such changes or alterations have had, and the constraints such changes or alterations have placed on the hydrology of an affected watershed, surface water, or aquifer shall be considered (Subsection 373.0421(1), F.S.). For further discussion on hydrologic alterations that have occurred in the LWC Planning Area, see **Appendix G.**

Within the LWC Planning Area, MFL criteria were established in 2001 for the Caloosahatchee River (Rule 40E-8.221(2), F.A.C.), and the Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers (Rule 40E-8.331, F.A.C.) that occur within Charlotte, Hendry, Glades, Lee, and Collier counties. For more information, see **Appendix G.**

When a MFL is established, it must be evaluated to determine if the existing flow or level criteria is currently being exceeded or will be exceeded within the next 20 years. If the existing water flow or level is below the MFL, or projected to fall below the MFL within the

next 20 years, the SFWMD must develop and expeditiously implement a recovery or prevention strategy, which includes the development of additional water supplies and other actions to achieve recovery of or prevent the existing flow or level from falling below the established MFL (Subsection 373.0421(2), F.S.). A recovery strategy is needed when the water body currently exceeds the MFL. The goal of a recovery strategy is to achieve the established MFL as soon as practicable. The recovery strategy must include the provision of sufficient water supplies for reasonable-beneficial uses, and may include the development of additional supplies, construction of new or improved storage facilities, and implementation of conservation or other efficiency measures.

A prevention strategy is necessary when the MFL is not currently violated, but is projected to be exceeded within the next 20 years. The goal of a prevention strategy is for the water body to continue to meet the established MFL in the future. Both recovery and prevention strategies must include phasing or a timetable that allows for the provision of sufficient water supplies for all existing and projected reasonable-beneficial uses. The strategy should include development of additional water supplies and implementation of water conservation and other efficiency measures consistent with the provisions in Sections 373.0421 and 373.709, F.S.

Caloosahatchee River MFL

In 2001, the SFWMD established an MFL for the Caloosahatchee River. A minimum mean monthly flow of 300 cubic feet per second (cfs) (equivalent to 194 million gallons of water a day [MGD]) at the S-79 structure was determined necessary to maintain sufficient salinities to prevent a MFL exceedance. A minimum flow of 300 cfs would create salinity conditions that support a sustainable population of submersed aquatic vegetation beds in the upper estuary.

A MFL exceedance occurs during a 365-day period when a) a 30-day average salinity concentration exceeds 10 practical salinity units (psu) at the Fort Myers salinity station, or b) a single, daily average salinity exceeds a concentration of 20 psu at the Fort Myers salinity station. Exceedance of either "a" or "b" for two consecutive years is a violation of the MFL.

Analyses completed for the *2000 Lower East Coast Water Supply Plan* (SFWMD 2000a) demonstrated that long-term regional storage was necessary to achieve proposed MFL criteria, and that MFL violations would continue until implementation of the recovery strategy. As a result, the SFWMD projected that a recovery strategy based on construction of regional storage would be necessary to achieve the MFL. The structural features of the recovery plan are described in **Appendix G**.

Lower West Coast Aquifers MFL

In 2001, the SFWMD's Governing Board adopted a MFL rule specifying that the minimum water levels for the Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers must equal the structural top of the aquifer (SFWMD 2000b). A violation of the criteria occurs when water

levels drop below the top of the uppermost geologic strata comprising the aquifer at any point in time. Water level measurements used to determine the conditions of the aquifers for the purpose of this rule will be located no closer than 50 feet from any existing pumping well (Rule 40E-8.331, F.A.C.).

In order to prevent these aquifers from falling below the minimum water level, the SFWMD adopted MDLs. The MDL (contained in the Basis of Review) prohibits consumptive uses from lowering the potentiometric head within the Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers to less than 20 feet above the top of the uppermost geologic strata that comprises the aquifer at any point during a 1-in-10 year drought condition (SFWMD 2010a). This prevention strategy is described in greater detail in **Appendix G.**

Water Reservations

A Water Reservation sets aside water for the protection of fish and wildlife or public health and safety. When a volume of water is reserved, it is not available for allocation to consumptive uses. Water Reservations can be developed based on existing water availability and/or consideration of future water supplies made available by water resource projects. The SFWMD is required to reserve or allocate water for natural systems provided by CERP projects under the Water Resources Development Act of 2000 and Section 373. 470, F.S.

Picayune Strand and Fakahatchee Estuary

SFWMD adopted a Water Reservation for the Picayune Strand and Fakahatchee Estuary in February 2009 in support of the CERP Picayune Strand Restoration Project. This reservation sets aside water for the protection of fish and wildlife (Rule 40E-10.041, F.A.C.) and affects the availability of surface water and groundwater in the Picayune Strand area. Consumptive use permit applicants must provide reasonable assurances that their proposed use of water will not withdraw water reserved for the natural system. The regulatory criteria to provide such reasonable assurances are described in Section 3.11.1 of the Basis of Review.

CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project

The SFWMD initiated rule development for a Water Reservation in December 2009 to fulfill its project assurance commitments for the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project. The Water Reservation rule will require consumptive use permit applicants to provide reasonable assurances that their proposed use of water will not withdraw water reserved for the natural system. The SFWMD's objective in establishing this Water Reservation is to ensure that all water contained in the C-43 Reservoir is protected for the natural system. Additional information regarding this Water Reservation can be found in **Appendix G.**

EVALUATION AND ANALYSIS

This section of the chapter provides an overview and summary of previous analyses. The findings and conclusions of the *1994 Lower West Coast Water Supply Plan* (1994 LWC Plan; SFWMD 1994), 2000 LWC Plan, and 2005–2006 LWC Plan Update are still representative of the LWC Planning Area. Previously identified water resource and water supply issues remain considerations in this current update. Previous modeling analyses used assumptions and general hydrogeologic conceptualization that are consistent with current understanding of the groundwater systems. The projected 2030 gross water demands for all categories of water use in this plan update are three percent less than the projected demands in the 2005–2006 LWC Plan Update for 2025 (see **Chapter 2**). Because the previously identified issues are still valid, and projected water demands are similar to those previously analyzed, new modeling scenarios were not deemed necessary for the current update. For further information, refer to the 1994 and 2000 LWC plans and 2005–2006 LWC Plan Update.

Previous Analyses

Previous water supply planning efforts analyzed the ability of traditional freshwater sources to meet future water demands. Evaluation tools used in these analyses included surface water budgets, groundwater models, integrated surface water and groundwater models, and saltwater intrusion vulnerability mapping. Additionally, the South Florida Water Management District (SFWMD) examined projected demands, land use, and basin renewals of consumptive use permits, performed field inspections, and revised consumptive use permitting rules (SFWMD 2010a).

Three subregional groundwater models simulated the potential impacts of water use: 1) Collier County Ground Water Flow Model, 2) Hendry County Ground Water Flow Model and 3) Lee County Ground Water Flow Model. Results from these models were used in vulnerability mapping to identify areas where potential for future saltwater intrusion in the SAS and IAS may occur. A detailed review of these modeling efforts conducted by the SFWMD for the LWC Planning Area can be found in the 1994 and 2000 LWC plans.

Simulations of SAS and IAS withdrawals and associated drawdowns examined estimates of future water use under 1-in-10 year drought conditions. Performance targets were developed to simulate resource protection criteria and were applied to predict areas with potential wetland harm and possible saltwater intrusion. Based on extensive field research, updated resource protection criteria were ultimately developed and adopted as regulatory strategies (see the *Resource Protection* section of this chapter).

Other models developed for the LWC Planning Area, or portions of the planning area, evaluated environmental, water quality, and water quantity concerns. These models were not developed specifically for water supply analysis but provided additional understanding of surface hydrology and hydrogeology.

These modeling efforts include the following:

- Regional Integrated Surface Water-Groundwater Model – the Southwest Florida Feasibility Study Integrated Hydrology Model (SDI Environmental Services, Inc. et al. 2008)
- Subregional Integrated Surface Water-Groundwater Model – Caloosahatchee River Basin (C-43) Model (DHI, Inc. and Stanley Consultants, Inc. 2005)
- Subregional Integrated Surface Water-Groundwater Model – Big Cypress Basin Subregional Model (CDM 2006a)
- Subregional Integrated Surface Water-Groundwater Model – Tidal Caloosahatchee River Basin Model (CDM 2006b)
- Subregional Integrated Surface Water-Groundwater Model – Estero Basin Subregional Model (CDM 2006c)
- SEAWAT Density-dependent Solute Transport Model – Big Cypress Basin Saltwater Intrusion Pilot Model (Schlumberger Water Services 2010).

In addition to demonstrating potential harm to water resources under certain planning conditions, previous LWC modeling results indicated that historically used water sources (fresh groundwater from the SAS and IAS, and surface water from the Caloosahatchee River [C-43 Canal]) were not adequate to meet the LWC Planning Area's growing water needs through 2020. Most agricultural water users in the Hendry and Glades counties portions of this area use surface water for irrigation and analyses also indicated that surface water supplies were inadequate to meet existing and future agricultural irrigation demands. Updates related to this conclusion are discussed in the next section of this chapter.

Previous Plan Recommendations

The 1994 and 2000 LWC plans recommended new sources of water be identified and used to reduce the potential for harm to water resources where appropriate. The 2005–2006 LWC Plan Update continued emphasizing increased development of alternative water supplies to meet future needs including use of the Floridan aquifer system (FAS) and reclaimed water, increased water conservation efforts, and use of innovative water treatment technologies to assist in meeting future water needs.

Existing Conditions and Implementation of Previous Recommendations

This section discusses recent water resource trends and summarizes progress made in implementing prior recommendations. For purposes of water supply planning, the focus of this section is water resources in relation to the user demand categories presented in **Chapter 2**. Discussions concerning environmental restoration projects follow in later sections of this chapter.

Existing conditions of fresh groundwater sources reflect multiple physical changes in land use/land cover, stormwater management, water use, and climatic variations. Agricultural and residential development within the region changed surface drainage patterns and

increased water demands affecting groundwater resources. While hydrologic conditions at some locations have improved with the implementation of 2005-2006 LWC Plan Update recommendations, in other areas, natural changes (e.g., drought) and southwest Florida activities have intensified stress in locations with existing long-term declining water levels.

Surficial and Intermediate Aquifer Systems Water Levels

The hydrologic data used in this analysis was from the past five years and it has shown great variation in rainfall as well as changing water use volumes and increases and decreases in water levels in the SAS and IAS. The SAS depends on local rainfall for recharge. The wetland systems that are part of this aquifer system are dependent on rainfall and support from groundwater levels in the SAS. During dry or drought conditions, recharge diminishes, drainage persists, and irrigation demands and other demands increase, compounding stress on the aquifer and wetland systems.

Typically, the IAS receives little direct recharge from rainfall but is recharged by seepage from above or laterally from outside the boundaries of the planning area. Increased demand from the IAS source is therefore dependent upon available seepage from overlying strata and is limited.

Water demands from 2006 to 2008 increased due to population growth and an increase in recreational landscape irrigation acreage. Drought conditions started in 2007 and continued through much of 2008 and 2009. The resulting water demands placed additional stress on both the SAS and IAS and record low water levels were set in 2007 at many IAS monitoring wells. Water demand declined in late 2008 and 2009, and again in 2011 due to water shortage restrictions imposed across the region. **Chapter 4** of this document and Chapter 9 of the Support Document provide a review of the LWC Planning Area's water sources.

Surficial Aquifer System Water Levels

The Surficial (water table) and Lower Tamiami aquifers within the SAS are the primary sources for self-supplied potable drinking water and irrigation water as well as a major source for PWS in Collier, Lee, and Hendry counties. As such, the aquifers are critically important to the region. Throughout the LWC Planning Area, no consistent downward or upward trend in water levels is apparent in the SAS. However, individual wells may show upward or downward trends in their periods of record. This demonstrates the importance of local hydrogeologic conditions. **Figure 8** shows water levels and trends for two SAS wells in northwestern Collier County that are about ten miles apart. Seasonal variations in levels from wet and dry seasons are typical in rainfall-driven aquifers. The trend lines shown in the graphs were calculated by performing a regression against the daily water level elevations for the last 35 years at each well, which were taken from the United States Geological Survey (USGS) National Water Information System database in 2012.

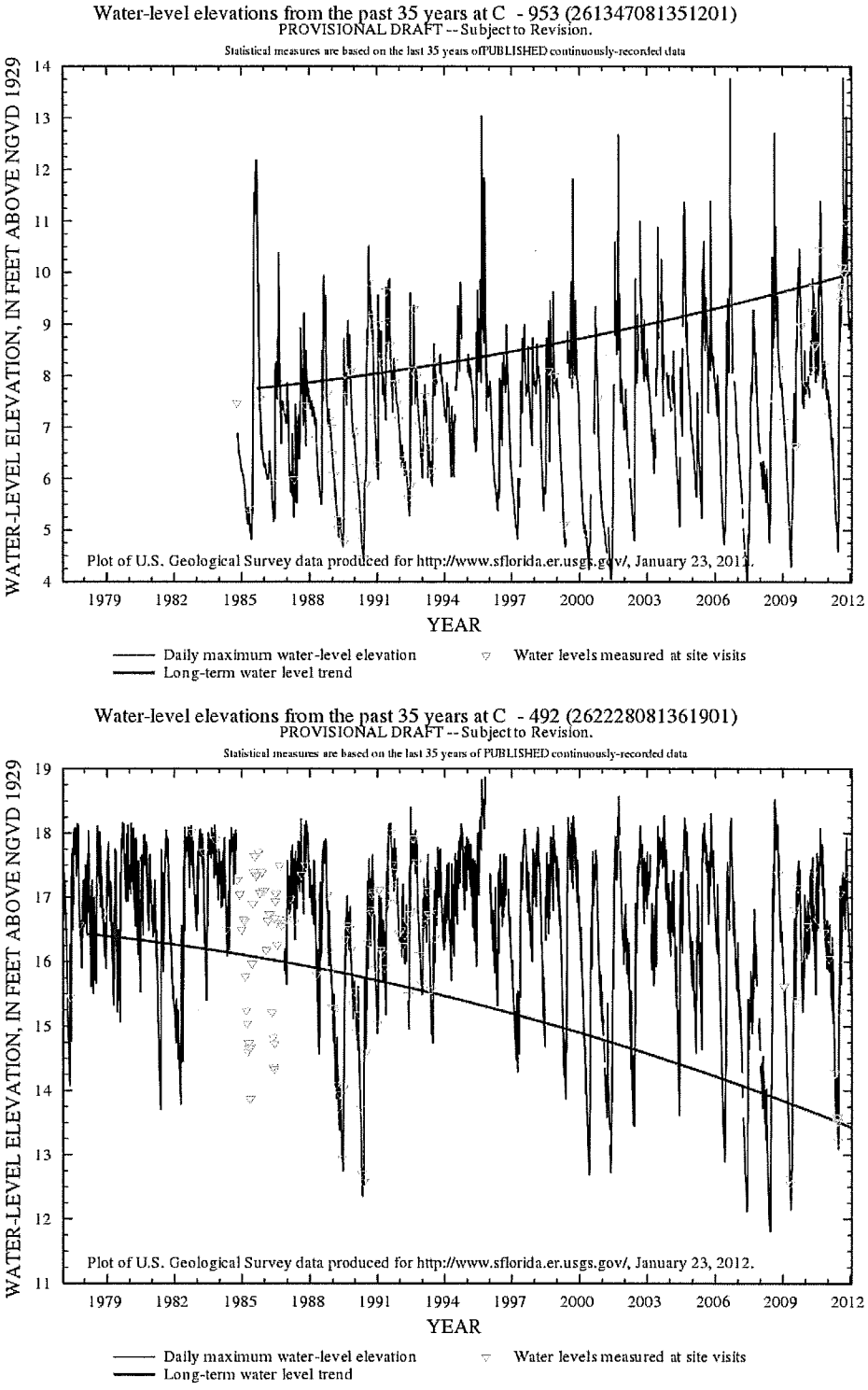


Figure 8. Long-term water level trends in SAS wells C-953 (top panel) and C-492 (bottom panel) in northwestern Collier County (Source: USGS). (Note: NGVD 1929 – National Geodetic Vertical Datum)

To increase surface and groundwater storage, which could diminish the affects of water use and drought, the SFWMD Big Cypress Basin Capital Improvement Program has made structural, operational, and monitoring improvements to the Golden Gate Canal System to retain stormwater within the canal system.

Intermediate Aquifer System Water Levels

In the LWC Planning Area, the IAS includes the Sandstone and Mid-Hawthorn aquifers (see Chapter 9 of the Support Document). There appears to be a slight overall downward trend in water levels over the last 10 years, with some evidence of a slight rise in water levels over the last three years. **Figure 9** shows Sandstone aquifer water levels in southern Lehigh Acres. Since 2005, record low water levels have occurred for the period of record in Well L-729 and other Sandstone aquifer wells in Lehigh Acres (**Figure 9**). These reduced water levels caused some DSS wells to become inoperable. During the 2007 drought, 64 percent of the 526 replacement wells permitted by Lee County were in Lehigh Acres. However, Sandstone aquifer water levels have recovered in wellfield areas where Lee County Utilities has reduced its withdrawals from this aquifer (**Figure 9**). Overall, DSS and other withdrawals from the Sandstone aquifer have increased in the LWC Planning Area.

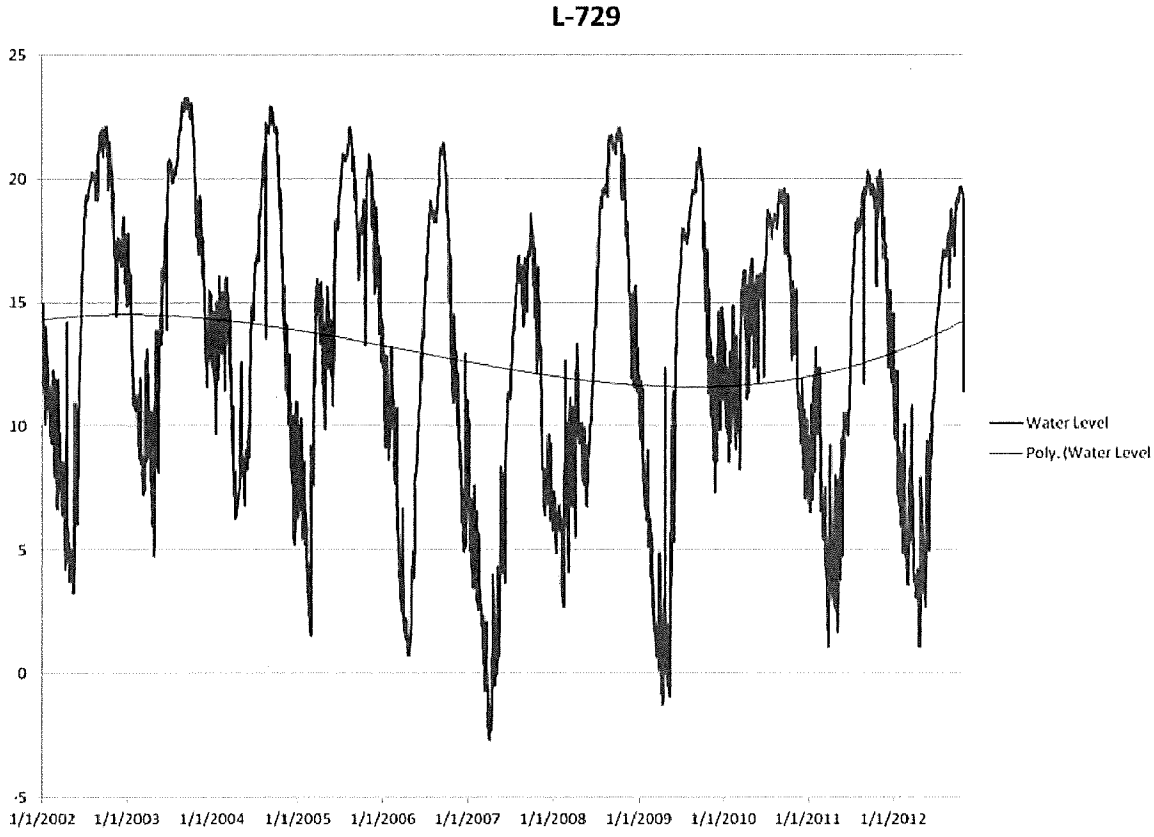


Figure 9. Sandstone aquifer water levels at Well L-729 in southern Lehigh Acres.

In 2010, the SFWMD conducte
Sandstone aquifer wells that
accurately delineate the top o
results from other drilling in t
data from a site cannot be us
location. As the top-of-aquifer
associated MDLs, the study ne
more comprehensive understa

In contrast to the general decli
Hawthorn aquifer have risen
withdrawals (**Figure 10**). PWS
the underlying FAS, which is hy
of the city utility's service are
identified in the 2005–2006 LW
availability in this location. In
portion of Fort Myers not serv
continued to decline (**Figure 1**
and Sandstone aquifers is not
to ensure adequate future supp

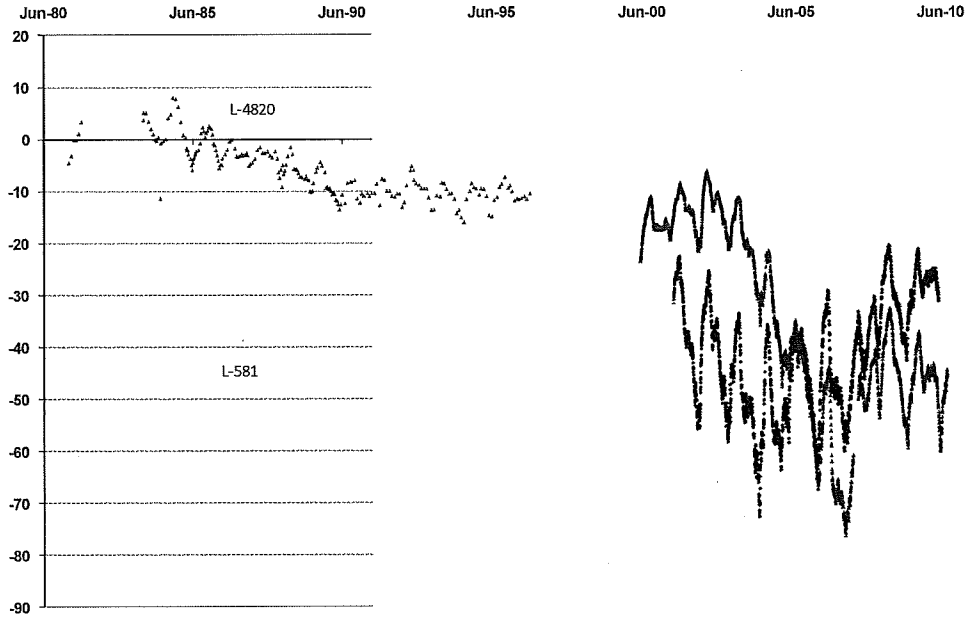


Figure 10. Mid-Hawthorn aquifer wate

Surficial and Intermediate Aquifer Systems Chloride Levels

Elevated salinity content above the amount allowed in drinking water, in the form of total dissolved solids and chloride and sodium concentrations, is present in various SAS and IAS locations. The United States Environmental Protection Agency (USEPA) drinking water standard for chloride is 250 milligrams per liter (mg/L).

Saltwater intrusion is the inland movement of the saltwater interface or the sustained upward movement of saline groundwater (upconing). In the LWC Planning Area, the potential for both saline sources to migrate into freshwater sources exists. Another mechanism is upward leakage from wells with open intervals that cross multiple aquifers (short-cased) or leaking casings (Schmerge 2001, Shoemaker and Edwards 2003, Sherwood and Klein 1963, Burns 1983).

Lateral encroachment of seawater into the Lower Tamiami aquifer has occurred to varying extents in the region. Saline groundwater beneath the Gulf of Mexico could move through the permeable rock comprising the Lower Tamiami aquifer to come into equilibrium with modern natural and anthropogenic stresses, such as withdrawals, sea level, and drought. Some evidence indirectly suggests the occurrence of lateral encroachment in the Lower Tamiami aquifer near Bonita Springs (Shoemaker and Edwards 2003).

Since 2006, monitoring sites and consumptive use permit application submittals have shown that some areas inland of coastal Collier and Lee counties have salinity content above 250 mg/L in the SAS and IAS. Data with sufficient periods of record indicate chloride concentrations have increased over time at some locations, but concentrations have decreased at other locations. **Appendix F** contains chloride concentration data for the water table and the Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers within the SAS and IAS. The Lee County Natural Resource Division plugged and abandoned 68 Floridan aquifer wells from June 12, 2007 through March 24, 2010 (Lee County 2012) that allowed saline water to migrate into the overlying Mid-Hawthorn and Sandstone aquifers.

In 2011, the SFWMD examined April–May 2009 chloride data from a number of USGS wells and from data submitted by consumptive use permittees in compliance with permit limiting conditions. A series of isochlor maps were developed to show the locations of data source wells, proximal wellfields, and lines where wells at any depth in a specific aquifer showed chlorides greater than 250 mg/L. These maps are provided in **Appendix F.** Maps such as these are very useful in maintaining a watchful eye for changes in water quality including possible migration of the saltwater interface.

Increasing chloride trends can be seen in two Lower Tamiami aquifer wells (**Figure 11**). Chlorides in Well C-525 (top panel of **Figure 11**) have increased significantly over the 250 mg/L drinking water standard since 1998. In other wells, such as C-489 (bottom panel of **Figure 11**), chlorides have increased more gradually and are well below the drinking water standard.

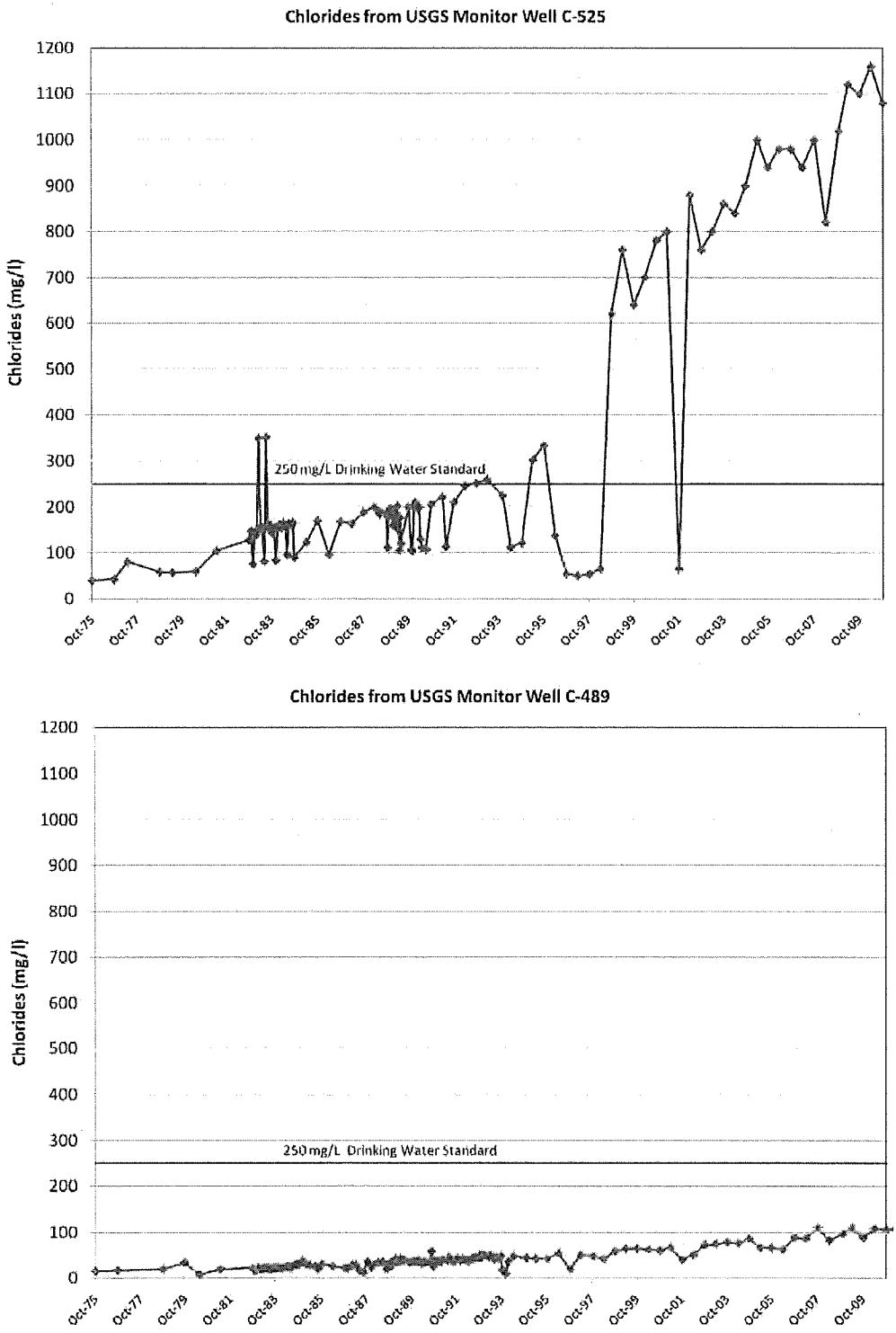


Figure 11. Chloride levels from USGS monitor wells C-525 (top panel) and C-489 (bottom panel) for 1975–2010.

Saltwater intrusion can be exacerbated by excessive drainage, canal leakage, and water supply withdrawals. The Big Cypress Basin Board, in collaboration with the USGS, is developing a Saltwater Encroachment Monitoring Network Improvement Plan for Big Cypress Basin, which was part of its 2010–2015 Strategic Plan (SFWMD 2010b).

Floridan Aquifer System

Monitoring Network

As recommended in the 2000 LWC Plan, the local FAS water level and water quality monitoring network was expanded in the LWC Planning Area. This network includes cooperative agreements with agricultural owners and PWS utilities. The data gathered are used to evaluate current conditions and trends, and provide additional observed data for calibration of an updated numerical model of the FAS for the LWC Planning Area. As a greater understanding of the FAS evolves, modification of the monitoring network may be required.

Use Trends

Over the last decade, a number of utilities have developed the FAS as a water source to meet a portion of existing and future demands. These efforts were initiated by Marco Island Utilities and Cape Coral Utilities. Additional utilities using the FAS in the LWC Planning Area include the City of Fort Myers Public Utility, Clewiston Utilities, Collier County Water-Sewer District, Bonita Springs Utilities, Greater Pine Island Water Association, Island Water Association, Lee County Utilities, and LaBelle Department of Public Works. Also, approximately 20 percent of the golf courses in this region use the FAS to meet a portion of their demand for landscape and golf course irrigation.

Table 8 shows an increasing use of the FAS by LWC utilities. Withdrawals from the FAS by utilities averaged 53.51 MGD in 2009 compared to 21.93 MGD in 1998 — an increase of 31.58 MGD. From 1998 to 2009, use of the SAS decreased from 52.58 to 48.95 MGD. The SFWMD anticipates this trend will continue as most utilities in the LWC Planning Area intend to use the FAS for future water supplies. **Appendix D** contains more information on PWS use of the FAS.

Water Levels

Regional potentiometric surface maps of FAS water level data, prepared by the USGS (Johnston and Bush 1988) and Florida Atlantic University and the SFWMD (2008), estimate potentiometric surfaces of the FAS for predevelopment and average 2004 conditions, respectively. These maps, provided in **Appendix F**, display similar areal distribution of hydraulic gradients and water levels. Some differences between the maps are evident along the coast and in the northern portion of the LWC Planning Area because the average 2004 water levels are lower. The maps also illustrate how most of south Florida has FAS potentiometric levels well above land surface, indicating the wells are under artesian pressure.

Table 8. PWS water sources and use in MGD for 1998–2009.

Aquifer	1998	1999	2000	2005	2009
Floridan Aquifer System					
Total from FAS	21.93	23.93	20.01	48.64	53.51
Percent of total withdrawals	23%	24%	19%	37%	41%
Intermediate Aquifer System					
Total from IAS	13.66	14.68	15.18	23.13	20.41
Percent of total withdrawals	14%	15%	15%	18%	16%
Surficial Aquifer System					
Total from SAS	52.58	51.70	61.07	50.26	48.95
Percent of total withdrawals	55%	53%	58%	38%	38%
Surface Water					
Total from surface water	8.29	7.71	8.51	9.67	6.66
Percent of total withdrawals	8%	8%	8%	7%	5%
Total withdrawals	96.46	98.02	104.77	130.71	129.53

Figure 12 presents water level data from an Upper Floridan monitor well at a location and depth typical for agricultural withdrawals in Glades County. The data show seasonal variations in water levels and declines in levels during drought periods where increased irrigation use of the FAS occurs due to lack of rainfall. The period of record (1973–2011) indicates water levels have declined approximately five feet and that a declining trend is apparent over the past 13 years.

Figure 13 presents water level data from an Upper Floridan monitor well at a location and depth typical for PWS withdrawals in Lee County. Again, the data show swings of a few feet over the period of record due to seasonal variations and levels declining during droughts because of the need for increased supplemental irrigation.

Major PWS wellfields withdrawing water from the FAS produce drawdowns in the potentiometric surface that may reach 60 feet, depending on the wellfield and proximity to production wells. However, these depressed water levels remain hundreds of feet above the top of the aquifer system and are not as important as the changes in hydraulic gradients that may induce the upward movement of higher salinity water into the wells' producing zones. Increases in salinity of groundwater are important because they can increase water treatment costs or negatively affect users that do not require treatment prior to use.

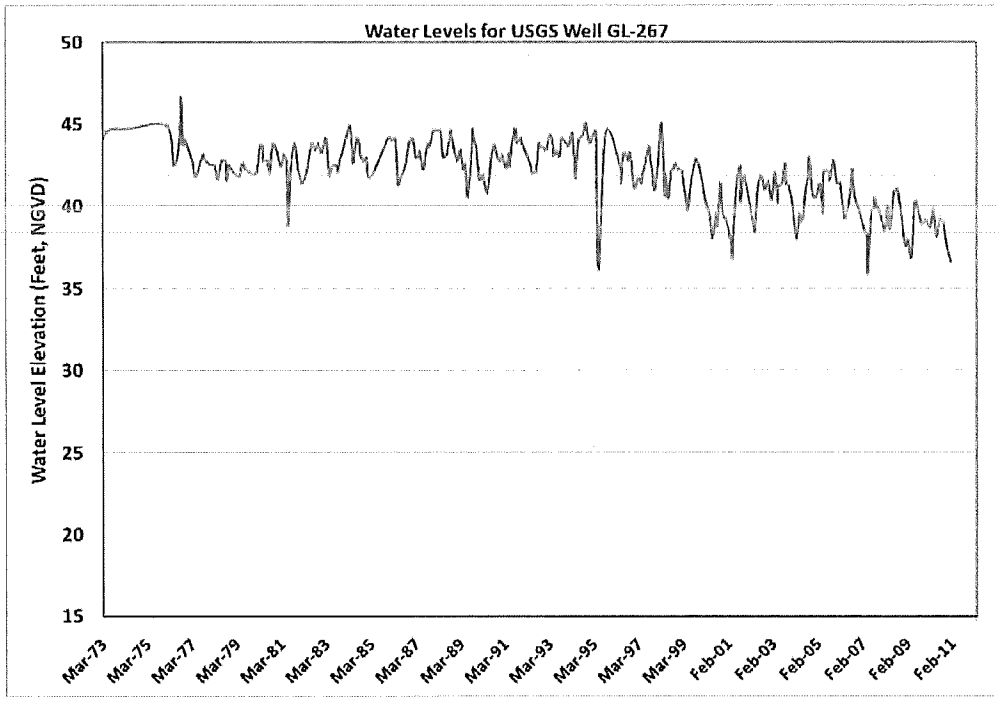


Figure 12. Water levels in an Upper Floridan monitor well at a location and depth typical of agricultural withdrawals in Glades County.

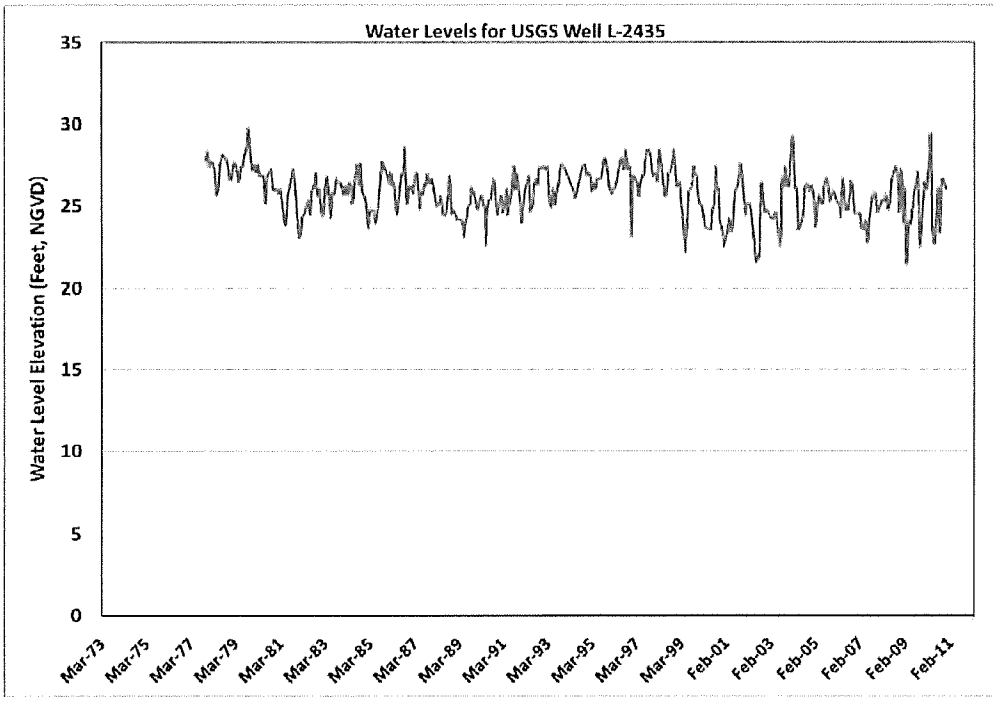


Figure 13. Water levels in an Upper Floridan monitor well at a location and depth typical of PWS withdrawals in Lee County. (Note NGVD – National Geodetic Vertical Datum of 1929)

Chloride Levels

The FAS contains brackish water with varying chloride and total dissolved solids concentrations, from just above allowable drinking water standards to concentrations typical of seawater. Generally, salinity in the FAS is lower in the northern portion of the LWC Planning Area than in the southern and coastal areas. In all areas, salinity levels are higher at the bottom of the FAS than levels near the top of the system.

The occurrence of more saline water in lower portions of the FAS is a consideration in the development of the upper portion of the FAS for water supply. Overpumping of the upper portions of the FAS can result in upconing of more saline water from the lower portions of the FAS. The treatment of brackish water for potable drinking water and the blending of brackish and fresh water for irrigation purposes become more costly as salinity increases. Based on regional areal extent, thickness, and average yielding capabilities, a large volume of brackish water is available from the FAS. However, local aquifer variability, the pumping rates of production wells, and the proximity of these wells to saltwater sources will influence the long-term sustainability of the FAS for specific locations.

The Lower Hawthorn aquifer producing zone, a portion of the Upper Floridan aquifer, is targeted for water supply production in the LWC Planning Area. Tables F-7 and F-8 in **Appendix F** contain chloride concentration data for the Lower Hawthorn producing zone in the LWC Planning Area.

Raw water chloride concentrations and withdrawals from the Cape Coral Southwest brackish water wellfield are depicted in **Figure 14** (Schers et al. 2007). This figure reflects trends in average monthly chloride concentrations and wellfield pumping over time in Cape Coral. These trends suggest that proper monitoring, maintenance, and wellfield operation management can moderate the rate of increase in chloride concentrations. Although average chloride concentration increased approximately 50 percent in 20 years, from about 600 to 900 mg/L, it remains well within the treatment capabilities of the Cape Coral treatment facility.

Figure 15 illustrates changes in chloride concentrations over time from FAS production wells at the North Lee County wellfield. The use of Production Well 6 was discontinued due to high chloride concentrations. Additional FAS production wells were subsequently added with greater spacing between wells to reduce the potential for upconing of saline water and provide greater operational flexibility and capacity.

FAS Demands

The projected 2030 gross water demands for all categories of water use in this plan update are approximately three percent less than the 2025 projected demands in the 2005–2006 LWC Plan Update (see **Chapter 2**). Previous water supply planning analyses of the FAS and consumptive use permitting activities have indicated that the FAS has the potential for supplying sufficient water to meet the regional PWS demands through the 20-year planning horizon. However, the rate of withdrawals is dependent on localized aquifer properties, water quality, and proximity to other FAS production wells.

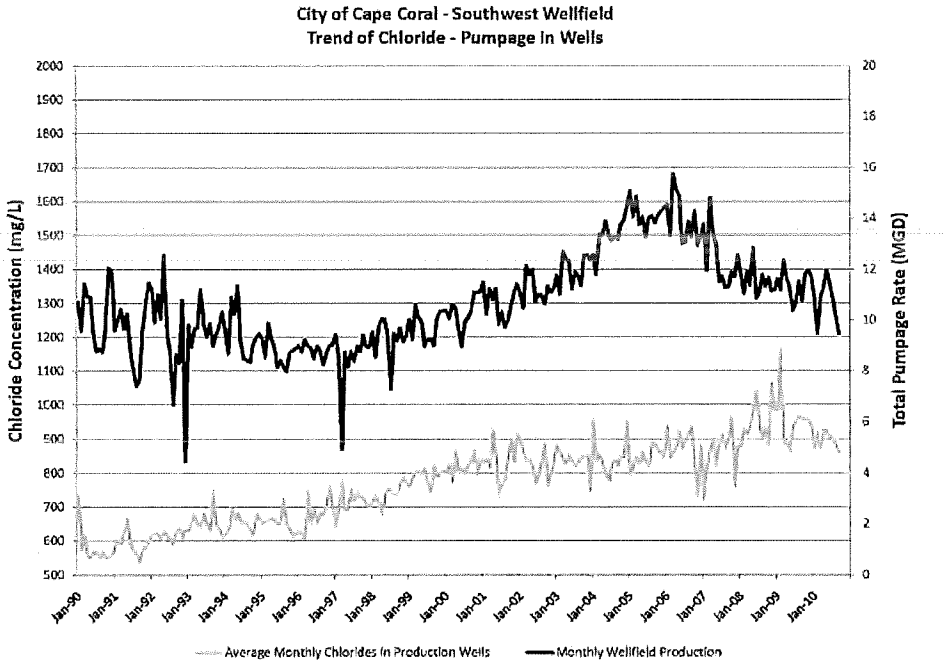


Figure 14. Raw water chloride concentrations and withdrawals from the Cape Coral Southwest brackish water wellfield (Schers et al. 2007).

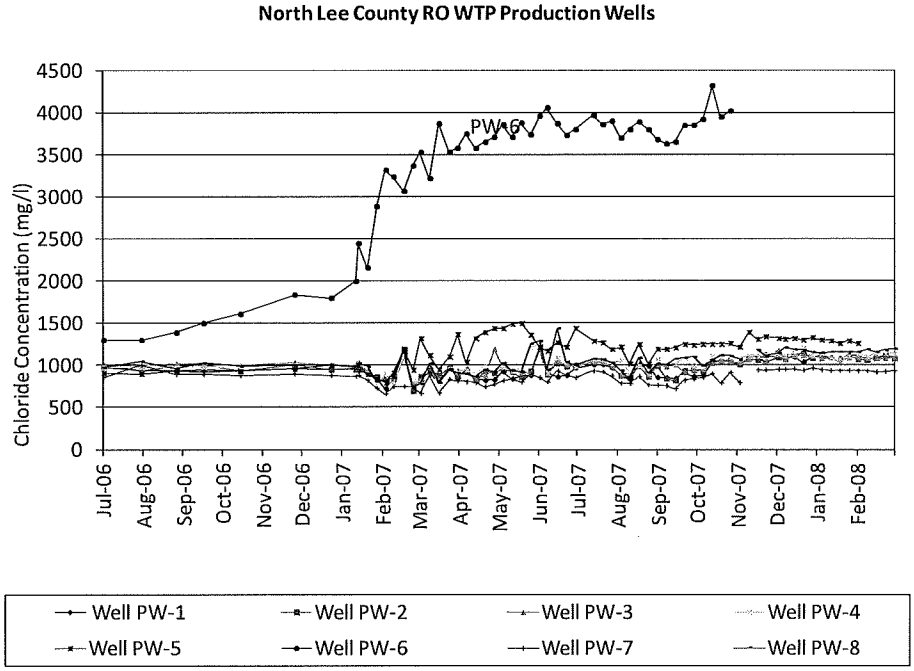


Figure 15. Chloride concentrations from production wells (PW) at the North Lee County FAS wellfield.

Experience gained from the past five years demonstrates the variability and complexity of the FAS system and the need for testing and long-term monitoring to better understand this resource. The depth, location, withdrawal rates, and well spacing of a proposed FAS wellfield needs to be carefully investigated and planned to minimize the potential for salinity increases that compromise the proposed existing treatment technologies.

Lower West Coast Floridan Aquifer System Model

The Lower West Coast Floridan Aquifer System Model (LWCFAS) has the ability to incorporate density effects while calculating hydraulic head, groundwater flow, and chloride concentration within the modeled system on a monthly basis. This model was developed in 2008 and uses the USGS's SEAWAT-2000 program to numerically represent the hydrogeology of the region, nearshore portions of the Gulf of Mexico and Florida Bay. Model boundaries allow interaction with external flow and solute transport to simulate the effects from internal sources and sinks. This model was reviewed by an independent peer review panel and the recommendations were incorporated into the model. During Fiscal Year (FY) 2010, a revised steady state model was created to represent estimated predevelopment conditions in the FAS. The model was recently updated and recalibrated to transient conditions (Schlumberger Water Services and SFWMD 2011). This revised model will be used for future regional water supply planning efforts to evaluate the use of the FAS and potential impacts of water withdrawals on the resource. Once models are peer reviewed and those comments are addressed, the updated model's documentation is downloadable from our website, and electronic model input files are available upon request.

Surface Water

Most surface water in the LWC Planning Area is derived from rainfall making the resource seasonally variable and subject to extreme rainfall events or droughts. The Caloosahatchee River (C-43 Canal) is the major surface water source used for agricultural water supply in the portions of Hendry, Glades, and Lee counties in the LWC Planning Area. To a lesser extent, the canal systems in the City of Cape Coral and Big Cypress Basin provide surface water for water supply but these canals were originally designed to convey water for drainage.

Surface water availability and level of certainty in the Lake Okeechobee Service Area has been reduced since the Lake Okeechobee regulation schedule was modified as a result of dike integrity in 2008 (see **Appendix H** and the *2012 Lower East Coast Water Supply Plan Update* (SFWMD 2012b) for more information).

Reservoirs and changes to local and regional surface water management systems can be used to increase surface water availability. These include the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project, Big Cypress Basin surface water control modifications, and local drainage district improvements including Cape Coral and East County Water Control District.

CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project

The purpose of the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project is to improve the quantity, timing, and distribution of freshwater flows to the Caloosahatchee River and Estuary. This planned reservoir project will capture and store surface water runoff from the Caloosahatchee River (C-43 Canal) Basin and Lake Okeechobee to provide a more natural and consistent flow of fresh water to the estuary. After construction and flow-through testing, operation of this project is expected to improve the Caloosahatchee Estuary's salinity balance by reducing a portion of the peak discharges during the wet season and providing essential flows during the dry season.

The project includes an above-ground reservoir located south of the Caloosahatchee River (C-43 Canal) and west of the Ortona Lock (S-78) on a 10,700-acre parcel west of LaBelle formerly known as Berry Groves. The reservoir will provide a total storage capacity of approximately 170,000 acre-feet of above-ground storage volume in a two-cell reservoir. The land is cleared and designs for construction are permitted. The project is awaiting congressional authorization and appropriation of funds to start construction. The USACE anticipates project authorization to occur in August 2013 with appropriation of funding to follow at a later date. Once congressional funding has been appropriated, a timetable for the completion of the reservoir will be developed.

Caloosahatchee River Watershed Protection Plan

The *Caloosahatchee River Watershed Protection Plan* (SFWMD et al. 2009) identifies the need for additional storage and proposes reservoirs and stormwater treatment areas to address the volume and timing of fresh surface water for the Caloosahatchee Estuary. These efforts were planned to meet the natural system needs. The *Caloosahatchee River Watershed Protection Plan* is part of the Northern Everglades and Estuaries Program, which is discussed in **Appendix G** and the Support Document.

Big Cypress Basin

The Big Cypress Basin canal systems also provide surface water supply, and to a lesser extent, local stormwater ponds for landscape irrigation. The Big Cypress Basin canal system was constructed as a surface water drainage system; however, improvements to structures, operations and management, and monitoring have resulted in an estimated 850 acre-feet of additional surface water storage in canals since 2000.

Local Drainage District Improvements

The Canal Weirs Improvement Program for the City of Cape Coral added higher control elevations to operable weirs to store more fresh water in the canal system during wet conditions. This provides 1.7 MGD additional supply to the city's reclaimed irrigation system.

The *East County Water Control District Consolidated Plan for Water Management* (ECWCD 2008) includes improvement projects to reduce high flows to the Orange River, which currently discharges into the Caloosahatchee Estuary, capture and store stormwater runoff, and raise groundwater levels for wetland restoration, water storage, and aquifer recharge.

Reclaimed Water

Since 1994, the volume of reclaimed water use has doubled in the region. In 2010, the reclaimed water use rate was 70.4 MGD (**Table 9**) (FDEP 2010a). Where available, reclaimed water provides many communities with all or a portion of their irrigation demands. Water supply development projects (**Chapter 6**) under way or proposed by utilities are expected to continue this trend. The LWC Planning Area's increasing production of reclaimed water may require utility reclaimed water interconnects and construction of seasonal storage, such as ASR.

Table 9. Reclaimed water use in the LWC Planning Area in MGD for 1994–2010.

	1994	1996	1998	2000	2002	2004	2006	2008	2010
Annual Average (MGD)	32.30	44.70	50.24	63.19	61.90	71.69	68.93	68.25	70.40

Aquifer Storage and Recovery

ASR is the underground storage of storm water, surface water, fresh groundwater, drinking water or reclaimed water, which is treated to appropriate standards (dependent upon the water quality of receiving aquifer). The aquifer (typically the FAS in south Florida) acts as an underground reservoir for the injected water. The water is stored with the intent to recover it for use in the future.

To date, over 19 ASR wells have been built by water and wastewater utilities in the LWC Planning Area. Many of these wells store treated drinking water, although some store raw groundwater and raw or partially treated surface water. Approximately half of these ASR wells are fully permitted for operation. The remaining wells are in operational testing or are inactive.

Water Conservation

Several SFWMD water conservation programs have been initiated since publication of the 2005–2006 LWC Plan Update. These include the approval of the Comprehensive Water Conservation Program and adoption of the Mandatory Year-Round Landscape Irrigation Conservation Measures Rule (Chapter 40E-24, F.A.C.). For more details about the Comprehensive Water Conservation Program, see **Chapter 4** of this document, and Chapters 4 and 5 in the Support Document.

The Mandatory Year-Round Landscape Irrigation Conservation Measures Rule became effective March 15, 2010. This rule limits landscape irrigation to two days per week with no irrigation allowed between 10 a.m. and 4 p.m. and an allowance for three days a week in

identified counties. However, three-day-per-week year-round measures have been in place in the LWC Planning Area since 2003. Some municipalities and counties in the LWC Planning Area, such as Lee County and Cape Coral, enacted a two-day-per-week irrigation schedule.

The SFWMD has observed reductions in regional utility base year per capita finished water use since 1990 (**Table 10**). The base year regional utility per capita use rates (PCURs) in the 1994 and 2000 LWC plans and 2005–2006 and current plan updates have decreased from a high in the 1994 LWC Plan of 194 gallons per day (GPD) per person to a low of 151 GPD per person in this plan update. These values are calculated by dividing the utility finished water produced by the estimated permanent population connected in the service area for that year. Since the 2005–2006 LWC Plan Update, several conditions contributed to declining PCURs including the SFWMD's Comprehensive Water Conservation Program, local government conservation programs, water shortage restrictions, and the economic downturn.

Table 10. Regional utility PCURs in the LWC Planning Area using overall finished water.

LWC Plan	Base Year Used	PCUR (GPD per person)
1994	1990	194
2000	1995	167
2005–2006	2000	176
2012	2005	151

OUTLOOK ON CLIMATE CHANGE

Climate change, especially sea level rise, has the ability to affect water supply in the LWC Planning Area. While climate change is occurring across the globe, the impact to individual regions varies, and the degree and rate of change remains uncertain. Long-term data show changes in parameters, such as temperature and sea level. Despite the uncertainties, climate change and its related affect on hydrogeologic conditions must be included as a consideration in water supply planning (see **Chapters 1** and **7**).

As sea level rises, low elevation coastal areas will be increasingly subject to flooding, especially during spring and fall high tides, storms, and strong onshore winds (Murley et al. 2008). The canal networks of the SFWMD in much of the Lower East Coast and LWC planning areas are typically maintained at predetermined water levels to reduce the potential for saltwater intrusion into the PWS wellfields and to provide flood protection. Projected sea level rise may reduce the flood discharge capacity of coastal structures, thus affecting flood protection in urban areas (SFWMD 2009a).

In addition to concerns of climate change on water supply and flood protection, rising sea level could cause groundwater near the coast to become more saline and groundwater levels to increase. This has the strong potential to increase the salt content of water leaking

into sewer collection systems and complicate the operations of wastewater treatment plants (Bloetscher et al. 2009).

Other changes, such as increased evapotranspiration (ET), and changes in weather patterns, are less predictable. If temperatures and ET increase as many experts expect, both PWS and AGR Self-Supply water demands may increase. More frequent intense rainfall events with longer interim dry periods could increase total annual rainfall, but decrease effective rainfall, as more water may be lost to runoff or tide. Precipitation in Florida varies in many ways. Annual rainfall is affected by decadal-scale variability such as the Atlantic Multidecadal Oscillation and the El Niño-Southern Oscillation (warming phenomenon in the Pacific Ocean). Natural, climate, and human-induced changes to freshwater inflow into estuaries have changed estuarine circulation patterns and salinity regimes (Scavia et al. 2002).

Affect on LWC Planning Area

Southwest Florida is particularly vulnerable to the effects of climate change and sea level rise because the topography of the area is generally flat and naturally poorly drained. The regional economy has major investments within close proximity of the coast or lake water bodies (SWFRPC and CHNEP 2009). In the LWC Planning Area, anticipated sea level rise may increase the intrusion of salt water into groundwater. Miami-Dade and Broward counties have both initiated action plans to help with this determination and recommendations. Additional analysis is needed in the LWC Planning Area to better understand the vulnerability of its aquifers to climate change.

Anticipated sea level rise may increase the intrusion of salt water into groundwater. Miami-Dade and Broward counties (located in the Lower East Coast Planning Area) have both initiated action plans to help with this determination and recommendations. Additional analysis is needed in the LWC Planning Area to better understand the vulnerability of the LWC aquifers to climate change.

According to the Southwest Florida Regional Planning Council, the LWC Planning Area could see some agricultural production patterns shift. Warmer temperatures and less soil moisture due to increased evaporation may increase the need for irrigation and an increase in climate variability could make farming more difficult. Analyses based on changes in average climate, and that assume farmers effectively adapt, suggest that aggregate United States food production will not be harmed, although there may be regional changes (SWFRPC and CHNEP 2009).

In 2010, Lee County developed a climate change resiliency strategy to guide the county plans and strategies relating to specific vulnerabilities and priorities of the county. Previously, the Southwest Florida Regional Planning Council and the Charlotte Harbor National Estuary Program had prepared the *Comprehensive Southwest Florida/Charlotte Harbor Climate Change Vulnerability Assessment* (2009).. They concluded that this study would be used to work with local government staff to consider sea level increases when planning for public facility expansions and reconstruction after hurricane damage or due to

old age. The intent of the study was to facilitate the work of local government elected officials and staff as they consider how to best plan for the impacts of sea level rise (SWFRPC and CHNEP 2009)

While the Community Planning Act (in Chapter 163, F.S.), passed in 2011, does not require local governments to address climate change and sea level rise issues in their comprehensive plans, it provides an option for a local government to develop an adaptation action area designation in the coastal management element (Section 163.3177). The designation would be for those low lying coastal zones that are experiencing coastal flooding due to extreme high tides and storm surge and are vulnerable to the impacts of rising sea level.

SUMMARY

The findings and conclusions of the previous LWC plans and updates are still representative of the issues involved in meeting the 2030 projected water demands in the LWC Planning Area. These findings were considered in the development of this plan update. Projected 2030 gross water demands for all categories of water use in this plan update are three percent less than the projected demands in the 2005–2006 LWC Update (see **Chapter 2**).

The following accomplishments have been made towards fulfilling recommendations made in previous plans:

- Users of the SAS and IAS have diversified their supply sources and reduced their reliance on these aquifers. Most coastal utilities are using the FAS or other alternative water supply sources to meet some of the current needs and their future needs. Of the total water withdrawn by major PWS utilities, use of brackish water increased from 23 percent in 1998 to 41 percent in 2009.
- Reclaimed water use has doubled since 1994 and offsets existing and proposed use of fresh groundwater. Utilities have successfully increased the use of reclaimed water from an annual average of 32.3 MGD in 1994 to 70.4 MGD in 2010.
- Water conservation measures have resulted in reduced PWS PCURs over last two decades. The overall PCUR has decreased from 194 GPD per person in 1990 to 151 GPD per person in 2005.
- Over 19 ASR wells have been constructed.
- IAS water levels at some locations have risen, likely because of reduced usage.
- A Water Reservation rule was developed for Picayune Strand and Fakahatchee Estuary.
- Plans continue on construction of the CERP Caloosahatchee (C-43) West Basin Storage Reservoir Project and other storage projects.

The following are ongoing concerns and future activities:

- To update the Caloosahatchee River MFL criteria, the SFWMD will evaluate the new information to determine if a revision of the MFL is necessary.
- Rule development has been initiated for a Water Reservation to ensure the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project provides water needed by the natural system.
- IAS water level declines persist in some locations.
- Saltwater intrusion into coastal aquifers is an ongoing concern due to a variety of factors, including wellfield withdrawals and potential sea level rise.
- Surface water supplies continue to be limited for agriculture.

Additional LWC Water Supply-Related Efforts

Significant water supply development and restoration efforts are under way throughout the LWC Planning Area including CERP projects. **Appendices G, H,** and **I** provide descriptions of the additional water supply-related activities in and around the LWC Planning Area.

4

Evaluation of Water Source Options

Historically, the Lower West Coast (LWC) Planning Area has relied on water from aquifers, canals, and the Caloosahatchee River (C-43 Canal) to meet the region's water supply needs. This chapter presents an evaluation of water source options and water conservation measures available within the LWC Planning Area through the 2030 planning horizon. To accommodate future urban and agricultural growth while still meeting the needs of the ecosystem, region-specific evaluations were conducted within the context of the issues identified in **Chapter 3**.

TOPICS

- Water Source Options
- Water Conservation

In the LWC Planning Area, freshwater source options include groundwater from the surficial aquifer system (SAS) or intermediate aquifer system (IAS), and surface water from the Caloosahatchee River (C-43 Canal) and connected canals and water bodies. Additional water source options include brackish groundwater from the IAS and Floridan aquifer system (FAS), reclaimed water, new storage capacity for surface water or groundwater using reservoirs and aquifer storage and recovery (ASR), seawater, and water conservation.

WATER SOURCE OPTIONS

Each water source option presented in this chapter includes a brief discussion about resource sustainability and potential natural systems impacts. Additional information about water source options, including water conservation and related costs, is provided in Chapter 5 of the Support Document. Water treatment technologies and associated costs are presented in Chapter 6 of the Support Document and in the *Water Supply Cost Estimation Study* (CDM 2007a) and *Water Supply Cost Estimation Study – Phase II Addendum* (CDM 2007b).

Groundwater

Three major aquifer systems — the SAS, IAS, and FAS—lie beneath southwestern Florida. As **Figure 16** illustrates, these systems are composed of multiple, discrete aquifers separated by confining units with low permeability. The hydrogeology of these aquifer systems is

complex, and continue to be studied due to spatial variability in productivity. More information about these aquifers, including yields and characteristics specific to the LWC Planning Area, is provided in Chapter 9 of the Support Document.

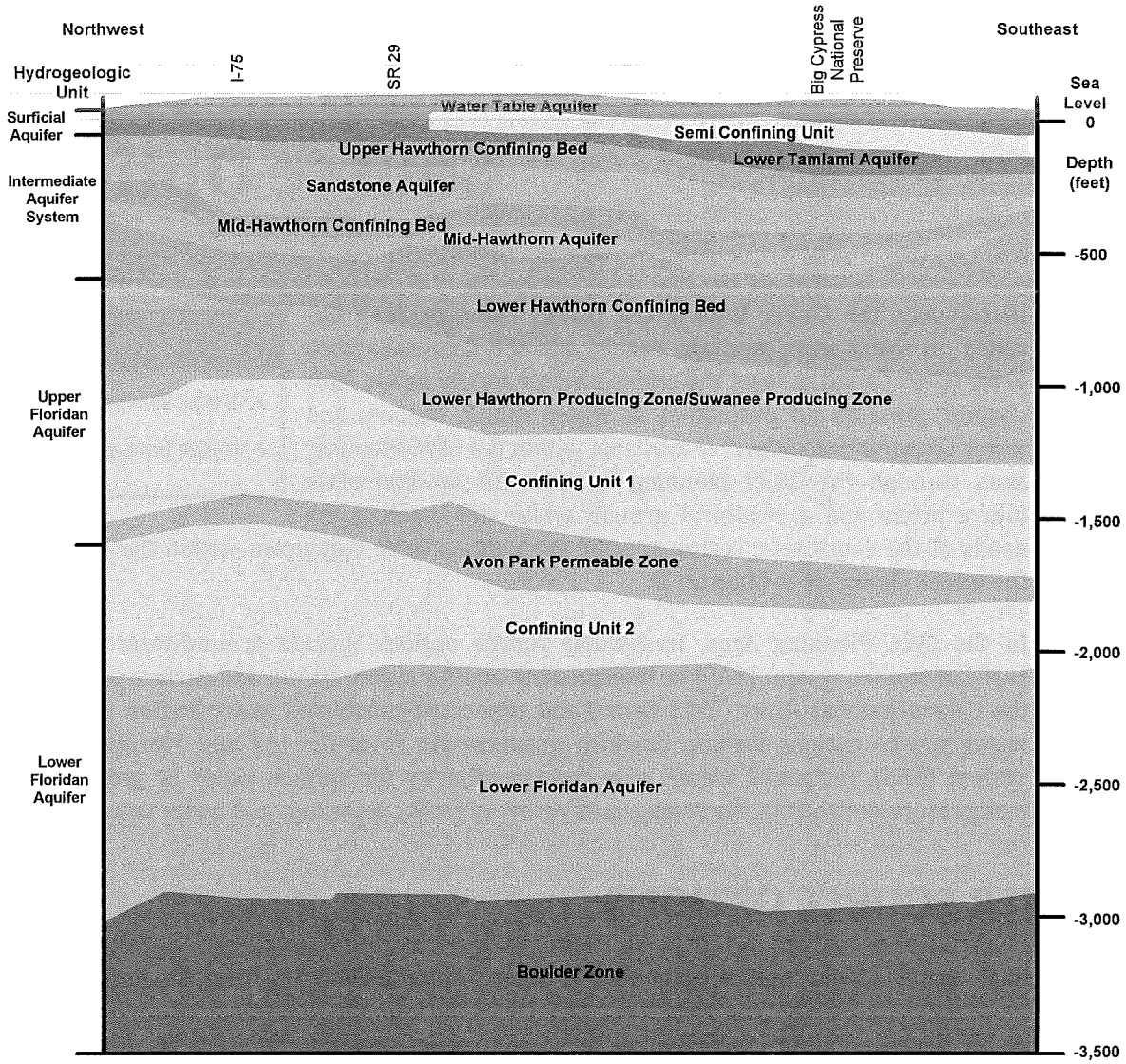


Figure 16. Generalized hydrogeologic cross-section of the LWC Planning Area.

In the LWC Planning Area, different aquifers are tapped in specific areas to meet user needs from a water quantity and quality perspective. **Figure 17** shows the distribution of South Florida Water Management District (SFWMD)-permitted consumptive use production wells. This demonstrates the spatial variability of the aquifers.

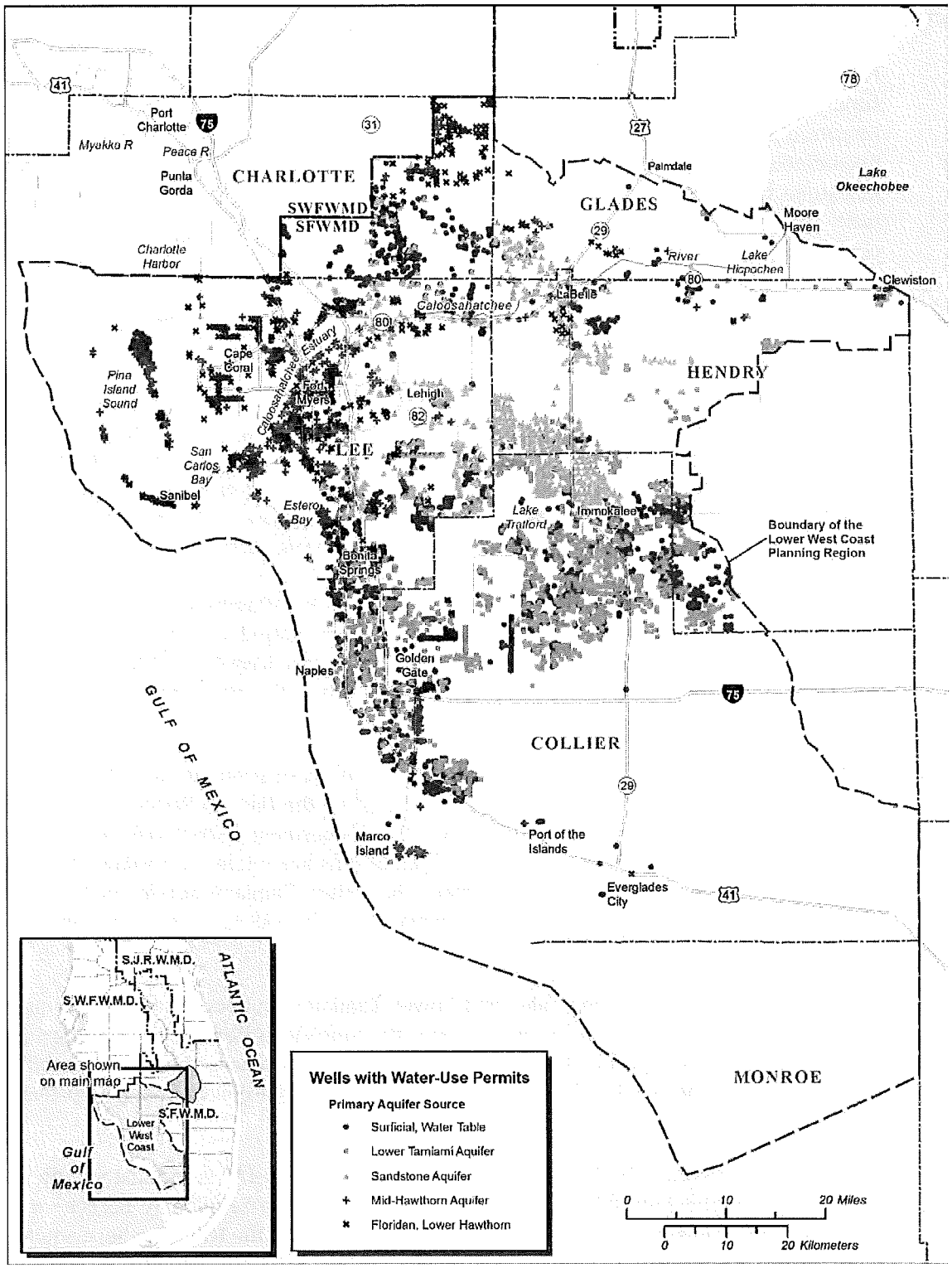


Figure 17. Location of permitted production wells and associated aquifer sources as of 2010 in the LWC Planning Area.

Fresh Groundwater

Fresh groundwater is the primary potable water supply source for public consumption and urban irrigation in the LWC Planning Area. The SAS is unconfined, consisting of varying amounts of limestone and sediments that extend from the land surface to the top of an intermediate confining unit. The IAS consists of five zones of alternating confining and producing units. The producing zones include the Sandstone and Mid-Hawthorn aquifers.

WATER OPTIONS

Freshwater sources include those historically used as the region's primary sources of water. Water quality and availability determine the viability of freshwater sources, and differ from region to region within the SFWMD. Where freshwater sources are determined to have limited availability, alternative water sources must be identified and developed.

In 2009, 62 million gallons of water per day (MGD), approximately 50 percent of the potable water produced by utilities with capacity equal to or greater than 0.1 MGD (public water supply [PWS]), and all of the estimated 16 MGD of Domestic Self-Supply (DSS) water originated from fresh groundwater. It is projected that only 8.8 MGD of additional future PWS demand will be met with fresh groundwater. The anticipated increased PWS demands in 2030 will be met primarily using brackish groundwater (70 MGD).

Information from the SFWMD's Water Use Regulatory Database shows that fresh groundwater is the primary source for 67 percent of permitted allocations for landscape and golf course irrigation, and 49 percent of agricultural irrigation. Other sources for landscape and golf course irrigation are storm water, brackish water when blended with fresh groundwater, and reclaimed water.

Within this area, the SAS and IAS are the sources of fresh groundwater. These aquifer systems are sources of limited availability as defined by the *Basis of Review for Water Use Permit Applications within the South Florida Water Management District*, referred to simply as the Basis of Review (SFWMD 2010a). The limitations are related to wetland harm and saltwater intrusion concerns. In areas where the Lower Tamiami aquifer of the SAS is absent and the water table aquifer is not productive, the IAS has historically met local water demands.

Within the SAS, the local water table and Lower Tamiami aquifers produce good quality fresh water from shallow wells. In many cases, the ambient water quality meets primary and secondary drinking water standards. These aquifers are recharged by local rainfall and provide water storage during dry seasons and support the hydrology of natural systems at the land surface.

In western Lee County, the Mid-Hawthorn aquifer within the IAS is the historically used source for DSS and Industrial/Commercial/Institutional (ICI) Self-Supply because it has acceptable water quality. Elsewhere in the LWC Planning Area, the Mid-Hawthorn aquifer is not a historically used source because the groundwater is brackish. The Sandstone aquifer of the IAS is a major source of groundwater for agricultural use in southwestern Hendry and northern Collier counties. The Sandstone aquifer has variations in water quality, and the

chloride levels range from about 200 milligrams per liter (mg/L) to about 1,000 mg/L. This aquifer is present primarily west of State Road 29 in Hendry County, and available data indicate it pinches out laterally a few miles east of there (Smith 1990). Information on the hydraulic properties of the Sandstone aquifer in rural Hendry and Glades counties is limited. Future use of the Sandstone aquifer in the Lehigh Acres area and the Mid-Hawthorn aquifer in Cape Coral (aquifers within the IAS) will likely be limited due to current cumulative water level drawdowns from existing users and the maximum developable limits (MDLs) defined in Section 3.2.4 of the Basis of Review. However, new or increased allocations will be evaluated on an application-by-application basis to determine if the project meets consumptive use permitting criteria.

Increased use of fresh groundwater sources to meet future demand in the LWC Planning Area is highly dependent on location, source limitations, natural system requirements, reclaimed water availability, and water conservation measures. Opportunities may exist for limited development of fresh groundwater sources through the following:

- Changes in land use/land cover and water use distributions allowing existing permitted allocations to be redistributed in more efficient ways
- Modifications to wellfield locations, configurations, and pumping regimes
- Blending multiple alternative water sources to achieve acceptable water quality and distribute potential impacts across these multiple sources
- Conversion of fresh groundwater sources to reclaimed water for landscape and golf course irrigation

Any significant increase in withdrawals from fresh groundwater sources must be balanced against resource protection criteria, and will be reviewed on an application-by-application basis through the consumptive use permitting process.

Brackish Groundwater

Brackish water is water that has a chloride level greater than 250 mg/L and less than 19,000 mg/L. The water quality in the FAS decreases significantly from central Florida to south Florida, increasing in hardness, chlorides, and salinity. Salinity also increases with depth, making the deeper producing zones less desirable for development than shallower parts of the system.

The upper portion of the FAS is the principal source of brackish groundwater supply in the LWC Planning Area and is not considered a limited resource in the region based on current criteria and the quality of the water. The IAS also produces brackish water in many locations. With limitations on fresh groundwater in the SAS and IAS, most utilities have developed brackish water sources from either the FAS or IAS.

Brackish water use from the FAS and the IAS began in the late 1970s, and increased in the 1990s, with more significant use after 2000 (**Figure 18**). In 2009, 41 percent (53.51 MGD) of PWS was produced from brackish water sources in the LWC Planning Area.

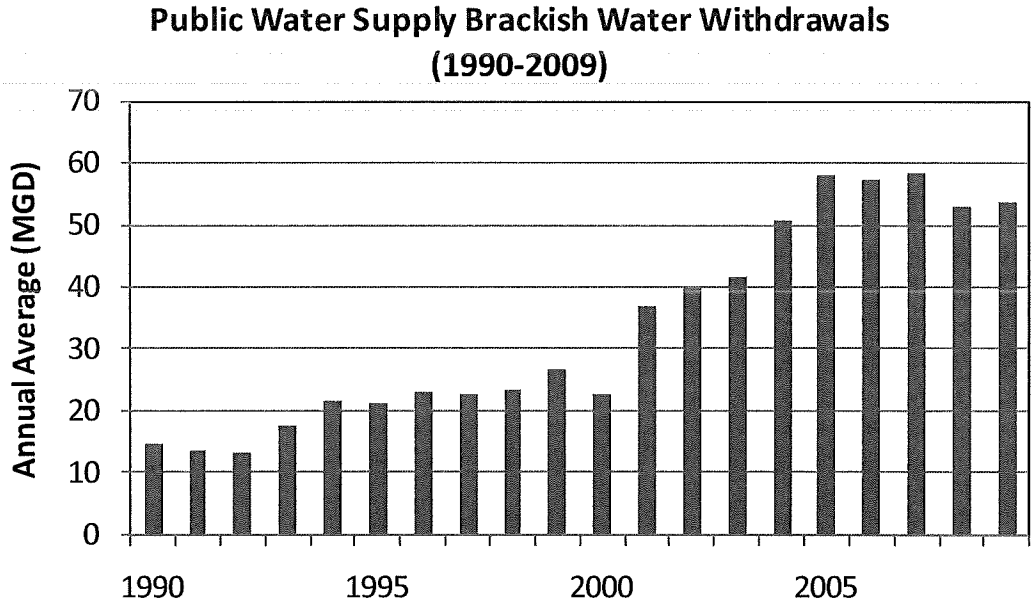


Figure 18. PWS withdrawals from brackish water sources in the LWC Planning Area 1990–2009.

LWC utilities are proposing significant increases in brackish water source development over the next 20 years. The anticipated increased PWS demands in 2030 will be met primarily using brackish groundwater from the IAS and FAS (see **Chapter 6**).

Brackish groundwater is also a source of water for agricultural and landscape irrigation needs. The FAS is a source for Agricultural (AGR) Self-Supply in northern Charlotte County, though supplemental surface water is often added to reduce salinity and improve water quality for the intended crop. Some FAS wells are used to provide frost and freeze protection for citrus groves but fresh surface water and groundwater are the preferred water supply sources for this use category.

BRACKISH GROUNDWATER

Brackish (saline) groundwater is defined as water with a total dissolved solids concentration greater than 250 mg/L and less than 19,000 mg/L. The terms fresh, brackish, saline, and brine are used to describe the quality of the water. Although brackish supplies in the low range of these salinities may be used for some agricultural purposes, this raw water does not meet public drinking water standards. Desalination treatment technologies, such as reverse osmosis, electrodialysis, or electrodialysis reversal, must be used before this type of water supply is suitable for human consumption.

Use of the brackish FAS as a supplemental source for landscape irrigation has increased in the past 10 years as the availability of additional fresh groundwater has diminished. This water may be blended with groundwater and surface water in stormwater ponds to produce acceptable irrigation quality water. Blended water supplies are dependent on water sources, stored water volume, and natural system requirements, and require monitoring to ensure acceptable water quality.

As discussed in **Chapters 3** and **5** of this plan update, a FAS monitor well network was established in the planning area to monitor water levels and quality. Conclusions of previous LWC plans with similar projected demands did not anticipate major regional reductions in water levels or deterioration in water quality (SFWMD 1994, 2000b, 2006). Unexpected water quality changes appear to be related to aquifer variability, insufficient well spacing, and possibly overpumping of production zones close to zones with upconing (saline water underlying fresh water in an aquifer rises upward into the freshwater zone as a result of pumping water from the freshwater zone). The amount of water withdrawn from the FAS by existing and proposed users is very small relative to the amount of water contained within the system. However, the response to increased withdrawals is not fully understood and the distribution of water quality within the FAS is not well established.

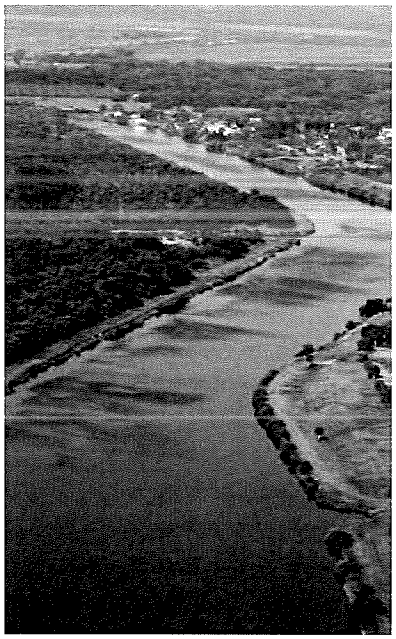
Water level monitoring is critical to assess the potential for movement of highly saline water from the deeper portions of the FAS or inland from the coast. Most of the current water use is located in coastal Collier and Lee counties, with some withdrawals in Charlotte and Glades counties. Consumptive use permits for withdrawals from the FAS have chloride monitoring requirements. Data from uses permitted after the *2005–2006 Lower West Coast Water Supply Plan Update* (2005–2006 LWC Plan Update; SFWMD 2006) was published will improve understanding of the distribution of chloride concentrations within the FAS.

Much of the FAS monitoring and analysis completed to date in the LWC Planning Area provides critical information for developing more sophisticated analyses using computer modeling. The SFWMD has developed a revised Lower West Coast Floridan Aquifer System (LWCFAS) Model based on a peer review of its original density-dependent solute transport model (see **Chapter 5**). Calibration of the model has been completed with significant changes. The peer review comments have been incorporated. Finally, the transient model with draft documentation has been completed (Schlumberger Water Services and SFWMD 2011). The revised model is expected to be used as a tool to evaluate potential water quality changes in the IAS and FAS due to the cumulative withdrawals of existing and future water users. This model may be able to determine long-term availability of this water source.

Surface Water

Surface water is water above the soil or substrate surface, whether contained in bounds created naturally or artificially or diffused. Water from natural springs is classified as surface water when it exits from the spring onto the earth's surface.

Primary surface water sources in the LWC Planning Area include the Caloosahatchee River (C-43 Canal) and connected water bodies, such as the Townsend Canal, Roberts Canal, and City Ditch. The Cape Coral and Big Cypress Basin canal systems also provide surface water supply, and to a lesser extent, local stormwater ponds provide water for landscape irrigation. AGR Self-Supply is the largest water use category in the planning area and the primary consumer of surface water.



Caloosahatchee River
(C-43 Canal)

Use of surface water in stormwater ponds for recreational and landscape irrigation is a common practice. However, in most cases, the surface water is a supplemental supply to a primary groundwater source. AGR Self-Supply water users may also have stormwater impoundments to provide additional water supply or storage for blending with brackish groundwater.

As discussed in **Chapter 3**, in October 2008, Restricted Allocation Area criteria for the Lake Okeechobee Service Area were developed as part of the Minimum Flow and Level (MFL) recovery strategy for Lake Okeechobee. The criteria limits allocations from Lake Okeechobee and connected surface waters, including the Caloosahatchee River (C-43 Canal) and St. Lucie River (C-44 Canal), to base condition water uses that occurred from April 1, 2001 to January 1, 2008. MFL criteria have also been established for the Caloosahatchee River (C-43 Canal). For more information see the *2012 Lower East Coast Water Supply Plan Update* (SFWMD 2012b).

The SFWMD initiated rule development for a Water Reservation for the C-43 Basin Storage Reservoir Project in December 2009. The purpose of the Water Reservation is to identify and reserve water from consumptive use for the Comprehensive Everglades Restoration Plan (CERP) Caloosahatchee River (C-43) West Basin Storage Reservoir Project to ensure the project provides the intended benefits to the natural system. MFLs, Water Reservations, and Restricted Allocation Areas (see **Chapter 3**) must be considered when determining surface water availability.

The development of additional surface water sources is dependent on development of additional storage capacity. Proposed new storage projects creating additional water supply may be considered alternative water supply sources (see the *New Storage Capacity for Surface Water or Groundwater* section later in this chapter).

For example, the Big Cypress Basin canal system in Collier County was constructed as a surface water drainage system; however, improvements to structures, operations, management, and monitoring since 2000 have resulted in an estimated 850 acre-feet of

additional surface water storage in canals. The Big Cypress Basin Capital Improvement Program (Fiscal Year [FY] 2005–FY 2014) includes projects for the Golden Gate Canal System, Henderson Creek, and Barron River. These projects and others provide water resource benefits through reduction of overdrainage and restoration of groundwater and surface water levels to more natural conditions. In addition to providing environmental benefits, these improvements serve to enhance water supply opportunities by increasing groundwater storage and improving the timing and duration of surface water discharges. As a result, the canal system now holds more water for longer periods of time, capturing water previously lost to tide. The City of Naples Utility Department is developing a surface water source from the Big Cypress Basin canal system to supplement its reclaimed water supply (see the *Future Reuse in the LWC Planning Area* section later in this chapter).

Cape Coral Utilities also uses a freshwater canal system to augment the City of Cape Coral's reclaimed water supply for residential and commercial landscape irrigation. The Canal Weirs Improvement Program for the City of Cape Coral added higher control elevations to operable weirs to store more fresh water in the canal system during wet conditions, providing 1.7 MGD additional supply to the city's reclaimed irrigation system. Additional improvements are planned to add transfer pumps to move water between basins, and allow three completed ASR wells to store peak flows for irrigation use during dry periods. The City of Marco Island (Marco Island Utilities) uses surface water from Henderson Creek/Marco Lakes, and Lee County Utilities uses some surface water from the Caloosahatchee River (C-43 Canal). For more information about these projects, see the utility summaries provided in **Chapter 6**.

New Storage Capacity for Surface Water or Groundwater

Storage is an essential component of any supply system experiencing fluctuation in supply and demand. Capturing excess surface water and groundwater during wet conditions for use during dry conditions increases the availability of water when demand is highest. Two-thirds of south Florida's annual rainfall occurs in the wet season. Without sufficient storage capacity, much of this water discharges to tide through surface water management systems and natural drainage to coastal estuaries. In the LWC Planning Area, potential types of water storage include ASR wells, surface water impoundments, ponds, and reservoirs.

Aquifer Storage and Recovery

ASR is the underground storage of storm water, surface water, fresh groundwater, drinking water or reclaimed water, which is treated to appropriate standards (dependent upon the water quality of the receiving aquifer). The aquifer (typically the FAS in south Florida) acts as an underground reservoir for the injected water. The water is stored with the intent to recover it for use in the future.

Potable water, surface water, groundwater, or reclaimed water can be stored using ASR technology. The water that is recovered depends on subsurface conditions and the level of treatment required after storage. Recovery also depends on whether the water is for public consumption, irrigation, surface water augmentation, or wetlands enhancement.

The volume of water made available through ASR wells depends on factors such as well yield, water availability, variability in water supply and demand, and use type. Uncertainty of storage and yield capabilities and water quality characteristics present associated risks for success, but ASR provides storage of water that would otherwise be lost to tide or evaporation.

WATER OPTIONS

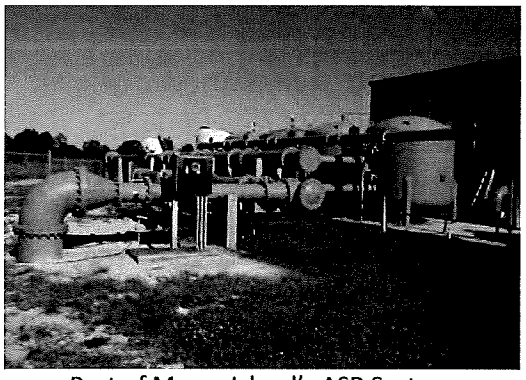
ASR is the underground storage of water into an acceptable aquifer. Available waters are collected during times when water is plentiful (typically during the wet season in south Florida), and then pumped into an aquifer through a well. In south Florida, most ASR systems store treated water in the FAS, which contains brackish water. When discharged into the aquifer, the fresh water displaces the brackish water. The aquifer acts as an underground reservoir for the injected water, reducing water lost to evaporation. The water is stored with the intent to later recover it for treatment and use during future dry periods.

To date, 19 ASR wells have been constructed within the LWC Planning Area. An ASR location map is provided in Figure D-4 in **Appendix D**. All but one of these wells were built by water/wastewater utilities. The remaining well is an inactive United States Geological Survey (USGS) test well. Many of these ASR wells store treated drinking water, although other source waters include raw groundwater, raw or partially treated surface water, and reclaimed water.

Inactivity at some of these wells is related to a regulatory change in the primary drinking water standard for arsenic (i.e., 50 to 10 parts per billion). This change has introduced some uncertainty in obtaining an operational permit from the Florida Department of Environmental Protection (FDEP) for ASR systems. Through site testing, new treatment technology, and possible changes in regulatory criteria, ASR wells are considered a viable option for providing future water supply to meet growing demands.

The SFWMD and the United States Army Corps of Engineers (USACE) are conducting pilot tests on two ASR systems within the SFWMD to evaluate the feasibility of ASR for the large-scale storage of excess surface water as part of the CERP. A report about the CERP ASR pilot testing is expected in 2013.

The City of Marco Island has the largest ASR system within the boundaries of the SFWMD and has the capacity to store 1.7 billion gallons of water. At the local level, the city's drinking water supply depends on its ASR system for supply during high demand months. The city's system includes seven wells that store partially treated surface water in the FAS for retrieval to its treatment facility. Marco Island Utilities intends to increase ASR capacity to meet the city's future potable water



Part of Marco Island's ASR System

needs.

Lee County Utilities also stores treated drinking water from its Corkscrew Treatment Facility in ASR wells for retrieval during peak demand periods. The county intends to expand ASR capacity at its west ASR wells for reclaimed water for non-potable use and at its Gateway Wastewater Treatment Plant ASR well system. For more information about these projects, see the utility summaries provided in **Chapter 6**.

Aquifer Storage and Recovery Pretreatment Investigation

This project investigates methods to suppress the freeing of arsenic from aquifer bedrock associated with ASR activities. It is co-funded by the Southwest Florida Water Management District, St. Johns River Water Management District, and SFWMD (through the CERP). The pilot project began in 2008 and was completed in 2011. The project consisted of 1) evaluation of arsenic mobilization processes occurring during ASR activities, which is being pursued by two independent consultant teams, 2) bench-scale leaching studies on storage zone cores, and 3) development of a degasification system to remove dissolved oxygen from source water prior to injection. Dissolved oxygen has been identified as a likely suspect in mobilization of arsenic from the FAS strata. The project concluded that the degasification technology was successful at reducing arsenic concentrations in recovered water; however, the process was expensive and required expanded operations and maintenance activities.

Local and Regional Reservoirs

Surface water reservoirs provide storage of water, primarily captured during wet weather conditions for use in the dry season. Water is typically captured and pumped from rivers or canals and stored in reservoirs. For example, small-scale (local) reservoirs are used by individual farms for storage of recycled irrigation water or the collection of local stormwater runoff, such as tailwater recovery. Tailwater recovery is addressed under agricultural best management practices (BMPs) later in this chapter. These reservoirs may also provide water quality treatment before off-site discharge. Large-scale (regional) reservoirs are used for stormwater attenuation, water quality treatment in conjunction with stormwater treatment areas, and storage of seasonally available supplies for use during dry periods.

Projects to Capture, Treat, and Store Water

Captured stormwater projects are planned for water management, water quality, and water supply purposes. A brief overview of projects planned to capture, treat, and store water in the LWC Planning Area are provided in the following sections.

CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project

This project is an above-ground reservoir located on the south side of the Caloosahatchee River (C-43 Canal) and west of the Ortona Lock (S-78). It is on a 10,700-acre parcel west of

LaBelle formerly known as Berry Groves. The purpose of the project is to improve the quantity, timing, and distribution of freshwater flows to the Caloosahatchee River and Estuary. This proposed reservoir project would capture and store surface water runoff from the C-43 Basin and Lake Okeechobee to provide a more natural and consistent flow of fresh water to the estuary. After construction and flow-through testing, operation of this project is expected to improve the Caloosahatchee Estuary's salinity balance by reducing a portion of the peak discharges during the wet season and providing essential flows during the dry season. The reservoir will provide a total storage capacity of approximately 170,000 acre-feet of above-ground storage volume in a two-cell reservoir. For further information refer to **Appendix G**.

CERP Picayune Strand Restoration Project

This project is under construction with several phases completed. It is designed to restore and enhance over 55,000 acres of public lands by reducing overdrainage and returning the natural and beneficial sheetflow of water to the project site and adjacent areas, including the Fakahatchee Strand Preserve State Park, Florida Panther National Wildlife Refuge, Ten Thousand Islands National Wildlife Refuge, and Collier-Seminole State Park. In addition, this project is expected to improve aquifer recharge and maintain existing flood protection for private properties. A Water Reservation in support of this project became effective in July 2009 (see the *Water Reservations* section of **Chapters 1**, **3**, and **5**).

Dispersed Water Management Program

This program is a collective and collaborative effort designed to encourage property owners to retain water on their land rather than drain it, accept regional excess runoff for storage, or both. Managing water on public, private, and tribal lands is a way to reduce the amount of water delivered to Lake Okeechobee and discharged to coastal estuaries for flood protection purposes. This program complements water storage options available through public facilities, such as reservoirs, restoration projects, and stormwater treatment areas. For further information refer to **Appendix I**.

East County Water Control District

The East County Water Control District is an independent 298 Special Water Control District that manages storm water in Lehigh Acres in Lee County. The *East County Water Control District Consolidated Plan for Water Management* (ECWCD 2008) includes improvement projects to reduce high flows to the Orange River, which currently discharges into the Caloosahatchee Estuary, capture and store stormwater runoff, and raise groundwater levels for wetland restoration, water storage, and aquifer recharge.

Reclaimed Water

Reclaimed water is water that has received at least secondary treatment and basic disinfection and is reused after flowing out of a domestic wastewater treatment facility (Rule 62-610.200, Florida Administrative Code [F.A.C.]). Reuse is the deliberate application

of reclaimed water for a beneficial purpose. Criteria used to classify projects as "reuse" or "effluent disposal" are contained in Rule 62-610.810, F.A.C. The term "reuse" is synonymous with "water reuse."

Reclaimed water is a key component of water resource management in southwest Florida. Potential uses of reclaimed water include landscape irrigation (e.g., medians, residential lots, and golf courses), agricultural irrigation, groundwater recharge, industrial uses, environmental enhancement, and fire protection.

WATER OPTIONS

Reclaimed water has received at least secondary treatment and basic disinfection. It is reused after flowing out of a domestic wastewater treatment facility. Reuse is the deliberate application of reclaimed water for a beneficial purpose in compliance with the FDEP and water management district rules.

The State of Florida encourages and promotes the use of reclaimed water. The Water Resource Implementation Rule (Chapter 62-40, F.A.C.) requires the FDEP and water management districts advocate and direct the use of reclaimed water as an integral part of water management programs, rules, and plans. The SFWMD requires all applicants for consumptive use permits proposing to use more than 0.1 MGD of water to use reclaimed water if it is environmentally, technically, and economically feasible to do so, as determined in the permitting process.

Wastewater reuse conserves resources and is an environmentally sound alternative to traditional disposal methods, such as surface water discharge and deep well injection. Although back-up disposal methods are needed in wet periods with low irrigation demands, wastewater reuse minimizes disposal of needed water resources. Reclaimed water also provides additional water supply for water uses not requiring potable water, such as irrigation.

Existing Reuse in the LWC Planning Area

The primary use of reclaimed water in the LWC Planning Area is for irrigation of public access areas including golf courses, residential lots, parks, schools, and other green spaces. Reclaimed water is also used to recharge groundwater. Use of reclaimed water for industrial cooling is expected to grow as Power Generation (PWR) Self-Supply demands increase during the 20-year planning horizon (see **Chapter 2**).

In the LWC Planning Area, wastewater management has evolved over the past 15 years from package plants and smaller subregional facilities to an integrated system of larger regional facilities and a network of reclaimed water pipelines carrying treated water. The volume of reclaimed water used for a beneficial purpose, such as groundwater recharge and landscape irrigation, has more than doubled from 1994 to 2010 as shown in **Figure 19**. Over this period, the volume of reclaimed water use varied from year to year, depending on the addition of new users and area rainfall.

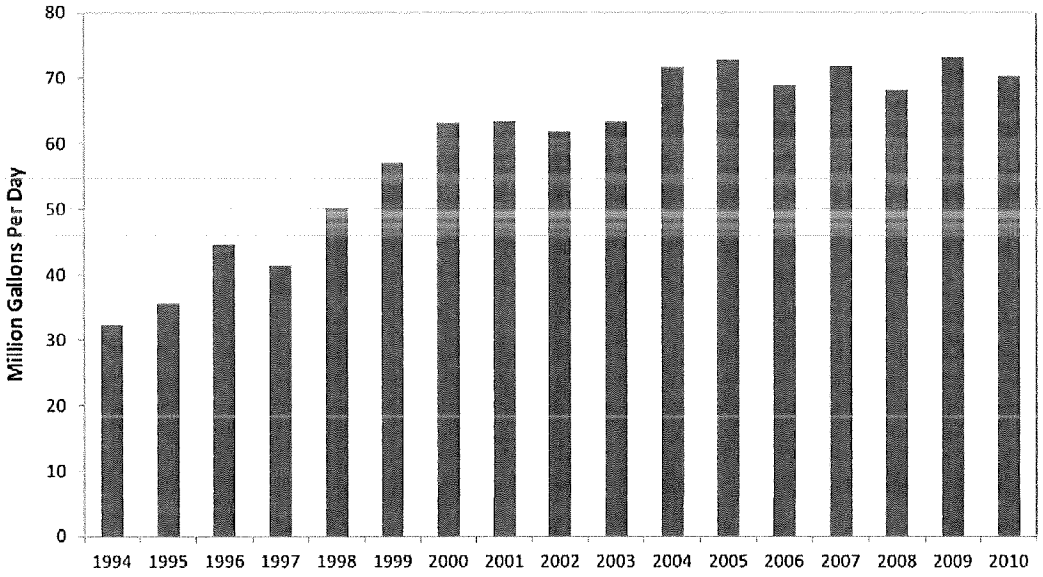


Figure 19. Annual reclaimed water reuse history in the LWC Planning Area 1994–2010 (Sources: FDEP Reuse Inventories 1994–2010[1]).

In 2010, there were 41 wastewater treatment facilities in the LWC Planning Area with a capacity of 0.1 MGD or greater. These facilities had a total wastewater treatment capacity of 148 MGD to meet peak daily flows and treated 77 MGD of wastewater. Collier County Water-Sewer District's North County Water Reclamation Facility, with a capacity of 24.1 MGD, remains the area's largest wastewater treatment/reclamation facility.

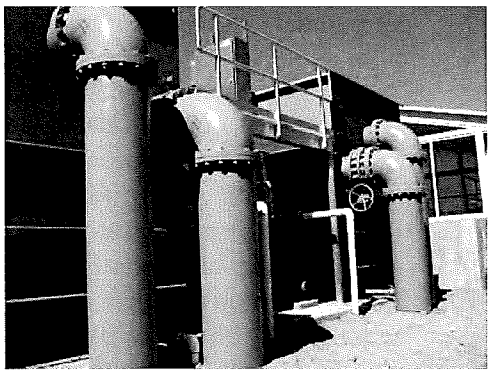
Of the 41 wastewater treatment facilities, 38 facilities reuse all or a portion of their wastewater. In 2010, 71 MGD (91 percent) of the wastewater treated in the LWC Planning Area was reused for a beneficial purpose. Approximately 61 MGD of reclaimed water was used for irrigation of more than 51,000 residential and commercial lots, 77 golf courses, 48 parks, and 24 schools (FDEP 2011). About 4 MGD of the planning area's reclaimed water supply was used for groundwater recharge through rapid infiltration basins and spray fields. The remainder was used for miscellaneous uses, such as for industry and agriculture. The reuse of reclaimed water in lieu of traditional fresh groundwater and surface water in the LWC Planning Area has helped reduce potential resource impacts.

In 2010, 9 MGD of the LWC Planning Area's 77 MGD of the wastewater treated, which is potentially reusable, was disposed of through injection wells. The City of Fort Myers, Naples, and Lee County also use surface water discharge. However, each of the utilities plans to minimize future wastewater discharges. A listing of reclaimed water facilities and capacities is provided in **Appendix D**.

---

[1] FDEP 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2010a, 2010b, 2011

Reclaimed Water System Interconnects


City of Fort Myers Reclaimed Water Facility

Reclaimed water system interconnects are connections between two or more reclaimed water distribution systems. These systems may be owned or operated by different utilities, or may be shared between two or more domestic wastewater treatment facilities that provide reclaimed water for reuse activities. When two or more reclaimed water systems are interconnected, additional system flexibility is attained, which increases efficiency and reliability. For example, possibilities exist for regionalization, where flows from smaller water treatment facilities are diverted to larger regional facilities. For example, Fort Myers produces excess reclaimed water and Cape Coral's irrigation water demand exceeds its reclaimed water supply, thus, the reclaimed water connection between them is beneficial for both utilities. Lee County Utility's Waterway Estates facility currently sends some wastewater to the City of Cape Coral in an effort to increase overall efficiency and to reduce discharges to the Caloosahatchee River (C-43 Canal).

2012 Reclaimed Water Bill

In 2012, the Florida legislature amended Section 373.250, Florida Statutes (F.S.). The amendments required the FDEP to initiate rulemaking to incorporate criteria for the use of "substitution credits" and "impact offsets" when a water management district is reviewing a consumptive use permit application. Impact offsets are derived from the use of reclaimed water to reduce or eliminate a harmful impact that has or would otherwise occur as a result of a surface or groundwater withdrawal. A substitution credit means the use of reclaimed water to replace all, or a portion of, an existing permitted use of a resource-limited surface water or groundwater, allowing a different user or use to initiate a withdrawal or increase its withdrawal from the same resource-limited water resource. Water management districts rules will be modified, as needed, to be consistent with the amendments to Section 373.250, F.S., and amendments to FDEP's Chapter 62-40, F.A.C.

Future Reuse in the LWC Planning Area

Utility wastewater flows are projected to increase to an estimated 139 MGD by 2030. All of the major utilities (greater than 0.1 MGD capacity) have excess treatment capacity at this time and plan to expand their reuse systems as additional reclaimed water becomes available and demand increases. Most of the utilities plan to reach full reuse of their average daily wastewater flow by 2030. The utilities that still have FDEP-issued surface water discharge permits intend to minimize or eliminate those discharges through either reuse or deep well injection. In many cases, future reuse will occur in new residential developments,

as many local governments have requirements for reclaimed water line installation. Consumptive use permits for landscape irrigation in the LWC Planning Area require the use of reclaimed water when environmentally, technically, and economically feasible, as determined in the permitting process.

The City of Naples reused 71 percent of the wastewater generated in 2010 for public access landscape irrigation, primarily golf courses. The city plans to expand its reclaimed water distribution to reach more residential irrigation systems and facilitate 100 percent use of its reclaimed water supply. Many residential irrigation systems currently use potable water; consequently potable water demand will decrease with the increased use of reclaimed water. The City of Naples intends to supplement its reclaimed water supply with captured storm water and will provide irrigation water to customers currently using potable water for irrigation. The city's plan is designed to reuse all of its wastewater, decrease the per capita use rate (PCUR) of its potable water supply, and eliminate the need for additional potable water treatment capacity over the next 20 years.

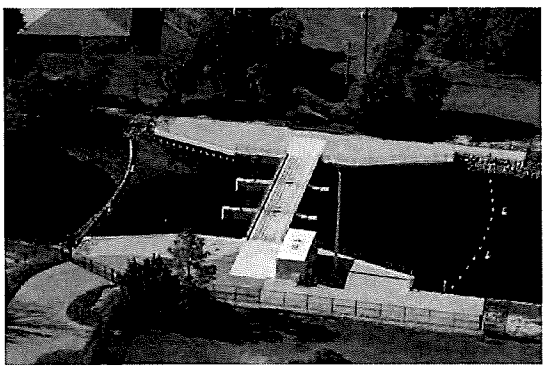
The City of Marco Island has an ongoing septic system replacement program in place. The city has upgraded its wastewater treatment and reclaimed water production capacity. By adding reclaimed water lines to its distribution system to provide more reclaimed water supply for landscape irrigation, the city is reducing its reliance on potable water for irrigation. In 2010, the average daily reuse flow for the City of Marco Island was 1.5 MGD, nearly 81 percent of its average wastewater flow. By 2030, the city projects its average reuse flow will reach 2.5 MGD, which is 86 percent of its projected 2030 wastewater flow.

Supplemental Sources

The use of supplemental water supplies to meet peak demands for reclaimed water may enable a water utility to maximize its use of reclaimed water resources. However, during times of drought, other water sources, such as surface water, groundwater, or storm water, may not be available to supplement reclaimed water supplies in some areas. Use of supplemental water supplies is subject to consumptive use permitting by the SFWMD, and the availability of these supplies to supplement reclaimed water will be evaluated on an application-by-application basis.

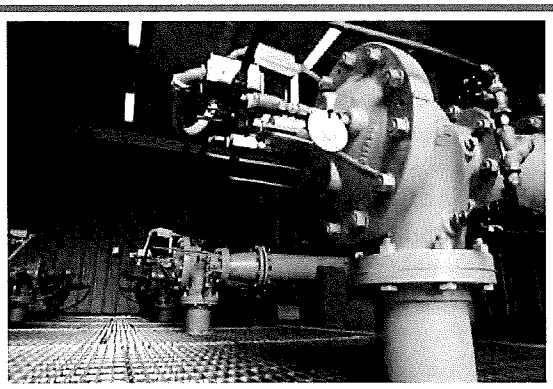
The use of supplemental water supplies to meet peak demands for reclaimed water may enable a water utility to maximize its use of reclaimed water resources. However, during times of drought, other water sources, such as surface water, groundwater, or storm water, may not be available to supplement reclaimed water supplies. Use of these sources as supplemental water supplies is subject to consumptive use permitting by the SFWMD. The availability of surface water, groundwater, or storm water to supplement reclaimed water will be evaluated on an application-by-application basis. The FDEP is amending provisions of Chapter 62-40, F.A.C. to recognize and promote the supplementation of reclaimed water supplies with surface water and groundwater sources in order to maximize the reuse of reclaimed water.

The Golden Gate Canal Irrigation Quality Facilities Project proposed for the City of Naples will develop a 10 MGD water supply from captured storm water to supplement a reclaimed water system for irrigation.


Golden Gate Main Canal

The City of Cape Coral supplements its reclaimed water supply with water from the freshwater canal system. The canal system has the capacity to supply 46 MGD of surface water to its Water Independence for Cape Coral system, which has 715 miles of reclaimed water lines and irrigates about 8,000 acres of residential and commercial landscape. The planned 4,000-acre expansion of the system to provide irrigation for over 12,000 acres will require additional reclaimed water and supplemental sources.

The Collier County Water-Sewer District utilizes supplemental groundwater supply to help meet irrigation demands when reclaimed water supply declines and irrigation demands peak. The Collier County Water-Sewer District's Irrigation Quality Water System supplies irrigation water to over 50,000 end users, including 21 golf courses, 6 county parks and schools, residential communities, and 65 miles of roadway medians. The Collier County Water-Sewer District has identified future irrigation quality water customers and is developing additional irrigation water supply through the use of ASR, which will utilize a combination of reclaimed water, groundwater, and storm water.


Collier County Water-Sewer District irrigation quality water pump station at Pelican Bay

Seawater

Seawater or salt water is defined as water with a chloride concentration at or above 19,000 mg/L. Seawater requires desalination treatment prior to being used as potable water. Desalination is the process of removing or reducing salts and other chemicals from seawater or other highly mineralized water sources, resulting in the production of fresh water.

The use of desalinated seawater from the Gulf of Mexico is an additional water source option for the LWC Planning Area. The Gulf of Mexico is essentially an unlimited source of water. However, desalination treatment is required before potable or irrigation uses are feasible. Desalination treatment technologies include reverse osmosis (RO), electrodialysis, or electrodialysis reversal.

While seawater treatment costs are declining, costs remain moderately higher than brackish water desalination. In December 2006, the SFWMD completed a feasibility study for co-locating seawater treatment facilities with power plants in south Florida (Metcalf & Eddy 2006). The study's most feasible three sites are co-located with Florida Power & Light's (FPL's) facilities in Fort Myers, Fort Lauderdale, and Port Everglades.

Summary of Water Source Options

Historical water sources include fresh groundwater from the SAS and IAS, and surface water, primarily from the Caloosahatchee River (C-43 Canal) and canals. However, from a regional perspective, development of the SAS and IAS for potable water has been maximized over time in certain areas, and potential increases in production are limited, especially in coastal areas. New or increased allocations will be reviewed on an application-by-application basis to determine if the project meets consumptive use permitting criteria. Alternative water supply sources include brackish groundwater from the FAS, reclaimed water, and captured storm water.

The FAS and portions of the IAS in the LWC Planning Area are brackish water sources that require blending or desalination treatment before use. Over the 20-year planning horizon, development of these brackish sources will exceed development of freshwater sources.

Two-thirds of south Florida's annual rainfall occurs in the wet season, but without sufficient storage capacity, much of this water discharges to tide. In the LWC Planning Area, potential types of needed water storage include ASR wells, reservoirs, and surface water impoundments and ponds.

Reclaimed water is a key component of water resource management in south Florida. Thirty-eight out of 41 wastewater treatment facilities in the LWC Planning Area reuse all or a portion of their wastewater. In 2010, 71 MGD (91 percent) of the wastewater treated in the LWC Planning Area was reused for a beneficial purpose, primarily for irrigation. However, 9 MGD of potentially reusable water was disposed of via deep well injection. Utility wastewater flows are projected to increase to an estimated 139 MGD by 2030. The utility interconnects discussed in this plan update could significantly increase water reuse in the planning area.

Desalinated seawater is an additional water source option for the LWC Planning Area. Water conservation is also considered a water source option. Water conservation measures, as discussed in the following section, present feasible options for all locations and use types to meet the water needs of the region by reducing water use demands.

Water source options are dependent on location, use type, demand, regulatory requirements, and cost. As competition for limited water resources increases, development of alternatives has become more common.

WATER CONSERVATION

Water conservation, also known as demand management, is an integral part of water supply planning and water resource management. For planning purposes, water conservation is also considered a water source option because it can reduce the need for expansion of the water supply infrastructure.

The first part of this section identifies the water conservation opportunities, programs, and tools available for urban water use along with examples of potential water savings. The majority of these programs and tools apply to the PWS use category, which provides water for residential, industrial, commercial, institutional, landscape, and recreational needs. The second part of this section reviews BMPs and water conservation opportunities for agricultural and urban irrigation. Information about the SFWMD's Comprehensive Water Conservation Program, water conservation-related laws and rules, available planning resources, and funding opportunities is also presented.

DISTRICT

The SFWMD's consumptive use permitting rules require PWS utilities to plan and implement water conservation measures. These rules have been in place since 1991.

As detailed in Section 2.6.1 of the Basis of Review, these rules include the following:

- Adoption of an irrigation days/hours ordinance
- Adoption of a Florida-Friendly Landscape™ ordinance
- Adoption of an ultralow volume fixtures ordinance
- Adoption of a rain sensor device ordinance
- Adoption of a water conservation-based rate structure
- Implementation of a utility leak detection and repair program
- Implementation of a water conservation public education program
- An analysis of reclaimed water feasibility

More information about water conservation is provided in the Support Document.

Generally, water conservation promotes permanent water use efficiencies and increases the available supply of water from existing sources to support growth and maintain natural resources. It is also more immediate, significantly less costly, and more energy efficient to conserve water than to develop new sources of water. Water demand reduction is a viable alternative to new water supply development and enhances existing water supplies. While short-term water restrictions imposed during a water shortage can temporarily relieve pressure on water sources, lasting water conservation involves a combination of retrofits,

new water saving appliances, maintenance of infrastructure, and a collective water conservation ethic focused on resource use, allocation, and protection.

At the utility level, a well crafted water conservation or demand management plan can improve a utility's systemwide operational efficiency and reduce, defer, or eliminate the need for investments in new production capacity. Quantitative analysis of a utility's current and future water production, service area characteristics, and population can yield robust estimates of water and cost savings achievable through water conservation. The SFWMD recommends that utilities compare the cost of water conservation measures and the resultant water savings with production costs for new sources.

Comprehensive Water Conservation Program

The SFWMD's Comprehensive Water Conservation Program is a series of implementation strategies approved by the SFWMD's Governing Board in September 2008. The program is the result of a Water Conservation Summit hosted by the SFWMD's Water Resource Advisory Commission (WRAC) and a series of stakeholder meetings.

The Comprehensive Water Conservation Program is designed to bring about a permanent reduction in individual water use and is organized into 1) regulatory, 2) voluntary and incentive-based, and 3) education and marketing initiatives. Under the umbrella of these initiatives, the SFWMD and other agencies offer numerous water conservation tools, building codes requiring use of water efficient appliances and fixtures, and more efficient landscape and irrigation practices. Chapter 5 in the Support Document provides additional background information about the development of the Comprehensive Water Conservation Program.

Urban Use – Tools, Programs, and Potential Savings

In this section, urban use is defined as water used for non-agricultural purposes. It includes the water used in homes and businesses, landscape irrigation, and power generation. The majority of water consumed for residential and commercial use is provided by PWS utilities. This PWS consumption is included in each utility's PCUR. However, some homes and businesses use well water for their source of potable water and irrigation water, which is DSS and classified as urban use.

Collectively, south Florida's PCUR is the highest in the state. It is estimated that south Florida uses 179 gallons per day (GPD) per person (Marella 2009), including approximately 70 GPD indoors. While this plan update concentrates on water conservation for PWS utilities because savings can be quantified, the SFWMD's recommended water conservation measures are applicable to both PWS and DSS water users.

Measuring the Effects of Water Conservation

The key indicator of long-term water conservation effectiveness is PCURs and their fluctuations over time. Per capita consumption is calculated as PWS withdrawals in GPD (Marella 2009) divided by the number of permanent residents.

While a PCUR is an effective measure of conservation effectiveness for a single community or utility over time, it is much less effective when comparing one community or utility to another. Significant differences between communities, such as industrial use, seasonal populations, and other demographic differences affect the total amount of water used by a community. This is because these factors are not accounted for in the calculation of per capita consumption.

Table 11 shows the base year regional utility PCUR for this plan update as well as those cited in the *1994 Lower West Coast Water Supply Plan* (1994 LWC Plan; SFWMD 1994), *2000 Lower West Coast Water Supply Plan* (2000 LWC Plan; SFWMD 2000b), and *2005–2006 Lower West Coast Water Supply Plan Update* (2005–2006 LWC Plan Update; SFWMD 2006). The PCUR has gone down from 194 GPD per person, in the 1994 LWC Plan, to a low of 151 GPD per person in this plan update.

Table 11. PCURs in the LWC Planning Area (using overall finished water).

LWC Plan Year	Base Year Used	PCUR (GPD per person)	Water Saved Compared to 1994 (MGD)
1994	1990	194	---
2000	1995	167	13.42
2005–2006	2000	176	10.72
2012	2005	151	34.35

These numbers show a pronounced downward trend in the use of finished water per person per day. This reduction in water use may suggest that a water conservation ethic is emerging or dependence on potable water for irrigation is declining due to increased water reuse or the use of private wells for irrigation. Water efficient appliances, plumbing retrofits, minimum building code standards, education, and other water conservation-oriented practices contribute to the reduction in finished water use. The SFWMD's objective is to continue this water use trend by working with water users to achieve significant long-term water savings. For a discussion about estimating the effects of water conservation, see the Support Document.

Public Water Supply Use: Utility and Local Government Programs

A variety of options are available to municipalities and water supply utilities for developing and enhancing water conservation programs. These options include comprehensive plans, such as goal-based programs, as well as specific solutions, such as plumbing retrofits and advanced irrigation technology. Many of the options prescribed for PWS users are also applicable for DSS users.

Utilities may direct conservation measures to individual users through water conservation rate structures, retrofits, and rebates. Water conservation can also be promoted at the utility level by addressing plant efficiencies, use of reclaimed water, and automatic flushing devices. An effective program includes several programmatic water conservation components. **Appendix E** provides the status for PWS water conservation program implementation for municipalities and water utilities in the LWC Planning Area.

Water Conservation Rate Structures

Water pricing is an effective means to promote water conservation. A water conservation-based rate structure provides a financial incentive to reduce use. Users faced with higher rates will often achieve water conservation by implementing a number of the conservation measures discussed in this chapter.

Water conservation-based rates may include the following:

- Increasing the block rate – the marginal cost of water to the user increases in two or more steps as water use increases
- Seasonal pricing – water consumed during peak season (October through May), is billed at a higher rate than water consumed in the off-peak season
- Quantity-based surcharges
- Time-of-day pricing

Utilities seeking a consumptive use permit must adopt a water conservation-based rate structure as part of their water conservation plan. In the LWC Planning Area, the majority of PWS providers have a block rate structure (also referred to as a "tiered" rate structure). The block rate structure is generally expected to have the largest impact on heavy irrigation users. The responsiveness of customers to water conservation rate structures depends on the existing price structure, incentives of the new price structure, the customer base, and their water uses. **Appendix E** provides single family water use rates in the LWC Planning Area.

Goal-based Water Conservation Plans

A goal-based water conservation plan allows utilities to achieve agreed upon conservation goals within their consumptive use permits to help meet future water supply needs and possibly eliminate the need to construct additional facilities or wells. A well designed program identifies a variety of methods and practices that decrease water demand to meet numeric goals. Water conservation planning tools are available to help PWS utilities develop water conservation plans with a numerical goal for achievable water savings. The practices selected should reflect, among other parameters, population projections, existing PCURs, the ability of the population to make the necessary changes, and the service area's water use profile. It is important for the plan to project the costs for supplying the additional water needed to meet water supply objectives. The SFWMD recommends regular review and analysis of plan results, which allow for program adjustments as needed to meet

water conservation goals. More information about goal-based water conservation is provided in **Appendix E**.

Water Conservation Program Planning Tools for Public Water Supply Utilities

PWS Utilities in the LWC Planning Area are strongly encouraged to use a water conservation planning tool offering conservation standards to create goal-based demand management plans for their service areas. Upon request, the SFWMD provides support and assistance to utilities in creating a service area demand management plan. In general, water conservation planning tools can help a utility to do the following:

- Develop a service area water use profile
- Evaluate and compare the costs and benefits of various conservation measures
- Create a mid- to long-range conservation (or demand management) plan

The Conserve Florida Water Clearinghouse's *EZ Guide* (2009) generates estimates of indoor water use and savings for utility service areas using data from entities such as county property appraiser offices and the Florida Department of Revenue. The entities maintain detailed data on all land parcels in the state. For each parcel, these data typically include the age of a structure, number of bathrooms, total square footage of the parcel, and total square footage of the built structure on the parcel. These data, along with population estimates, are used to create estimates of water consumption for structures built during each plumbing code era and for each water use sector (e.g., single and multiple family residential, industrial, commercial, and institutional).

The *EZ Guide* output results include water savings, costs, and net benefits for each recommended water conservation option, and each water use sector is subdivided by plumbing code dates. In addition, the *EZ Guide* produces a ranked and optimized list of water conservation actions based on cost benefits and gallons of water saved. The *EZ Guide* is available at no cost from the Conserve Florida Water Clearinghouse website (http://www.conservefloridawater.org).

The Alliance for Water Efficiency's Water Conservation Tracking Tool is a Microsoft® Excel-based model, which uses baseline demand data for each water use sector (customer class) and avoided cost data to evaluate and design utility conservation programs. It contains a library of predefined water conservation measures users can select for evaluation. Water savings, costs, and benefits of each measure can be examined and tracked for each year of the proposed program. The tracking tool features comprehensive and highly developed economic analyses of each water conservation option accounting for program costs using time-valued dollars. Yearly peak and off-peak demands and savings are calculated to identify specific points of capacity deferment and present value benefits. The tool's avoided cost calculator includes analysis of short-term avoided costs and long-term avoided or deferred capacity expenses. The analysis functions of the tool include utility revenue and rate impact calculations. The tool recently concluded a beta testing period and is now available free of charge to Alliance for Water Efficiency members from http://www.allianceforwaterefficiency.org.

Water Conservation versus Development of Additional Water Supplies

Most water supply development options require significant upfront investments and ongoing operations and maintenance costs. In many cases, demand management is often a more immediate and cost-effective means of meeting water supply needs. **Tables 12** and **13** compare the unit costs to save or create 1,000 gallons of water using an aggressive water conservation program or common water treatment technologies. Based on the costs in **Table 12**, **Table 13** shows the daily cost to produce 1 MGD, 3 MGD, and 5 MGD of water using nanofiltration and RO as compared with water conservation.

Table 12. Cost comparison of water conservation versus nanofiltration and RO treatment technologies for 1,000 gallons of water.

	Hardware	Cost to Save or Create 1,000 Gallons	Cost Factors
Water Conservation[a]	High-efficiency fixtures/appliances[b]	$0.40 to $3.00	Purchase and installation of hardware plus program administration costs
New Facility Construction[c]	Nanofiltration	$3.42 to $9.46[d]	Annual capital cost for raw water supply, pretreatment, nanofiltration, or RO process train, and post-treatment annual operations and maintenance expenses, and annual renewal and replacement fund deposit
	RO	$4.41 to $11.33[d]	
Expansion of Existing Facility[c]	Nanofiltration	$3.13 to $9.07[d]	Nanofiltration or RO membrane units and associated equipment, filters, piping, and supplies
	RO	$3.69 to $10.38[d]	

a. Cost of 1,000 gallons saved is based on the cost of all devices across the service life and the number of gallons saved per day normalized to 1,000 gallons.
b. Fixtures and appliances include, but may not be limited to, toilets, faucet aerators, showerheads, irrigation spray heads, rain and soil moisture sensors, and computerized irrigation controllers for large-scale irrigation.
c. Costs are considered to be order-of-magnitude estimates as defined by the American Association of Cost Engineers.
d. Amortization of initial capital investments is a term of 20 years at a 7 percent discounted rate.

Table 13. Daily cost of water conservation versus nanofiltration and RO for 1 MGD, 3 MGD, and 5 MGD of water supply.

	Water Conservation	New Facility Nanofiltration	New Facility RO	Nanofiltration Expansion	RO Expansion (Low Pressure)
1 MGD	$400 – $3,000	$9,460	$11,330	$9,070	$10,380
3 MGD	$1,200 – $9,000	$13,500	$17,430	$12,330	$14,580
5 MGD	$2,000 – $15,000	$17,100	$22,050	$15,650	$18,450

The cost ranges for common water treatment technologies shown in **Table 12** illustrate an inverse relationship of cost to production. This is due to initial fixed capital costs and economies of scale in production. The cost range for conservation items (per 1,000 gallons saved) relates to the costs for the various conservation items themselves (faucet aerators, toilets, irrigation hardware, etc.), minus any shared costs with end users (via utility rebate programs) and the cost of program administration. The fixed savings rates of each conservation item can have a linear effect on total program cost as the program size increases, in contrast to common water treatment technologies. Once administrative and end user shared costs have been established, the costs and savings rates of the individual conservation items are likely to be the strongest driver of conservation program expenses.

Tables 12 and **13** indicate that the unit and daily cost of water conservation is significantly less than new water production through expansion of an existing facility or construction of a new facility. In addition, indoor water conservation measures reduce wastewater generation and flows that have to be treated and disposed of, resulting in additional cost savings not addressed in these tables. **Appendix E** contains a comparison of water conservation measures and alternative water supply development.

A well crafted water conservation or demand management plan can improve a utility's systemwide operational efficiency and reduce, defer, or eliminate the need for investments in new production capacity. Utilities should consider water conservation as a water source option to meet future growth and water production needs.

Case Study

The Miami-Dade Water and Sewer Department is a real world example of how a utility was able to capitalize on cost and water savings through water conservation. The department implemented a goal-based water conservation plan that shows actual savings in dollars and gallons. This example presents compelling evidence of how water conservation can be used in combination with, or in lieu of, developing alternative water supplies.

EXAMPLE

Case Study

The *Miami-Dade County Water Use Efficiency 20-Year Plan* (Miami-Dade County 2007) estimates the conservation program could generate 19.6 MGD in water savings by 2026. The Miami-Dade Water and Sewer Department used the Conserve Florida Guide (a predecessor to the *EZ Guide*) to create a goal-based water conservation plan consisting of non-quantifiable measures and quantifiable BMPs to achieve water savings. The plan involves indoor plumbing fixture retrofit projects, permanent two-day-per-week irrigation restrictions, residential irrigation efficiency improvement projects, and other measures.

Based on the initial cost estimates of water supply development and quantified water conservation savings observed to date, each dollar the Miami-Dade Water and Sewer Department spent on implementing its water conservation plan since 2006 has deferred or eliminated between $5 and $9 in capital project costs. Due in large part to water conservation plan implementation, per capita water demand has been reduced from 154 gallons per capita per day in 2005 to 140 gallons per capita per day in 2009. The drop in overall water demand, together with slower population growth rates, has allowed the county to reschedule its water supply development plan, eliminate two alternative water supply projects, and postpone four alternative water supply projects. In addition, the county was able to extend the duration of its current consumptive use permit.

More information about this goal-based water conservation example and water conservation is available in **Appendix E** and the Support Document.

Indoor Use

The indoor use category represents the water used within homes, businesses, and institutions to take care of everyday needs and commercial operations. Examples of indoor use include preparing food, washing dishes, taking showers, flushing toilets, and operating equipment.

Plumbing Fixture Efficiency

To help reduce indoor PCURs, the SFWMD supports the efforts of municipalities and utilities in implementing high efficiency indoor retrofit programs. Programs that provide funding, hardware, or support for plumbing retrofits, including WaterSense, Water Savings Incentive Program (WaterSIP), Water Conservation Hotel and Motel Program (Water CHAMP), and Florida Water Star℠, are discussed in the following sections.

EXAMPLE

The School District of Lee County

The School District of Lee County partnered with FPL to assess and implement water conservation and cost reduction measures in Lee County schools. During FY 2009, Phase II of the program targeted Estero High School. The school lavatories were retrofitted with technologies to reduce consumption well below the conventional flow rates for water closets, urinals, and faucets. The following high efficiency plumbing fixtures were purchased and installed: 97 toilets, 26 urinals, 46 aerators, 20 faucets, and five kitchen pre-rinse sprayers. Actual usage rates per fixture type were based on site visits and interviews with school personnel, as well as the ratio between males and females at the high school. In 2009, before the retrofit program began, Estero High School's water usage was 3.56 million gallons per year (MGY). In 2010, after the retrofit program was implemented, the school's water usage was 2.78 MGY. The Estero High School retrofit program provided an actual water savings of 0.78 MGY, about 22 percent.

WaterSense

The SFWMD became a WaterSense Promotional Partner in 2009. WaterSense is a program established by the United States Environmental Protection Agency (USEPA) to protect the future of our nation's water supply by promoting water efficiency and enhancing the market for water efficient products, programs, and practices. WaterSense helps consumers identify water efficient products that meet rigorous efficiency and performance criteria. Products tested and proven at least 20 percent more efficient than those meeting current federal standards without compromising performance standards are awarded the WaterSense label.

When designing and planning a retrofit program, the SFWMD recommends utilities and municipalities refer to the WaterSense Program for standards, criteria, and information. The SFWMD also refers to WaterSense products and standards for use in the WaterSIP. The SFWMD also encourages local municipalities to become a WaterSense Promotional Partner and to amend or enact local plumbing ordinances to require WaterSense fixtures in new construction and in retrofit programs. Island Water Association, Inc., of Sanibel Island is a WaterSense utility partner. More information about this program is available from the WaterSense website, http://www.epa.gov/watersense.

Water Use Appliances Retrofits

Newer water fixtures and appliances provide significant water savings compared to older appliances and fixtures. For example, a more efficient washing machine generates a potential estimated savings of 20 gallons of water per use, so a household washing five loads of laundry each week could save more than 5,000 gallons of water per year. **Table 14** shows water consumption for common indoor fixtures and appliances. In addition, **Table 14** includes the WaterSense Program's maximum allowable consumption rate, as well as flow rates for the highest efficiency fixtures and water using appliances currently manufactured. A quantification of water savings is provided in the *Potential Urban Water Savings* section of this chapter.

Table 14. Gallons of water consumed for common indoor water fixtures and appliances.

	Water Consumption					
	Toilets (gallons per flush)	Showerheads (gallons per minute)	Faucets (gallons per minute)	Urinals (gallons per flush)	Dishwashers (gallons per load)	Clothes Washers (gallons per load)
Pre-1984	5.0–7.0	5.0–8.0	4.0–7.0	5.0	14.0	56.0
1984–1994	3.5–4.5	2.8-4.0	2.8–3.0	1.5–4.5	10.5–12.0	39.0–51.0
Post-1994	1.6	2.5[a]	2.5[a]	1.0	10.5	27.0[b]
WaterSense Max	1.3	2.0	1.5	0.5	--	--
Highest Efficiency	0.8–1.0	1.2–1.5	0.5–1.0	0.0–0.1[c]	4.5–6.5	16.0–22.0

a. At 80 pounds per square inch or 2.2 gallons per minute at 60 per square inch.

b. Post-1998.

c. Waterless urinals are only recommended under specific conditions.

The SFWMD recommends several online resources for consumers, building managers, utilities, and municipalities for research and comparison of indoor retrofit program water using devices:

- ENERGY STAR® Program (http://www.energystar.gov)
- Consortium for Energy Efficiency (http://www.cee1.org)
- Food Service Technology Center (http://www.fishnick.com)
- USEPA WaterSense Program (http://www.epa.gov/WaterSense/)
- Alliance for Water Efficiency (http://www.allianceforwaterefficiency.org)
- California Urban Water Conservation Council (http://www.cuwcc.org)

Indoor/Outdoor Use

Florida Water Star℠

Florida Water Star℠ is a points-based recognition program that promotes water efficient household appliances, plumbing fixtures, irrigation systems, and landscapes. The program is a voluntary water conservation initiative begun by the St. Johns River Water Management District and is now in place in three of Florida's water management districts, including the SFWMD. Residences, business, and communities can earn water conservation certification through meeting efficiency standards during new construction or retrofit projects.

The Florida Water Star℠ Program offers three forms of certification:

- Residential certification of new or existing residences in two tiers: Silver or Gold
- Certification of new or existing commercial/institutional buildings (offices, retail, and service establishments, and institutional and non-industrial commercial buildings)
- Community certification of a master-planned community

A single family home built to meet Florida Water Star℠ Silver criteria uses at least 40 percent less water outdoors and at least 25 percent less water indoors than a home built to current Florida building standards. Similarly, a single family home built to Florida Water Star℠ Gold criteria uses at least 50 percent less water outdoors and at least 35 percent less water indoors than a home built to current Florida building standards.

Local governments that adopt Florida Water Star℠ Silver criteria as their water conservation standard for new residential properties can expect new residential homes in their jurisdictions to use as much as 35 percent less water than their current residential stock of single family homes with permanent inground irrigation systems. Savings of up to 45 percent may be reasonably anticipated for such homes built to Florida Water Star℠ Gold criteria.

Tables 15 and **16** show PWS demand data for the LWC Planning Area (see also **Chapter 2**). These tables include available USGS data (Marella 2008), which were used to calculate the percentage of total PWS attributable to residential PWS. Housing data from *The State of Florida's Housing, 2009* (White and Stroh 2010) was also used to calculate the percentage of water use attributable to single family housing. Housing projections are based on 2010 data, assuming that the number of persons per household and the number of single family homes as a percentage of total housing units remain constant through 2030. For the purposes of this analysis, it was also assumed that all new single family homes have permanent inground irrigation systems. The tables show the estimated demand reduction potentially achieved with implementation of Florida Water Star℠ of Silver and Gold certifications for new single family homes in Collier and Lee counties. More information about the Florida Water Star℠ Program is included in Chapter 5 of the Support Document.

Table 15. Potential water demand reduction in Lee County based on implementation of Florida Water Star[SM].

Lee County	2010	2015	2020	2025	2030	Cumulative Single Family Change in Water Demand 2010–2030
Permanent residents[a]	606,950	671,921	753,272	850,561	957,100	
Single family housing projections (units)[b]	193,357	214,055	239,971	270,965	304,905	
Incremental housing increase[c]		20,698	25,916	30,994	33,940	
Water Consumption Estimates (Potential Water Savings) (MGD)						
Single family water demand without Florida Water Star[SM]	23.62	24.86	26.37	28.07	30.03	
Net daily five-year change in single family water demand without Florida Water Star[SM]		1.24	1.51	1.70	1.96	**6.41**
Single family housing water demand assuming new stocks are built to Florida Water Star[SM] Silver criteria **35% demand reduction**		24.43	25.84	27.48	29.34	
Net daily five-year change in single family water demand assuming new stocks are built to Florida Water Star[SM] Silver criteria **35% demand reduction**		0.81	0.98	1.11	1.27	**4.17**
Single family housing water demand assuming new stocks are built to Florida Water Star[SM] Gold criteria **45% demand reduction**		24.30	25.69	27.31	29.15	
Net daily five-year change in single family water demand assuming new stocks are built to Florida Water Star[SM] Gold criteria **45% demand reduction**		0.68	0.83	0.94	1.08	**3.53**

a. Permanent resident population from **Appendix A.**

b. Single family housing projections (units) are from *The State of Florida's Housing, 2009* (White and Stroh 2010).

c. Percent of water attributed to single family units is from *Water Use in Florida, 2005 and Trends 1950–2005* (Marella 2008).

Table 16. Potential water demand reduction in Collier County based on implementation of Florida Water Star[SM].

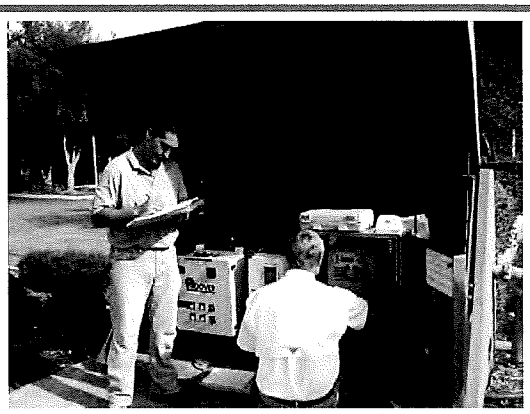
Collier County	2010	2015	2020	2025	2030	Cumulative Single Family Change in Water Demand 2010–2030
Permanent residents[a]	341,565	366,442	396,202	430,761	471,999	
Single family housing projections (units)[b]	76,447	82,015	88,676	96,410	105,640	
Incremental housing increase[c]		5,568	6,661	7,735	9,230	
Water Consumption Estimates (Potential Water Savings) (MGD)						
Single family water demand without Florida Water Star[SM]	20.89	23.35	26.43	30.05	34.35	
Net daily five-year change in single family water demand without Florida Water Star[SM]		2.46	3.08	3.62	4.30	**13.46**
Single family housing water demand assuming new stocks are built to Florida Water Star[SM] Silver criteria **35% demand reduction**		22.49	25.35	28.78	32.85	
Net daily five-year change in single family water demand assuming new stocks are built to Florida Water Star[SM] Silver criteria **35% demand reduction**		1.60	2.00	2.35	2.80	**8.75**
Single family housing water demand assuming new stocks are built to Florida Water Star[SM] Gold criteria **45% demand reduction**		22.24	25.04	28.42	32.42	
Net daily five-year change in single family water demand assuming new stocks are built to Florida Water Star[SM] Gold criteria **45% demand reduction**		1.35	1.69	1.99	2.37	**7.40**

a. Permanent resident population is from **Appendix A.**

b. Single family housing projections (units) are from *The State of Florida's Housing, 2009* (White and Stroh 2010).

c. Percent of water attributed to single family units is from *Water Use in Florida, 2005 and Trends 1950–2005* (Marella 2008).

Outdoor Use/Landscape Irrigation



Water Conservation Audit – Irrigation Controller

Nationally, 58 percent of average annual water use is for outdoor purposes (Mayer et al. 1999), and 80–90 percent of outdoor water use is for landscape irrigation (USEPA 2011). Up to 50 percent of the water applied to urban landscapes is lost to wind, evaporation, and improper irrigation system design, installation, or maintenance with no direct benefit to the landscape (USEPA 2011). As one of the largest water uses in the LWC Planning Area, landscape irrigation has many water conservation opportunities. Outdoor water conservation has a dual objective: reduce the amount of water used and accommodate attractive and healthy landscaping. Demand reduction is possible through the use of efficient landscape irrigation measures, which include Florida-Friendly Landscaping™ principles, rain sensors, advanced irrigation technology, and proper irrigation system design and scheduling, and maintenance of automatic irrigation systems.

Mandatory Year-Round Landscape Irrigation Conservation Measures

The LWC Planning Area has been under three-day-per-week year-round landscape irrigation restrictions since 2003. In 2005, Lee County adopted two-day-per-week irrigation limits within its jurisdictional boundaries (**Table 17**). The City of Cape Coral also adopted a two-day-per-week schedule based on numeric street address to reduce the impacts of peak demands on its water delivery system.

Other municipalities in Lee County can irrigate up to three times per week, in accordance with the SFWMD rule. Collier County has adopted a local watering ordinance limiting irrigation to three days per week, only during morning hours.

EXAMPLE

Under a two-day-per-week watering schedule, the 44 largest utilities in the SFWMD saved an estimated 138 MGD over a six-month period in 2007–2008 during an emergency water shortage. As demonstrated in **Table 18**, utilities in Lee and Collier counties saved an average of nearly 28 MGD during periods of two-day-per-week irrigation, an average demand reduction of 24 percent compared with pre-water shortage demand levels, which already reflected three-day-per-week irrigation limits in most areas.

Table 17. Landscape Irrigation Rules within the LWC Planning Area

Entity	Local Year-Round Ordinance	Number of Days Allowed	Ordinance Source
Lee County	yes	2	Local & SFWMD
Collier County	yes	3	Local & SFWMD

On March 15, 2010, the Mandatory Year-Round Landscape Irrigation Conservation Measures Rule went into effect, following considerable input from various water use stakeholders, including utilities and large water users. These measures are codified in Chapter 40E-24, F.A.C.

Broadly, this rule limits irrigation of existing landscapes to two days per week districtwide with no sprinkler irrigation allowed between 10 a.m. and 4 p.m. There is a provision for up to three-day-per-week irrigation in counties wholly located within the jurisdictional boundaries of the SFWMD, including Collier, Glades, Hendry, and Lee counties. The rule provides local governments across the region the flexibility to adopt alternative landscape irrigation ordinances that are at least as stringent as the SFWMD's rule. Counties or cities may limit irrigation to two days per week or adopt alternative irrigation days within their jurisdictional boundaries based on local demand patterns, system limitations, or resource availability. Irrigation using reclaimed water, cisterns, rain barrels, and various low volume methods, such as microirrigation, container watering, and hand watering with a hose equipped with an automatic shutoff nozzle, may be used at any time.

The SFWMD estimates that implementation of the Mandatory Year-Round Landscape Irrigation Conservation Measures Rule may reduce overall potable water demand by up to five percent districtwide. This estimate is based on the *Water Utilities Water Demand Reduction during the 2007–2009 Water Shortage* (SFWMD 2009b) report. Potential water savings for the rule may be calculated as shown in **Table 18**. Demand projections for 2030 are derived from the PWS demand data in **Chapter 2**.

Table 18. Estimates of possible impact of the Mandatory Year-Round Landscape Irrigation Conservation Measures Rule concerning potable water use[a].

Rule Requirement	Collier County (MGD)[a]	Collier County 2030 Estimated (MGD)[b]	Lee County (MGD)[a]	Lee County 2030 Estimated (MGD)[b]
Potable water use	63.00	114.31	54.11	75.76
Possible demand reduction with two-day-per-week irrigation ordinance implementation	15.56 (24.7%)	28.23	12.33 (22.8%)	17.27
Possible water demand with two-day-per-week irrigation ordinance implementation	47.44	86.08	41.78	58.49

a. *Water Utilities Water Demand Reduction during the 2007–2009 Water Shortage Restrictions* (SFWMD 2009b).

b. Assuming irrigation water demand reductions experienced during the 2007–2009 water shortage remain consistent through 2030.

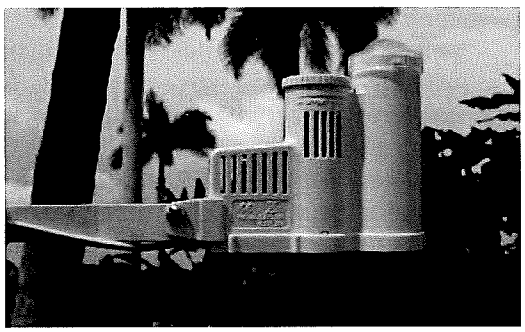
The SFWMD provides a model irrigation ordinance and technical support for local governments seeking to adopt an ordinance consistent with the rule. For additional information, see the Support Document.

Florida-Friendly Landscaping™

In 2009, changes to Section 373.185, F.S., replaced the term "Xeriscape™" with "Florida-Friendly Landscaping™" as the state's landscape design standard. The FDEP and the state's water management districts are complying with the statutory requirements by providing a model Florida-Friendly Landscaping™ ordinance, as well as technical support for local governments electing to adopt Florida-Friendly Landscaping™ ordinances. The FDEP and University of Florida's *Florida-Friendly Landscape Guidance Models for Ordinances, Covenants, and Restrictions* (FDEP and University of Florida 2009) is available from the SFWMD's Conservation website at http://www.savewaterfl.com under Governments/Utilities (see Guidance for Adoption of Florida-Friendly Landscaping™ Ordinances). See also Chapter 5 of the Support Document and the Florida-Friendly Landscaping™ website at http://www.floridayards.org.

As part of the SFWMD's effort to lead other state and local agencies by example, the SFWMD has begun an effort to have all of its owned facilities achieve Florida-Friendly yard certification (Section 373.187, F.S.). Such landscapes follow and maintain Florida-Friendly Landscaping™ principles as outlined by the University of Florida's Institute of Food and Agricultural Sciences (IFAS) Florida-Friendly Landscaping™ Program. These are attractive, low impact landscapes that protect Florida's natural environment and wildlife. As of May 2012, nine SFWMD facilities have been certified by the IFAS under the Florida-Friendly Landscaping™ Program.

Rain Sensors and Advanced Irrigation Technology


Rain Sensor

In 2009, Section 373.62, F.S., was amended, requiring all automatic landscape irrigation systems to be fitted with properly installed automatic shutoff devices, regardless of the systems' installation date. These devices automatically override scheduled irrigation events when sufficient moisture is present in the microclimate. Automatic shut-off devices include rain sensors as well as more efficient advanced irrigation technologies, such as soil moisture sensors, evapotranspiration (ET) sensors, or weather-based shutoff devices. Advanced irrigation technology consists of irrigation system components that regulate the frequency or duration of irrigation events in response to site-specific conditions.

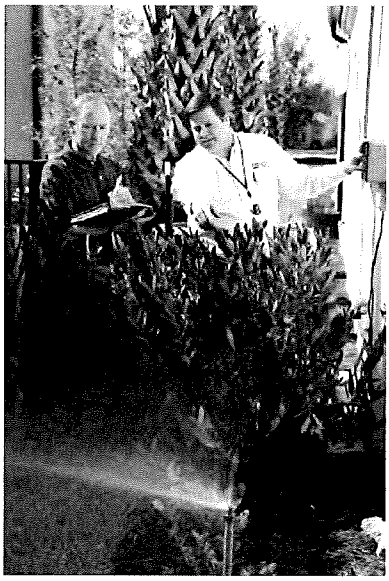
Research in controlled settings confirms the water savings potential of properly installed and maintained automatic irrigation shutoff devices (**Table 19**) (Cardenas-Lailhacar et al. 2010). An IFAS study involving 59 residential homes in Pinellas County demonstrated that soil moisture sensor irrigation systems realized significant water savings compared with automatic inground irrigation systems incorporating rain sensors and timed irrigation controllers (Dukes and Baum-Haley 2009).

Table 19. Reductions in irrigation water use based on device type versus systems governed by timers alone.[a]

Device	Percent Reduction[b]	Weather Conditions
Rain sensor	Up to 34%	Normal to Rainy
Rain sensor	Up to 15%	Dry
Soil moisture sensor	70–90%	Normal to Rainy
Soil moisture sensor	40–65%	Dry
ET-based sensors	60% or more	Normal to Rainy
ET-based sensors	40–50%	Dry

a. Cardenas-Lailhacar et al. 2010
b. Two or three days per week

Section 373.62, F.S., also requires licensed contractors who install or work on automatic irrigation systems to test existing shutoff devices for proper operation before completing other work on the system and to replace any devices or switches that are not in proper working order. As directed in the legislation, water conservation ordinances must require contractors to report any non-compliant property to the proper local authorities. In addition, ordinances must impose minimum penalties for property owners and contractors who fail to comply. Funds generated by penalties imposed under the ordinance are to be used by the local government to further water conservation activities including the administration and enforcement of the ordinance. The law also provides a statewide process for obtaining a variance from the applicable water management district day-of-week watering restrictions for users of advanced irrigation systems meeting the specific requirements outlined in Subsection 373.62(7), F.S.


Irrigation System Check

Urban Mobile Irrigation Labs

The Mobile Irrigation Laboratory (MIL) Program began in south Florida in 1989. The mission of the labs is to educate agricultural and urban water users about irrigation efficiency and to evaluate the performance of irrigation systems for potential water savings. See the *Agricultural Use – Tools, Program, and Potential Savings* section for information on

agricultural MILs. The Lee County Urban MIL was in operation until FY 2008. The 219 audits conducted in FY 2008 on 170 acres by this urban MIL identified potential water savings of 55.30 MGY or 0.15 MGD.

The Big Cypress Basin Urban MIL has been in operation for a decade, and works with homeowner and condominium associations, and interested individual homeowners, to provide evaluations of landscape irrigation efficiency. It is a service provided by the Collier Soil and Water Conservation District under a contract with SFWMD Big Cypress Basin Board. Through this service, participants learn to use water more efficiently including the adjustment of on-site timers. A total of 480 audits were conducted during 2008–2011 on 549 acres of urban landscapes within the Big Cypress Basin, and potential water savings of 211.4 MGY (0.58 MGD) were identified.

Outdoor Use/Recreational Irrigation

Recreational/Landscape (REC) Self-Supply water use includes water to irrigate parks, athletic fields, golf courses, large landscaped areas (e.g., homeowner association common areas, and the areas around malls and office buildings), roadway medians, golf courses, and cemeteries. The demand for water used for this purpose generally increases at a rate similar to population growth. Florida-Friendly Landscaping™ and advanced irrigation technologies help minimize the demand increase.

Golf Course Water Conservation

As of 2010, 165 permitted golf courses were located within the LWC Planning Area. The combined irrigated area of these golf courses is approximately 25,253 acres, with an estimated annual gross irrigation demand of 51.4 MGD. Golf course irrigation accounts for approximately 39 percent of the region's total REC Self-Supply water demand. For a summary listing of permitted golf courses in the LWC Planning Area and respective irrigation water sources, see **Appendix E**.

DISTRICT

Individual permit applicants for landscape and golf course irrigation projects shall develop and implement a conservation program incorporating the following mandatory elements (Sections 2.3.1 and 5.2.3, Basis of Review):

- Use of Florida-Friendly Landscaping™ principles for proposed projects and modifications to existing projects where it is determined that Florida-Friendly Landscaping™ is of significant benefit as a water conservation measure relative to the cost of implementation.
- Installation and use of rain sensor devices, automatic switches or other automatic methods that have the capability to override the operation of the irrigation system when adequate rainfall has occurred is required.

The Comprehensive Water Conservation Program calls for SFWMD staff to confirm the use of appropriate irrigation inhibiting technology, such as properly functioning rain sensors or soil moisture sensors, on existing golf courses. According to program guidelines, golf courses must also continue to employ best management and design practices, as well as adopt new irrigation technologies to improve landscape water use efficiency wherever feasible.

The SFWMD partnered with the Florida Golf Course Superintendents Association to create an inventory of the types of irrigation scheduling technologies currently employed by south Florida golf courses for irrigation of their play areas. Together, the SFWMD and Florida Golf Course Superintendents Association developed an informal short survey tool to gather data from area golf course superintendents. The survey was distributed to approximately 400 south Florida golf course superintendents districtwide in 2010. Responses were received from approximately 25 percent of the survey recipients. Among other findings, the survey results suggest a growing trend toward the use of on-site advanced irrigation technology, and soil moisture sensors to help them make irrigation decisions. Superintendents of newer courses (less than 10 years old) were three times more likely to employ advanced technologies than superintendents of older courses, which mainly use rain sensor-based scheduling.

The information collected will be used to develop programs that encourage water use efficiency in the golf industry and promote the water conservation practices many area golf courses follow. The SFWMD anticipates that increased widespread use of advanced irrigation technology, improved landscape design and management practices, and implementation of recognition programs will further optimize landscape water use efficiency in this sector.

Industrial/Commercial/Institutional Use Self-Supply

All applications for a consumptive use permit for ICI Self-Supply use must demonstrate that the volume requested is reasonable and relates to planned facility operations. The request must contain a water balance for the complete operation that includes the needs of the production process, personal needs of the employees and customers, and any treatment losses.

ICI Self-Supply water use category permit applicants must submit a water conservation plan at the time of permit application. The water conservation plan shall be prepared, implemented, and at a minimum, incorporate the following mandatory components (Section 2.4.1, Basis of Review):

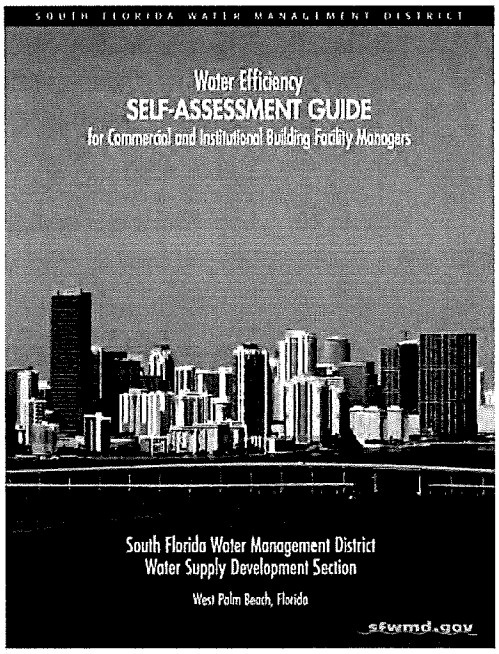
- A water audit for current operational processes
- Within the first year of permit issuance or audit completion, if found to be cost-effective, the following shall be implemented:
  - A leak detection and repair program
  - Recovery/recycling or other program providing for technological, procedural, or programmatic improvements to the facilities
  - Use of processes to decrease water consumption
- Develop and implement an employee awareness and consumer education program concerning water conservation
- Procedures and time frames for implementation

EXAMPLE

South Florida Water Management District

In 2009, the SFWMD conducted indoor and outdoor water use assessments of its 12 facilities. The results of the assessments indicated the SFWMD facilities are generally well maintained, but also revealed specific opportunities for improvements at each facility. If all recommended improvements at the facilities are implemented, the SFWMD could save as much as 3.5 million gallons of water and $8,700 annually for a total investment of $63,000. The prescribed recommendations are expected to be implemented as regular maintenance over the next several years based on individual facility budgets.

In August 2011, the SFWMD released the *Water Efficiency Self-Assessment Guide for Commercial and Institutional Facility Managers* (SFWMD 2011b). This guide was developed to walk facility managers through self-conducted water use assessment procedures, in a detailed step-by-step manner, for the most common points of water use at commercial or institutional facilities. The guide comprehensively covers both indoor and outdoor water use and is accompanied by a series of water use and savings calculators to help facility managers quantify potential water savings and investment recovery periods. By using this information-rich guidebook, the user will immediately become familiar with the general concepts of water use efficiency and conservation. The guide recently received the Florida Section of American Water Works Association's 2011 Water Conservation Award for Excellence, Best in Class.



Water Efficiency Self-Assessment Guide for Commercial and Institutional Facility Managers

Utilities are encouraged to incorporate this guide into their outreach efforts toward commercial and institutional water users. The manual and the companion water use and savings calculators are available free for download from the SFWMD's conservation webpage (http://www.savewaterfl.com) under "Businesses".

Water Conservation Hotel and Motel Program

The Water CHAMP recognizes lodging facilities that have taken steps to increase water use efficiency. Specifically, participating properties conduct voluntary linen and towel reuse programs and install high efficiency (1 gallon per minute) faucet aerators in guest bathrooms. Participation in the Water CHAMP supports the water conservation criteria needed to join the Florida Green Lodging Program, pending approval by the FDEP. **Table 20** summarizes the Water CHAMP water conservation potential for the LWC Planning Area.

WATER CHAMP

The Water CHAMP was originally launched by the Southwest Florida Water Management District in 2002. In 2010, the SFWMD introduced the Water CHAMP in the Florida Keys. All materials to begin the program — the high efficiency faucet aerators, staff training materials, linen reuse pillow cards, towel reuse door hangers, and promotional materials for guests — were supplied to the property owners by the SFWMD at no cost. Hotels may save up to 20 gallons of water per occupied room per night. Actual water savings by program participants in the Florida Keys was still being assessed at the time this plan update was written.

Table 20. Potential water savings of the Water CHAMP in Lee and Collier counties.[a]

County	Number of Hotel and Motel Units	Number of Rooms in Florida Green Lodging Programs	Potential Water CHAMP Rooms	Potential Water Savings (MGY)[b]
Lee County	9,205	4,245	4,960	21.7
Collier County	16,136	4,491	11,645	51.0
LWC Planning Area Total	25,341	8,736	16,605	72.7

a. Source: Florida Department of Business and Professional Regulation (http://www.myfloridalicense.com/dbpr). Accounts for hotels, motels, resorts, and bed and breakfast properties.

b. Potential savings over non-conserving lodging facilities built to current plumbing standards.

In the LWC Planning Area, there are 16,605 potential Water CHAMP rooms after deducting the number of rooms in hotels and motels in the Florida Green Lodging Program. If all hotels in the LWC Planning Area not currently in the Florida Green Lodging Program become SFWMD Water CHAMP lodging facilities, approximately 72.7 MGY of potential water could be saved (assuming an annual occupancy rate of only 60 percent). Projecting potential savings of hotels and motels to be built may not be possible, as improved efficiency standards of future plumbing codes for new construction cannot be made with certainty. These standards affect the savings rates of individual rooms. In addition, the expansion of the Florida Green Lodging Program may also affect projected savings.

Power Generation

Power generation requires large amounts of water for steam generation and cooling purposes. FPL has the only power generation facility in the LWC Planning Area (Fort Myers Energy Center). Nearly 78 percent of the water used at FPL's generating sites comes from non-potable water sources, such as oceans or estuaries. FPL also employs water reuse technologies such as cooling ponds and canals and cooling towers. These closed-loop technologies reduce their impacts to the aquatic environment by reducing the amount of water withdrawn. FPL's parent company, NextEra Energy, has reduced its fleetwide water withdrawal rate at power generating sites by more than 28 percent and reduced total water withdrawals by nearly 22 percent since 2007.

Efficient water use comes from utilizing the best available technologies at power plant facilities, which is why, during the preconstruction planning process, FPL identifies the best available generating technologies in order to minimize impacts to air, land, and water. In addition to preconstruction design efforts, FPL develops site-specific plans and processes to ensure that once these projects are brought online, they are operated in a responsible and sustainable manner. FPL also works with the regional water management districts and other state and federal agencies to ensure that their water management plans and practices meet or exceed all statutory requirements.

FPL recently began several modernization projects at existing sites using the newest natural gas combined-cycle technology including its Fort Myers facility. Modernizing older, less efficient power plants will result in an increase in power generating capacity; however, the design of these modernized facilities will ensure that total water withdrawal will either remain the same or decrease in the coming years and water withdrawal rates will decrease since these plants are more efficient.

Other Urban Water Conservation Programs

The SFWMD's Comprehensive Water Conservation Program consists of numerous efforts to promote water conservation by a variety of means. In addition to programs already described, the following programs are applied across user groups for either indoor or outdoor use.

Water Savings Incentive Program

The WaterSIP is the SFWMD's flagship funding assistance program. Through the WaterSIP program, the SFWMD provides 50-50 cost-share funding for implementation of water savings projects that reduce urban water use. The SFWMD provides matching funds up to $50,000 to water providers and users (i.e., cities, utilities, industrial groups, schools, hospitals, and homeowners associations) for water saving technologies. These technologies include low flow plumbing fixtures, rain sensors, fire hydrant flushing devices, and other hardware.

Local governments, businesses, and non-profit organizations may apply for WaterSIP funding annually during an open application period. Applications are reviewed and ranked based on established criteria that account for each project's water savings potential, cost efficiency, technological innovation, and other characteristics. **Appendix E** provides WaterSIP projects funded through 2012.

Since its inception in 2003, the WaterSIP has supported 151 local water conservation projects, representing a total estimated water savings of approximately 2.6 billion gallons of water per year, at a $4.37 million cost to the SFWMD. In FY 2012, the SFWMD supported nine local projects at a total cost of $250,000. These projects represented more than 43.9 MGY in potential water savings.

In the LWC Planning Area, the SFWMD allocated $627,456 for 23 projects funded from FY 2007 to FY 2012. These projects have an estimated potential savings of 178 MGY. **Appendix E** provides an overview of the specific projects funded in the LWC Planning Area through the WaterSIP to date including approved funding amounts and water savings estimates for each.

Education, Outreach, and Marketing

Education, outreach, and marketing are essential to accomplish a measurable change in water conservation and instill a lasting conservation ethic in south Florida businesses and communities. The SFWMD has supported the following programs, which are designed to build a water conservation culture, instill a stewardship ethic, and permanently reduce individual and commercial water use:

- Water Conservation Public Service Announcements
- WaterSense
- The Great Water Odyssey
- SFWMD Xtreme Yard Makeover
- SFWMD Water Conservation Website
- Big Cypress Basin Conservation Outreach
- Florida Atlantic University's Center for Environmental Studies
- Teacher Training
- Loxahatchee Impoundment Landscape Assessment
- Florida Gulf Coast University's Wings of Hope
- Student Field Study Programs and Service Learning at DuPuis Management Area
- Everglades: An American Treasure

More information about each of these programs is provided in the Support Document.

Potential Urban Water Savings

The SFWMD advocates the adoption of local building ordinances that incorporate the WaterSense and ENERGY STAR fixture and appliance standards and/or follow the Florida Water Star℠ or Leadership in Energy and Environmental Design building criteria. For example, the Toho Water Authority requires all new single family homes be built to Florida Water Star℠ standards. In turn, the Toho Water Authority offers a free Florida Water Star℠ inspection and developers receive a 20 percent rebate on the utility connection fee following the execution of a developer service agreement.

Water savings resulting from residential indoor retrofits were estimated for Lee, Collier, Hendry, Charlotte, and Glades counties using county parcel and population data, and a methodology similar to that used by Conserve Florida Water Clearinghouse's *EZ Guide* (2009). These estimates include, but do not isolate, potential savings derived from DSS water users.

Table 21 shows the number of residential dwelling units in Lee, Collier, Hendry, Charlotte, and Glades counties in the single and multiple family water use sectors, further divided by plumbing code era. Estimates of total potential water savings for each subsector are also provided. This planning-level information can help planners and water conservation professionals identify areas with the greatest savings potential from retrofit and water conservation initiatives, and quantify potential savings at the local level.

These data assume all homes have replaced all older fixtures and appliances with newer efficient ones and reflect the full theoretical potential savings available in each county. Current water use and savings for residences in each year built/plumbing code era were calculated using standard use frequency rates for each appliance and plumbing fixture (Vickers 2001) and average persons per household figures for each county (BEBR 2010). The number of residential units in each plumbing code era and water use sector was obtained from the Florida Department of Revenue's parcel data sets. Natural replacement rates of fixtures and appliances were taken into account (Maddaus Water Management 2009, NAHB and Bank of America Home Equity 2007). Savings figures do not account for replacements of fixtures or appliances that may have occurred as a result of past local conservation programs and do not reflect theoretical program or market saturation rates. Therefore, these data are meant to aid program planning and design, but not to serve as numerical objectives.

Savings resulting from water conservation efforts targeting outdoor water use are more difficult to estimate. By using Florida-Friendly Landscaping™ principles and improving irrigation efficiency through the use of advanced irrigation technology, such as rain and soil moisture sensors, an estimated water savings of 35 percent can be realized (Cardenas-Lailhacar et al. 2010, McCready et al. 2009, Pottorff et al. 2010). A typical quarter-acre lot equipped with a five-zone irrigation system irrigating for 30 minutes per zone uses approximately 2,250 gallons per irrigation event. A savings of 35 percent would amount to approximately 82,000 or 123,000 gallons of water per year for each property irrigating two or three times per week, respectively.

Table 21. Residential units in Lee County and potential savings of indoor water use through water conservation.

Year Built/ Plumbing Code Era	Number of Single Family Residential Units	Single Family Water Savings at High Efficiency Level[a] (MGY)	Number of Multiple Family Residential Units	Multiple Family Water Savings at High Efficiency Level[a] (MGY)
Lee County				
Pre-1984	70,450	1,973.0	13,198	369.6
1984–1994	46,657	915.5	9,180	180.1
Post-1994	102,541	959.3	19,601	183.4
Collier County				
Pre-1984	24,292	710.03	6,155	179.9
1984–1994	18,566	380.2	3,073	62.9
Post-1994	39,697	387.6	3,311	32.3
Hendry County				
Pre-1984	3,780	139.6	--	--
1984–1994	2,671	69.1	--	--
Post-1994	2,360	29.12	--	--
Charlotte County				
Pre-1984	71	1.9	13	0.3
1984–1994	68	1.3	26	0.5
Post-1994	76	0.7	17	0.2
Glades County				
Pre-1984	844	25.5.	140	4.2
1984–1994	525	11.1	53	1.1
Post-1994	741	7.5	26	0.3

a. High efficiency water use rates are as follows: toilets 1.28 gallons per flush, showerheads 2 gallons per minute, faucets 1 gallon per minute, dishwashers 4.5 gallons per load, and clothes washers 16 gallons per load.

An exact quantification of countywide outdoor water use and savings cannot be made directly through parcel data alone; however, if the number of residential units falling within the as-built plumbing code era is known, planners in the LWC Planning Area can estimate the water conservation potential of outdoor water use. Planners who are familiar with the area should be able to estimate the typical lot size and the prevalence of automatic irrigation systems for each of the plumbing code eras.

Water consumption within the ICI Self-Supply water use category has been correlated to square footage of building space under climate control (heating ventilation and conditioning, referred to as heated area) (Morales et al. 2009). Efficiency improvements in this water use category have been shown to produce water savings from 15 to 50 percent, with 15 to 35 percent being typical (Dziegielewski et al. 2000). Industrial operations may

see similar savings. Using Florida Department of Revenue parcel data, which include square footage of heated area, and water use per square foot of heated area coefficients, estimates of water use and potential savings (in MGY) for the ICI Self-Supply water use category are provided for Lee, Collier, Charlotte, and Glades counties in **Table 22**.

Table 22. Estimated water use and potential savings through improved water use efficiency within the ICI Self-Supply water use category.

Water Use Sector	Square Footage (in millions)	Current Estimated Water Use[a] (MGY)	Potential Water Use Reduction Range[b] (MGY)
Lee County			
Industrial	30.4	477.3	71.6–167.0
Commercial	63.3	3,058.8	458.8–1,070.5
Institutional	36.2	1,187.5	178.1–415.6
Collier County			
Industrial	9.9	155.7	23.4–54.5
Commercial	74.7	3,610.4	541.6–1,236.6
Institutional	23.6	772.2	115.8–270.3
Charlotte County			
Industrial	0.021	0.30	0.050–0.100
Commercial	0.003	0.20	0.020–0.050
Institutional	0.004	0.01	0.002–0.004
Glades County			
Industrial	0.15	2.4	0.4–0.9
Commercial	0.34	16.6	2.5–5.8
Institutional	0.30	9.3	1.4–3.2

a. Aggregate coefficients for converting square footage to water use are 1.31 gallons per square foot per month for industrial, 4.03 gallons per square foot per month for commercial, and 2.73 gallons per square foot per month for institutional.

b. 15–35 percent potential reductions of current estimated water use.

The residential and non-residential water use and potential savings in the LWC Planning Area are highest in Lee and Collier counties (**Table 22**). These counties represent an estimated potential savings of 5,289 MGY and 2,434 MGY, respectively, using the 15 percent estimates for the non-residential sectors. The combined estimated potential savings for Charlotte, Glades, and Hendry counties totals 297 MGY.

Appendix E includes a comparison of water conservation measures and alternative water supply development.

Maximizing Water Savings

Table 23 summarizes potential water use savings in the LWC Planning Area based on the following assumptions:

- High efficiency fixtures are implemented by both single and multiple family residential units.
- Measures to realize a 15–35 percent reduction in water use are implemented by all ICI Self-Supply equivalent square footage.

Table 23. Summary of potential savings of the ICI Self-Supply water use category and residential indoor water use through water conservation.

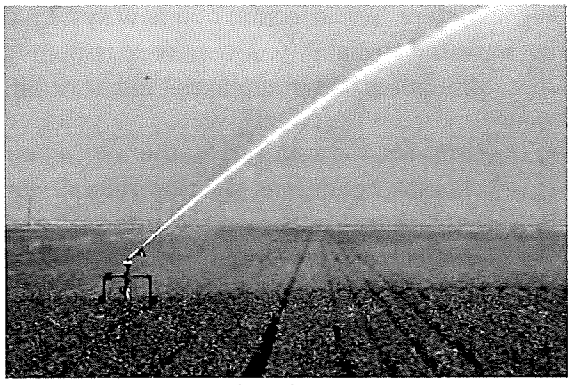
Indoor Water Use	Savings in MGY									
	Lee County		Collier County		Charlotte County		Glades County		Hendry County[a]	
Single Family Residential										
Pre-1984	1,973.0		710.0		1.9		25.5		139.6	
1984–1994	915.5		380.2		1.3		11.1		69.1	
Post-1994	959.3		387.6		0.7		7.5		29.1	
Multiple Family Residential										
Pre-1984	369.6		179.9		0.3		4.2		NA[b]	
1984–1994	180.1		62.9		0.5		1.1		NA	
Post-1994	183.1		32.3		0.2		0.3		NA	
Total Residential Savings	4,580.6		1,752.9		4.9		49.7		237.8	
Indoor Water Use	**Efficiency Increase in MGY**									
	15%	**35%**	**15%**	**35%**	**15%**	**35%**	**15%**	**35%**	**15%**	**35%**
Industrial	71.60	167.00	23.40	54.50	0.050	0.100	0.40	0.90	NA[b]	NA
Commercial	458.80	1,070.50	541.60	1,236.60	0.020	0.050	2.50	5.80	NA	NA
Institutional	178.10	415.60	115.80	270.30	0.002	0.004	1.40	3.20	NA	NA
Total ICI Savings	708.50	1,653.10	680.80	1,561.40	0.072	0.154	4.30	9.90	0.00	0.00
Total Savings	5,289.10	6,233.70	2,433.70	3,314.30	4.972	5.054	54.00	59.60	237.80	237.80

a. For the purposes of this table, Hendry County has negligible multiple family ICI Self-Supply uses.

b. NA - not applicable

The estimated water use reductions in **Table 23** assume 100 percent participation in conservation activities for the ICI Self-Supply water use category and residential indoor water use. These numbers are meant to illustrate maximum potential water savings based on a particular set of assumptions and are not intended to serve as a realistic objective.

Agricultural Use – Tools, Programs, and Potential Savings



Agricultural Irrigation

Agriculture remains the largest water user in the LWC Planning Area. As such, the AGR Self-Supply water use category offers significant water conservation potential. In the consumptive use permitting process, water allocations for agriculture are based on a number of factors, including the crop type, growing and irrigation methods, and site-specific parameters such as soil type and anticipated rain. Because a number of these factors are fixed, demand reduction must be based on aspects that can be changed, such as irrigation and growing methods. Generally, these types of changes are expensive and require careful planning and consideration.

Citrus growers continue to increase their irrigation efficiency. Approximately 98 percent of the citrus acreage in the LWC Planning Area is irrigated using low volume systems, and the remaining two percent uses flood irrigation or traditional spray irrigation (sprinklers).

For certain crops, such as citrus and container nursery, the SFWMD requires new consumptive use permit applicants to use low volume irrigation or other systems of equivalent efficiency whose irrigation systems are not constructed (Section 2.3.3.3.1, Basis of Review). Flood/seepage irrigation type systems are typically used for tomato, corn, rice, and sugarcane production. While these types of irrigation are not as efficient as microirrigation, flood irrigation does provide some recharge to the SAS.

Agricultural Best Management Practices

Agricultural BMPs are actions agricultural businesses can take to protect or improve water quality or quantity while maintaining or even enhancing agricultural production. The Florida Department of Agriculture and Consumer Services (FDACS) and the FDEP develop and adopt BMPs by rule for different types of agricultural operations.

Most BMPs in the region are established to improve water quality; however, some contain an implicit water conservation component. Tailwater recovery and irrigation efficiency are BMPs identified as having implicit water conservation benefits. Tailwater recovery is a planned system to conserve irrigation water supplies through the capture and recycling of water that runs off the field while also improving off-site water quality. This system normally includes a combination of practices and equipment that collects, conveys, stores, and recycles irrigation runoff water for reuse. Common components include pickup ditches, sumps, pits, pumps, and pipelines. Data were not available for the tailwater recovery BMP program for inclusion in this plan update.

Irrigation efficiency is defined as the proportion of the water that is beneficially used to meet the crop's water demands. Irrigation efficiency can be improved by either replacing an irrigation system or by optimizing the operations and maintenance of an existing irrigation system. The selection of a new system depends on the type of crop, soil, water source, and water availability. A review of irrigation scheduling — time between irrigation events and amount of water applied — might result in an increase of irrigation efficiency.

Growers and ranchers in the LWC Planning Area commonly rely on visual inspections and climatic conditions such as rainfall gauges, ET, and weather forecasts to schedule their irrigation. Many farmers use soil moisture sensors to understand soil conditions for particular fields and crops. Soil moisture sensors can be valuable tools for agricultural irrigation scheduling.

Agricultural Mobile Irrigation Labs

Agricultural MILs evaluate the performance of irrigation systems and encourage the adoption of efficient irrigation management practices that conserve water. The LWC Agricultural MIL is managed and administered by the Collier County Soil Water Conservation Service. Funds are traditionally provided by the FDACS and the SFWMD. More information about the Agricultural MIL Program is provided in the Support Document.

Real-time Weather Data – Florida Automated Weather Network

The Florida Automated Weather Network (FAWN) provides weather information from a number of locations throughout the state at 15-minute intervals and is operated by the University of Florida's IFAS. The FAWN management tools provide decision support functions to growers, using historical weather data and crop modeling technology to help in short- and long-term planning, thereby maximizing the efficiency of their irrigation practices.

In the LWC Planning Area, the IFAS maintains weather stations in Immokalee, Palmdale, and Clewiston. When funds are available, the SFWMD plans to assist in expanding the scope of this network within the LWC Planning Area. Access to the network is available from http://fawn.ifas.ufl.edu/data/.

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP), implemented through the United States Department of Agriculture – Natural Resources Conservation Service, was reauthorized in the Farm Security and Rural Investment Act of 2002 to provide a voluntary conservation program for farmers and ranchers. The program promotes agricultural production and environmental quality as compatible national goals. Financial and technical assistance is offered for eligible participants to install or implement structural and management practices that address impaired water quality and conservation of water resources on eligible agricultural land. For example, reduction of soil erosion and sedimentation can have a positive impact on water quality and improve irrigation

efficiency. During FY 2009 and FY 2010, in the LWC Planning Area, 28 farms, covering 34,348 acres, and 37 farms, encompassing 46,181 acres, participated in the program, respectively.

Potential Agricultural Water Savings

Agricultural crops in the LWC Planning Area include citrus, sugarcane, vegetables, nursery, and sod. Ninety-eight percent of citrus acreage is irrigated by low volume systems, and the remainder is irrigated using flood irrigation or spray irrigation (sprinklers). Sugarcane is irrigated exclusively with flood/seepage systems. Most vegetables grown in the region use seepage irrigation while some use low volume systems. Some crops are grown with a combination of flood and low volume systems. Details about crop irrigation are provided in **Appendix A**.

Sugarcane Crop

Alternative Water Supply Projects

Although water conservation helps to reduce or defer development of new water production capacity, in most cases, new water supplies will also be needed to accommodate the region's growth in the future. Through Florida's Water Protection and Sustainability Program, funds provided by the state are matched dollar for dollar with SFWMD funds for Alternative Water Supply Funding Program projects. Up to 40 percent of a project's construction cost can be funded through this program to qualified applicants seeking cost-sharing assistance.

For the 2007–2012 period, the SFWMD, in cooperation with the State of Florida, provided more than $123 million in alternative water supply funding for 212 projects, with 78 projects occurring in the LWC Planning Area.

Between FY 2007 and FY 2012, water supply development projects funded by the Alternative Water Supply Funding Program in the LWC Planning Area have created a total of 104 MGD of new water capacity. The new sources of this water include 37 MGD of brackish water, 33 MGD of reclaimed water, 16 MGD of Hawthorn Aquifer water, 3 MGD of ASR water, and 15 MGD of surface water/stormwater and other projects. For more information on local governments proposed water supply development projects for this plan update, see **Chapter 6**.

Water Conservation Summary

Cooperative water conservation efforts among water users, utilities, local governments, and the SFWMD are also necessary to accomplish water savings. The SFWMD will continue to track the progress of utilities and municipalities developing sources to meet future demands, but funding is not anticipated to return to pre-FY 2009 levels for some time. For this reason, demand reduction is important and necessary. The SFWMD intends to effect long-term reductions in water consumption across all water use categories by promoting and implementing many of the water conservation measures and the Comprehensive Water Conservation Program initiatives presented in this chapter.

Appendix E of this update includes the status of water conservation implementation, water conservation rate structures, water conservation versus development of additional water supplies, goal-based water conservation plans and associated water sources/irrigated acreage, and the WaterSIP projects.

5

Water Resource Development Projects

The role of the South Florida Water Management District (SFWMD) in water supply is primarily planning and water resource development (Section 373.705, Florida Statues [F.S.]). This chapter addresses the functions of the SFWMD and other parties in water resource development projects and provides a summary of projects in the Lower West Coast (LWC) Planning Area. This document uses the Fiscal Year (FY) 2012 budget as a base and includes the schedules and costs of water resource development projects by category for FY 2012 to FY 2016.

TOPICS

- Regional Projects
- Districtwide Projects
- Summary

Florida water law identifies two types of projects to meet water needs: water resource development projects and water supply development projects. Water resource development projects are generally the responsibility of water management districts. These projects support water resource development and are intended to ensure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial, including maintaining the functions of natural systems. Water supply development projects are generally the responsibility of local users, such as utilities, and involve the water source options described in **Chapter 4** to provide water to users. Water supply development projects are discussed in **Chapter 6.**

LAW / CODE

Water resource development is defined in Subsection 373.019(22), F.S., as "the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and non-structural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation, and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and groundwater recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities."

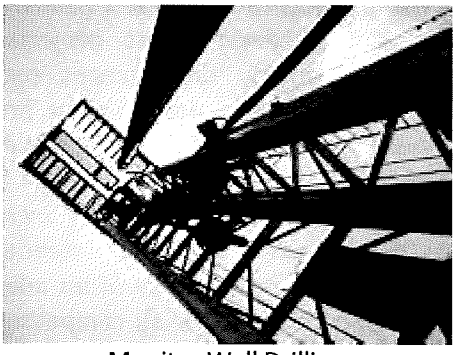
Although water resource development projects serve an important supporting role for water supply development projects, by themselves these projects often do not yield specific

quantities of water. For example, hydrogeologic investigations, groundwater monitoring, and numerical modeling provide important information about aquifer characteristics, such as hydraulic properties and water quality, but do not generate water. These efforts help quantify water resources that may be available and are useful in developing appropriate facility design, estimating sustainable yield, and evaluating the economic viability of water supply development projects. Water resource development projects include well drilling and aquifer testing, groundwater and evapotranspiration (ET) assessments, groundwater and wetland monitoring, districtwide feasibility studies, numerical modeling, water conservation, Minimum Flows and Level (MFL) criteria, and Water Reservations. Water conservation encourages the efficient use of water so that what has been saved can be used to meet potential future demands. In effect, water conservation may expand current water supplies.

The water resource efforts in the LWC Planning Area presented in this chapter reflect the current budget categories the SFWMD uses for funding both new and ongoing water resource development projects. Information about the status of these projects and implementing entities is also included. Annual updates on the status of water resource development projects are provided in Chapter 5A: Five-Year Water Resource Development Work Program (Hoppes 2009, Martin 2010, 2011, 2012) of the annual South Florida Environmental Reports – Volume II available at http://www.sfwmd.gov/sfer.

REGIONAL WATER RESOURCE DEVELOPMENT PROJECTS

The SFWMD funds water resource development projects such as hydrogeologic studies that provide greater understanding of the aquifers and the potential for additional water for permit holders in the planning area. The SFWMD also uses numerical models to evaluate groundwater and surface water resources. Some projects are co-funded with local, state, and federal agencies.


Monitor Well Drilling

Hydrogeologic Investigation of the Top of the Sandstone Aquifer

In 2010, due to declining water levels and reported well problems in the Lehigh Acres area of Lee County and insufficient geologic information in that vicinity, a drilling project was completed by the SFWMD to establish elevations of the top of the Sandstone aquifer in the intermediate aquifer system (IAS) at two existing monitoring sites. Drilling, coring, and geophysical logging were performed to determine aquifer elevations for the maximum developable limits (MDLs) at these two locations. During 2011, documentation of the drilling and coring at the two Sandstone aquifer wells adjacent to monitoring wells L-2186

and L-729 were completed to better develop lithologic descriptions of the aquifer, which will be used in defining the top of the aquifer. These efforts and the results for other drilling in the area demonstrate that the hydrogeology is variable and data from a site cannot be used to establish the elevation of the aquifer at a different location. As the top-of-aquifer elevations are used in determining the Sandstone aquifer's associated MDLs, the study needs to be expanded to account for variability and provide a more comprehensive understanding of the aquifer.

Numerical Models

Computer models developed by the SFWMD support development of water supply plans, MFLs, Water Reservations, and projects in the SFWMD's four regional planning areas. Collier and Lee counties and the City of Cape Coral have developed numerical groundwater flow models to address their particular needs. Modeling tools developed by MWH Global, Inc. (2008a) for Cape Coral and by RMA GeoLogic Consultants, Inc. (2007) for Lee County may be incorporated into or adapted to future SFWMD modeling efforts. Information about other SFWMD modeling efforts can be found in the regional water supply plan update for each planning area or on the SFWMD's website at http://www.sfwmd.gov (click "Scientists and Engineers" and then click "Modeling."). The modeling effort the SFWMD is currently performing in the LWC Planning Area is discussed next.

Lower West Coast Floridan Aquifer System Model

The Lower West Coast Floridan Aquifer System Model (LWCFAS) Model is a groundwater simulation model that uses the United States Geological Survey (USGS) SEAWAT-2005 code to numerically represent the hydrology of the region, nearshore portions of the Gulf of Mexico, and Florida Bay. The LWCFAS Model focuses primarily on the various production zones comprising the Floridan aquifer system (FAS) within the study area in Charlotte, Glades, Lee, Hendry, and Collier counties, as well as the Mid-Hawthorn aquifer of the IAS. The main advantage of this model is its ability to include the effects of fluid density in calculating hydraulic head, groundwater flow, and chloride concentration in the system on a continuous time series. Boundary interactions and stresses from internal sources and sinks are used to simulate transient hydrologic conditions.

During FY 2008, the SFWMD retained three independent groundwater modeling experts to conduct a technical peer review of its draft LWCFAS Model. Independent peer reviews are conducted per policy direction to ensure that models are developed under established groundwater modeling procedures and meet industry standards. The peer review panel completed its report in August 2008 and the SFWMD began the process of incorporating the panel's recommendations. The revised model is expected to be used as a tool to evaluate potential water quality changes in the IAS and FAS due to the cumulative withdrawals of existing and future water users and may be able to determine long-term availability of this water source. During 2011–2012, the calibration of the model was completed and peer review recommendations based on the previously developed steady-state model were implemented. A technical manuscript summarizing the model was published in FY2012 and

placed in the SFWMD's Library of Models for future application. Once models are peer reviewed and comments are addressed, the updated model's documentation is downloadable from the SFWMD website, and electronic model input files are available upon request.

Lower West Coast Surficial Aquifer System Model

The Lower West Coast Surficial Aquifer System (LWCSAS) Model was developed for the SFWMD by Marco Water Engineering, Inc. (2006) to simulate groundwater flow and water levels in the surficial aquifer system (SAS) in the LWC Planning Area. The LWCSAS Model was developed using the industry-standard Modular Three-dimensional Finite-difference Groundwater Flow Model (MODFLOW) computer code to evaluate this traditional source of fresh groundwater supply. This model needs to be updated to include the IAS and will then require a peer review that is tentatively scheduled for FY 2014. This model examines the potential impacts of existing and future groundwater withdrawals from the SAS and IAS.

Other Efforts

Efforts initially cited in the *2005–2006 Lower West Coast Water Supply Plan Update* (2005–2006 LWC Plan Update; SFWMD 2006) fall under the auspices of the Comprehensive Everglades Restoration Plan (CERP), the Caloosahatchee River Watershed Protection Plan, and other local initiatives. **Chapter 4** of this document includes discussions about the Big Cypress Basin's and the East County Water Control District's water source options.

DISTRICTWIDE WATER RESOURCE DEVELOPMENT PROJECTS

Projects encompassing more than one planning area are considered districtwide projects. **Table 24** at the end of this chapter summarizes the estimated costs and time frames for completion of the described districtwide water resource development projects. Aspects specifically pertaining to or having relevance to the LWC Planning Area are identified within the context of these districtwide projects. **Table 24** does not include other programs with water resource development components, such as the CERP and Big Cypress Basin projects, which are primarily budgeted as ecosystem restoration projects.

Hydrogeologic Assessment and Monitoring

Well Drilling and Aquifer Testing Program

This program provides an improved understanding of the geology and hydrogeology of the aquifers in south Florida as new exploratory or test wells are constructed. This hydrogeologic information is used to assess groundwater availability and support other projects. In addition, increased understanding has improved the accuracy of groundwater modeling and decision making regarding the approval of consumptive use permits. Sites for new drilling and testing are selected based on need. This program provides new data about aquifer parameters, improves the characterization of aquifer systems, and helps quantify hydraulic responses to stresses such as pumping. These data help produce more accurate modeling results and provide increased knowledge for water supply development and management.

Full documentation of each well site, including location, well construction details, geophysical logging, and aquifer testing data, is provided in SFWMD technical publications. Data are also loaded into the hydrogeologic portion of the SFWMD's corporate environmental database, DBHYDRO, available from the SFWMD website at http://www.sfwmd.gov/dbhydro.

Groundwater and Evapotranspiration Assessments

Over the years, a number of specialized hydrogeologic and ET studies have been completed by the USGS in cooperation with the SFWMD. The information afforded from these studies enhances the understanding of groundwater conditions and ET rates across the SFWMD. Typically, each project requires several years of effort by the USGS, including rigorous analysis of the data. Some projects were conducted in cooperation with other water management districts or other governmental agencies. The USGS reports, maps, and data are peer reviewed, respected, and considered valuable references for groundwater modeling and environmental assessments, as well as for policy and decision making.

USGS / SFWMD Evapotranspiration Study

In FY 2012, the USGS completed its multiyear ET study. The study's objective was to determine ET rates over pine uplands, marshes, wet prairies, and cypress stands in south Florida, presenting a broader representation of ecological communities than previously investigated. These data are used to better estimate ET rates in regional numerical modeling efforts, for example. Three years of simultaneous data collection at five stations were completed in 2010. Following quality assurance/quality control of the data by SFWMD staff, finalized data was uploaded to DBHYDRO (http://www.sfwmd.gov/dbhydro) with the final study report published in December 2011 by the USGS available at http://pubs.usgs.gov/sir/2011/5212/.

Transport and Reaction Simulation Engine for Modeling of Water Quality

A FY 2009 study developed water quality modeling components and applied these components to the SFWMD Regional Simulation Model. As a result of this study, a spatially distributed water quality model for phosphorus transport and cycling in wetlands was developed for application throughout the SFWMD (Jawitz et al. 2008).

Saltwater Intrusion Monitoring and Saltwater Interface Mapping

In August 2011, the SFWMD completed maps that estimate the position of the freshwater-saltwater interface in the Surficial, Lower Tamiami, Sandstone, Mid-Hawthorn, and Lower Hawthorn aquifers in Lee and Collier counties based on chloride data obtained in April–May 2009 (i.e., the end of the dry season). The maps were based on measured or estimated chloride concentrations in water samples from three primary sources: 1) wells from consumptive use permittees from the SFWMD Water Use Regulatory Database 2) USGS wells, and 3) SFWMD wells. Note that wells with no chloride data from May–June 2009 due to technical difficulties will also be used to assist in future map preparation, as will wells installed by others in the future. The maps are provided in **Appendix F**.

Review of previous freshwater-saltwater interface maps prepared in south Florida indicated that the interface is dynamic but has not moved appreciably over time, due in large part to coastal salinity control structures maintaining adequate freshwater heads. Given this fact, it is recommended that maps be prepared every 3 to 5 years. This will allow for comparison with previous maps so that the progression of the saline front within the aquifers can be tracked over time. Each time maps are prepared, the data sources noted above will be compiled and analyzed.

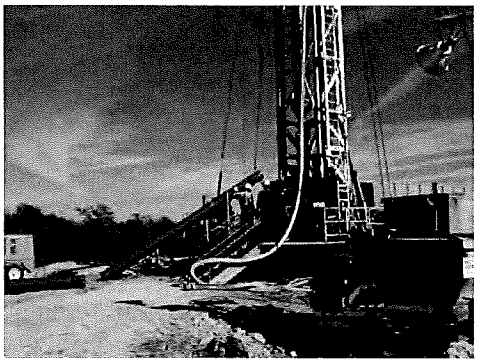
Hydrogeologic Investigation of Aquifer Systems in Highlands County

A hydrogeologic and water quality investigation of the SAS, IAS, and FAS in Highlands County was completed by the USGS in 2010. The resulting report, *Hydrogeology and Groundwater Quality of Highlands County, Florida* (Spechler 2010), enables water resource managers to better evaluate current hydrologic conditions, define present day baseline conditions, and identify additional hydrologic data needs. The findings from this investigation provide new insights into regional groundwater flow patterns within the IAS and FAS, which provide lateral recharge to the LWC Planning Area.

According to the study, the Lake Wales Ridge cuts through the county. West of the ridge, groundwater flow is southwest, while flows east of the ridge are toward the Kissimmee River. The groundwater flows to the southwest have the potential of affecting the northern portion of the LWC Planning Area as Highlands County is bordered by Glades County to the south and Charlotte County to the west. Both of these counties are partially located in the LWC Planning Area. In general, the study reports the groundwater resources of Highlands County is of good chemical quality and is of sufficient quantities for present and future needs. Additional studies on the quantity and quality of the groundwater resources in the

county are warranted because of the expected continued growth in both population and agriculture in Highlands County and adjacent counties.

Surface and Groundwater Monitoring


Floridan Aquifer Well Screen Installation

To understand the current conditions and monitor changes, the SFWMD has an extensive groundwater and surface water monitoring program. SFWMD staff conducted a query of the SFWMD's DBHYDRO database for monitoring stations active as of January 1, 2012 on July 19, 2012. The query revealed 1,249 surface water stations and 760 groundwater stations districtwide. Of these numbers, there were 298 surface water stations and 157 wells in Lee, Collier, Glades, and Hendry counties combined. Some sites are owned and maintained by the SFWMD, some are private wells whose owners allow the SFWMD to perform monitoring, and some belong to other agencies, such as the USGS and the United States Army Corps of Engineers (USACE). Monitoring sites are located throughout the SFWMD in all of the aquifers. Surface water sites are located in wetlands, lakes, canals, and headwater and tailwater areas of water control structures. Historical surface water stage time series data from the SFWMD and other external government agencies are available in DBHYDRO.

The SFWMD maintains this extensive network of monitoring sites, most of which date back several decades, and archives the data in its DBHYDRO database. Data from sites monitored by the USGS are published annually. Lee and Collier counties maintain their own monitoring site networks.

Monitoring of groundwater levels and water quality provides necessary information to develop and calibrate numerical models. In addition, groundwater and surface water monitoring supplies data to better understand trends, aquifer response to varying climatic conditions, pumpage over time, and the effects of changing water levels on natural systems.

Feasibility Studies

The SFWMD has performed feasibility studies to determine the viability of water resource development options to increase water supply through water resource alternatives. These efforts involved collecting and analyzing data and numerical modeling. The SFWMD recently funded several studies, including the St. Lucie and Indian River Counties Water Resources Study (HDR Engineering and HSW Engineering, Inc. 2009), the Water Desalination Concentrate Management and Piloting Study (Carollo Engineers, Inc. 2009), and water reuse pilot projects partnering with the City of Plantation and the City of Sunrise as separate initiatives (Hazen and Sawyer 2008, MWH Global, Inc. 2008b).

Water Desalination Concentrate Management and Piloting Study

This study was conducted to evaluate ways to increase treatment efficiency, decrease desalination concentrate by-products, and identify affordable and sustainable brackish water treatment technologies in south Florida (Carollo Engineers, Inc. 2009). The overall goal of the study was to evaluate alternatives for concentrate minimization in south Florida and provide recommendations through identification of affordable and sustainable treatment technologies. The study provided a systematic evaluation of a concentrate minimization approach, which demonstrated its feasibility as a representative brackish water treatment.

Existing treatment schemes for four representative reverse osmosis (RO) facilities were evaluated and four promising approaches for concentrate minimization were broadly evaluated for these facilities in terms of several economic and non-economic criteria. The evaluated concentrate minimization approaches included 1) dual RO system with intermediate chemical precipitation, 2) brine concentrator and evaporation ponds, 3) brine concentrator and crystallizer, and 4) salt recovery and extraction. The dual RO process with intermediate chemical precipitation was selected as the preferred approach for inland desalination plants within the SFWMD. The total treatment cost with this approach was estimated to be about half that of product water generated with a brine concentrator approach. Because of the similarity of the recovery limiting salts at most of the inland brackish water plants in the SFWMD, a common solution to concentrate management/minimization can likely be applied at multiple plants.

Natural Systems Protection

Minimum Flow and Level Activities

The SFWMD develops MFL criteria for specific water bodies to protect these water bodies from significant harm due to a reduction in water levels or flows. A Priority Water Bodies List and Schedule for MFLs is developed and submitted annually to the Florida Department of Environmental Protection (FDEP) in accordance with 373.041(2), F.S. To date, MFLs have been adopted for the following surface waters and aquifers within the SFWMD's boundaries:

- Caloosahatchee River and Estuary
- Lake Okeechobee

PROTECTION

Minimum Flow and Level Criteria

MFL technical criteria are important management tools used by the SFWMD to protect major water bodies from significant harm due to reduction in water levels or flows. These criteria provide a basis for defining the point at which additional withdrawals will result in significant harm to water resources.

If the water body is below the MFL or expected to fall below the MFL within 20 years, a recovery or prevention strategy is required. The recovery strategy may include phases or a timetable to achieve the MFL. The strategies may include construction of new or improved water storage facilities, development of additional water supplies, and implementation of water conservation. New or additional withdrawals may be limited until the water body is no longer experiencing significant harm.

- The Everglades (including Water Conservation Areas (WCAs) 1, 2, and 3; Holey Land and Rotenberger wildlife management areas; and Everglades National Park)
- The northern portion of the Biscayne aquifer
- The LWC aquifer system encompassing three semi-confined units (Tamiami, Sandstone, and Mid-Hawthorn)
- North Fork of the St. Lucie River
- Northwest Fork of the Loxahatchee River and Estuary
- Lake Istokpoga
- Florida Bay

The SFWMD's Governing Board has listed the Caloosahatchee River and Estuary as a 2012 Priority Water Body to continue data collection and analysis and model development to support an update to the Caloosahatchee River and Estuary MFL.

Water Reservations and Restricted Allocation Areas Activities

The SFWMD also provides a list to the FDEP specifying water bodies where Water Reservation and Restricted Allocation Area criteria will be developed to protect natural system water from future consumptive use allocations. The SFWMD is required to use its Water Reservation or Restricted Allocation Area authority to protect water for natural systems identified by CERP projects in advance of executing agreements with the USACE to construct these projects. Currently, the SFWMD is pursuing Water Reservations associated with the CERP Caloosahatchee River (C-43) West Basin Storage Project and the Biscayne Bay Coastal Wetlands Phase I project. No additional Restricted Allocation Area rulemakings are contemplated at this time.

PROTECTION

Water Reservations
A Water Reservation is a legal mechanism to set aside water for the protection of fish and wildlife or public health. The volume of water to be reserved is determined through scientific analysis. The SFWMD then undertakes rulemaking to ensure that the volume of water is not allocated for consumptive uses.

Restricted Allocation Areas
A Restricted Allocation Area is a legal mechanism for protecting water resources from adverse impacts due to consumptive uses of water. Section 3.2.1 of the *Basis of Review for Water Use Permit Applications within the South Florida Water Management District* (Basis of Review; SFWMD 2010a) contains the SFWMD's Restricted Allocation Area rules.

Some significant water bodies covered by Restricted Allocation Area rules include the following:

- **Loxahatchee River Watershed**
  - Northwest Fork of the Loxahatchee River
  - Kitching Creek
  - Cypress Creek
  - Hobe Grove Ditch
  - Moonshine Creek
  - Jonathon Dickinson State Park
  - DuPuis Reserve
  - J.W. Corbett Wildlife Management Area
  - Pal Mar
  - Loxahatchee Slough (C-14, C-18, C-18W, and C-18E canals)
  - Grassy Waters Preserve
  - Riverbend Park
  - L-8 Reservoir
  - L-8 Canal (from C-51 Canal to L-8 Tieback Canal)
  - M Canal
  - L-8 Tieback Canal
  - Integrated conveyance systems that are hydraulically connected to the water bodies identified above
- **Everglades**
  - WCA 1 (Arthur R. Marshall Loxahatchee National Wildlife Refuge)
  - WCAs 2A and 2B
  - WCAs 3A and 3B
  - Everglades National Park
  - Holey Land Wildlife Management Area
  - Rotenberger Wildlife Management Area
  - Integrated conveyance systems that are hydraulically connected to the water bodies identified above
- **Lake Okeechobee**
  - Lake Okeechobee
  - Integrated conveyance systems hydraulically connected to the Caloosahatchee River (C-43 Canal), the St. Lucie River (C-44 Canal), or secondary canal systems that receive water from Lake Okeechobee

The SFWMD's first Water Reservation rule was adopted in support of the CERP Picayune Strand Restoration Project and Fakahatchee Estuary in July 2, 2009. On March 18, 2010, the SFWMD adopted a Water Reservation for the North Fork of the St. Lucie River in support of the CERP Indian River Lagoon – South Project. Draft Water Reservation rules are expected to be ready for Governing Board consideration in 2013 for the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project. Further details on MFLs, Water Reservations, and Restricted Allocation Area rules are available on the SFWMD's website at http://www.sfwmd.gov/reservations. Related rule development and peer review activities are presented at http://sfwmd.websitetoolbox.com/?forum=174677.

Comprehensive Water Conservation Program

Water savings achieved through water conservation measures are the most cost-efficient way to expand current water supplies. The SFWMD's overall water conservation goal is to prevent and reduce wasteful, uneconomical, impractical, or unreasonable uses of water resources. To achieve this, the SFWMD has a number of conservation programs in place to cultivate a water conservation ethic within the LWC Planning Areas. These are discussed in the following subsections. For more information about the SFWMD's Comprehensive Water Conservation Program, see **Chapter 4** of this document and the Support Document.

WaterSIP

The Water Savings Incentive Program (WaterSIP) provides matching funds of up to $50,000 to water providers and high volume users (i.e., cities, utilities, and industrial groups; schools; hospitals; and homeowners associations) for water saving technologies. These technologies include low flow plumbing fixtures, rain sensors, and other hardware. Between FY 2007 and FY 2012, the SFWMD awarded $627,456 for 23 LWC Planning Area WaterSIP projects, representing a projected savings of 178 million gallons per year (MGY) (see **Chapter 4** and **Appendix E** of this plan update for more information on WaterSIP).

Mobile Irrigation Laboratory Program

This program provides funding to conduct efficiency audits of agricultural and urban irrigation systems by working with homeowner and condominium associations and interested individual homeowners to provide evaluations of landscape irrigation efficiency. In the LWC Planning Area, the Collier Soil and Water Conservation District provides this assistance under a contract with the SFWMD Big Cypress Basin Board. The Big Cypress Basin Urban Mobile Irrigation Laboratory (MIL), which had received funding in FY 2010 and FY 2011, will continue to receive funding in FY 2012. From 2008 through 2011, 480 audits were conducted on 549 acres of urban landscapes within the Big Cypress Basin, and potential water savings of 211.4 MGY (0.58 MGD) were identified. In FY 2010, five MILs were operating throughout the SFWMD — four agricultural MILs in Miami-Dade, Palm Beach, Martin, and St. Lucie counties and the one SFWMD-funded agricultural MIL serving the Big Cypress Basin area. Anticipated water savings from the MIL Program districtwide for FY 2010 to FY 2014 are approximately 438 MGY.

Water Conservation Outreach Programs

The SFWMD also funds water conservation outreach programs in the LWC Planning Area. The amount of money budgeted for water conservation activities in FY2012 as well as projected expenditures for each fiscal year between FY 2012 and FY 2016 are reported in **0** in the *Summary* section of this chapter and in Chapter 5A: Five-Year Water Resource Development Program of the *2012 South Florida Environmental Report – Volume II* (Martin 2012), which is available at http://www.sfwmd.gov/sfer. Some of the outreach programs are discussed in the following subsections.

Great Water Odyssey

This program conducts online water resource training for teachers to educate elementary school students (third, fourth, and fifth graders) throughout the SFWMD region. The students use a computer-based interactive curriculum that focuses on water conservation, providing a multidisciplinary educational experience consistent with Florida's Sunshine State Standards. Approximately 200 teachers are involved with this program that assist students in the successful completion of the Florida Comprehensive Assessment Test.

Wings of Hope Program

Florida Gulf Coast University's Wings of Hope Program in Big Cypress Basin introduces their students to native Southwest Florida wildlife species, habitats, water conservation, and environmental sustainability. The students share this knowledge with younger students in fourth and fifth grades through science-based environmental education programs at public and private schools in Collier County.

Big Cypress Basin Conservation Outreach Program

This program provides grant funding through the Education Foundation of Collier County's "Connect with a Classroom." This online program provides opportunities for teachers and community members to improve the quality of instruction in local schools. Grants will focus on projects related to water conservation.

Partnership with the Water Symposium of Florida

Big Cypress Basin Service center staff partner with the Water Symposium of Florida, Inc. to hold outreach seminars on water supply and water conservation for homeowners associations, civic groups, and businesses. These seminars are among the Big Cypress Basin and SFWMD ongoing efforts to create a year-round water conservation ethic that can help protect the area's water supply from regional weather extremes. Additionally, the Water Symposium of Florida creates a demonstration project displaying water conservation and water quality for the community.

Florida Automated Weather Network

The University of Florida operates the Florida Automated Weather Network (FAWN), a statewide research and data program that provides accurate and timely weather data to a wide variety of users. There are 35 stations located in Florida, two of which are located in the LWC Planning Area: Immokalee, and Clewiston. Ongoing enhancements of the FAWN network occur annually and include site field tests, database enhancements, and continued development of information provided on the web page.

SUMMARY

Water resource development projects serve various purposes in support of water supply development. Benefits of the water resource development projects discussed in this chapter include the following:

- Improved understanding of the hydrogeologic system that is the source of both traditional and alternative water supplies for the LWC Planning Area
- Prevention of the loss of natural resources
- Preservation of existing supplies through better resource understanding and management and continued implementation of regional resource monitoring
- Water conservation to protect water sources and provide an efficient way to expand current water supplies
- Increased future supply availability

The CERP projects are not reported as water made available in this plan update. Future water supply plan updates will reconsider this assessment as projects are completed and water needed for environmental protection is identified and reserved.

Table 24 provides the estimated costs and timeframes for completion of water resource development projects described in this chapter, including districtwide projects.

Table 24. Implementation schedule and costs for districtwide water resource development projects, FY 2012–FY 2016.

Water Resource Development Projects	Plan Implementation Schedule and Costs ($ in thousands)					
	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	Total
Well Drilling and Aquifer Testing Program Estimated start date: 1990 Estimated finish date: ongoing	$2,004	$2,000	$1,000	$0	$0	$5,004
Groundwater and ET Assessments Estimated start date: 1954 and 2002, respectively Estimated finish date: ongoing	$0	$0	$0	$0	$0	$0
Groundwater and Wetland Monitoring Estimated start date: 2002 Estimated finish date: ongoing	$703	$702	$702	$702	$702	$3,511
Feasibility Studies Estimated start date: 2001 Estimated finish date: ongoing	$0	$0	$0	$0	$0	$0
Modeling Estimated start date: 1998 Estimated finish date: ongoing	Staff Time	Staff Time	Staff Time	Staff Time	Staff Time	Staff Time
Comprehensive Water Conservation Program Estimated start date: 1977 Estimated finish date: ongoing	$438	$435	$435	$435	$435	$2,178
MFL, Water Reservation, and Restricted Allocation Areas Activities Estimated start date: 1995 Estimated finish date: ongoing	Staff Time	Staff Time	Staff Time	Staff Time	Staff Time	Staff Time
Total	**$3,145**	**$3,137**	**$2,137**	**$1,137**	**$1,137**	**$10,693**

Source: *2012 South Florida Environmental Report – Volume II,* Chapter 5A: Five-Year Water Resource Development Work Program, Table 5A-1 (Martin 2012).

6

Water Supply Development Projects

This chapter provides a summary of the water supply development projects anticipated to meet the water needs of the Lower West Coast (LWC) Planning Area during the 2010 to 2030 planning horizon. Information is provided for each water use category (see **Chapter 2**), with an emphasis on the Public Water Supply (PWS) category. Additional details about demand projections, local government information, and water supply development projects can be found in **Appendices A, B,** and **C**, respectively.

TOPICS

- Regional and Local Planning Linkage
- Projects Identified for This Plan Update
- Coordination Between Water Supply Planning and Consumptive Use Permitting
- Funding
- Summary
- PWS Utility Summaries

Growing population in the LWC Planning Area is driving the need for water supply development. The region's population is expected to increase by 51 percent, from approximately 992,486 in 2010 to more than 1.5 million by 2030. Net water demand for all water use categories is projected to increase about 28–33 percent, from 683.5 million of gallons of water per day (MGD) in 2010 to an estimated 873.27–908.2 MGD by 2030. Gross water demand for all water use categories is projected to increase from 971.1 MGD in 2010 to as much as 1,262.91 MGD by 2030, an increase of 25–30 percent. Gross agricultural water demand is projected to increase 10–18 percent over the 20-year planning horizon from 630 MGD to as much as 741 MGD.

As discussed in previous chapters, the availability of fresh groundwater is limited to meet the needs of future growth in the LWC Planning Area. Therefore, the additional water needed to meet increased future urban demand is expected to be developed from other sources, primarily through continued development of brackish groundwater resources, surface water captured during wet weather, new storage capacity of both surface water and groundwater, and expansion of reclaimed water systems.

LAW / CODE

Water supply development is defined in Subsection 373.019(24), Florida Statues (F.S.), as 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.

Agriculture, the largest water user in the LWC Planning Area, relies almost exclusively on fresh surface water and groundwater. Because surface water supplies are limited in this region, agricultural water users must consider alternative water supply sources, including water conservation to meet future water demands. Water supply options, such as blended sources and tailwater/stormwater recovery systems could also reduce agricultural water demand on freshwater supplies. The implementation of robust water conservation programs throughout the LWC Planning Area offers water use savings potential to reduce future water demand.

Water users, such as utilities, local governments, and self-suppliers, including Agricultural (AGR) Self-Supply and Industrial/Commercial/Institutional (ICI) Self-Supply, are primarily responsible for water supply development projects. For each PWS utility supplying more than 100,000 gallons per day (0.1 MGD) to its service area, a summary is included at the end of this chapter. In the LWC Planning Area, 25 utilities serve 17 local governments (listed in **Appendices B** and **D**). The utility summaries provide population and demand projections and list proposed sources and specific PWS development projects to meet future demands. For other water use categories, specific projects by other entities are identified as provided to the South Florida Water Management District (SFWMD) for this plan update.

REGIONAL AND LOCAL PLANNING LINKAGE

The SFWMD's water supply planning process is closely coordinated and linked to the water supply planning of local governments and utilities. Significant coordination and collaboration throughout the water supply plan development and approval process occurs among all water supply planning entities.

INFO

Planning Area The SFWMD is divided into four areas within which water supply planning activities are focused: Kissimmee Basin, Upper East Coast, LWC, and Lower East Coast.

Utility Service Area The geographical region in which a water supplier has the ability and the legal right to distribute water for use (SFWMD 2010a).

The water supply development projects proposed in the *2005–2006 Lower West Coast Water Supply Plan Update* (2005–2006 LWC Plan Update; SFWMD 2006) for PWS utilities proved useful to local governments preparing their 10-year water supply facilities work plans. The SFWMD has worked closely with staff from these utilities to identify water supply development projects for this plan update. Many of the projects listed in the utility summaries at the end of this chapter are also included in respective local government 10-year water supply facilities work plans. With the exception of projects using 100 percent seawater or reclaimed water, all water supply projects must obtain consumptive use permits from the SFWMD.

Although comprehensive plans, facilities work plans, and consumptive use permits are prepared at different times, each use the latest and best available data. Local governments' future projects should generally be consistent among plans and permits, and meet projected water demands.

Appendix B provides information and statutory requirements relevant to local government comprehensive plans. The regional and local water supply planning process is described as follows and is illustrated in **Figure 20**.

PROCESS

Regional and Local Water Supply Planning Process

The SFWMD is required to notify each PWS utility of the projects identified in this plan update for that utility to consider and incorporate into its corresponding local government required water supply facilities work plan in meeting future water demands. This notification must occur within six months following approval of the water supply plan update. Once the notice is received, PWS utilities then must respond to the SFWMD within 12 months about their intentions to develop and implement the projects identified by the plan or provide a list of other projects or methods to meet these needs [Paragraph 373.709(8)(a), F.S.].

In addition to the utility requirements above, local governments are required to adopt water supply facilities work plans and related amendments to their comprehensive plans within 18 months following approval of the regional water supply plan. The work plans contain information to update the comprehensive plan's capital improvements element, which outlines specifics about the need for, and the location of, public facilities, principles for construction, cost estimates, and a schedule of capital improvements.

The local governments are required by Paragraph 163.3177(6)(c)3, F.S. to modify the potable water sub-elements of their comprehensive plan to do the following:

- Incorporate the water supply project or projects selected by the local government from those projects identified in the updated regional water supply plan or proposed by the local government.
- Identify water supply projects to meet the water needs identified in the updated regional water supply plan within the local government's jurisdiction.
- Include a work plan, covering at least a 10-year planning period, for building public, private, and regional water supply facilities, including the development of alternative water supplies, which are identified in the potable water element to meet the needs of existing and new development.

By November 15 of every year, all utilities are required to submit a progress report about the status of their water supply projects (completed, underway, or planned for implementation) to the SFWMD. By December 1 of each year, local governments are required to submit updated capital improvement information to the Florida Department of Economic Opportunity and the SFWMD. **Figure 20** shows the linkage and sequence of the water supply planning process with local government water facilities work plans and comprehensive plans, beginning with the adoption of a water supply plan update.

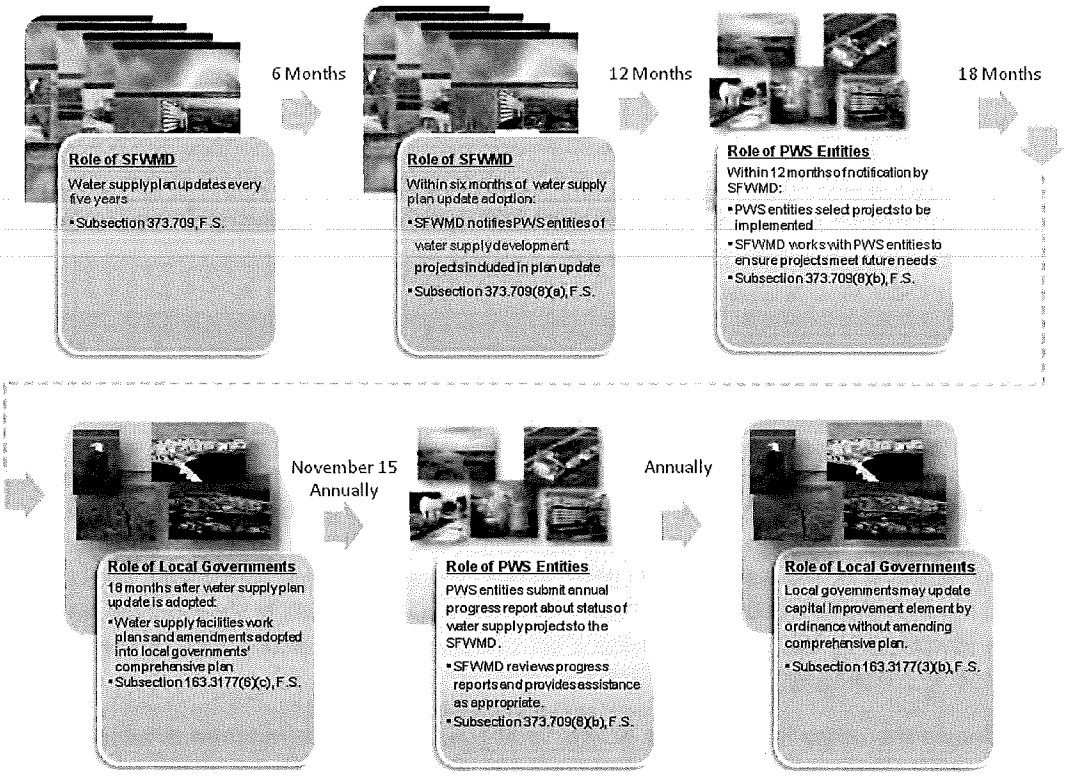


Figure 20. Linking regional water supply planning with local government comprehensive planning.

Consumptive Use Permitting

Consumptive use permits are required for all water supply development projects, except for those using 100 percent seawater or reclaimed water. While this plan identifies a number of projects, each project must be permitted by demonstrating the following (Section 373.223, Florida Statutes [F.S.]):

- Reasonable-beneficial use of water
- Project does not interfere with existing legal users
- Project is consistent with the public interest

PROJECTS IDENTIFIED FOR THIS PLAN UPDATE

Regional water supply planning is a critical tool for ensuring that existing and future water needs of the state are met while also protecting our valuable natural systems. Regional water supply plans are developed through collaboration among the water management districts, water providers, water users, and other stakeholders when future projected demands are estimated to exceed existing water supplies. The resulting plan provides a blueprint for the development of sustainable water sources by identifying water supply

options, from which local water suppliers can choose, that will be more than sufficient to meet future needs while protecting the water resources of an area, 373.709, F.S. (FDEP 2012).

To manage the water resources in the region, this plan update promotes the diversification of sources for water supply projects needed to meet future demands. Projects proposed for inclusion in this plan update were evaluated based on factors such as resource constraints, including Minimum Flows and Level (MFL) criteria and Water Reservations, and whether a project actually contributes to new water supply. Included in these project evaluations were projects proposed in local governments' 10-year water supply facilities work plans and identified in the annual utility progress or inventory reports. Some of the projects identified in this plan update were listed in the 2005–2006 LWC Plan Update and have proposed future expansion phases, or were delayed or modified due to fluctuations in population and demand projections.

Water suppliers are not required to choose a water supply development project identified in a regional water supply plan. However, if they do select a project from this plan update, the applicant should have confidence that the project was screened for feasibility and has a likelihood of being permittable. The PWS utilities submitted water supply development projects for this plan update to meet their 2030 water demands. With the exception of projects using 100 percent seawater or reclaimed water, all water supply projects require a consumptive use permit from the SFWMD. These projects will be evaluated on an application-by-application basis to determine if the project meets consumptive use permitting criteria.

Thirty-six multi-phased PWS facility projects are proposed for Fiscal Year (FY) 2012 to FY 2030. The diverse water sources for these projects are fresh surface water or fresh groundwater from the surficial aquifer system (SAS); brackish groundwater from the Floridan aquifer system (FAS); reclaimed water; aquifer storage and recovery (ASR); and surface water storage. These proposed projects include 17 potable and 19 non-potable water supply development projects (see utility summaries at the end of this chapter).

In the LWC Planning Area, all utilities indicated adequate water supplies to meet projected demands through 2030 with a combination of submitted projects and existing supplies. **Appendix C** provides a summarized list of proposed projects submitted for this plan update.

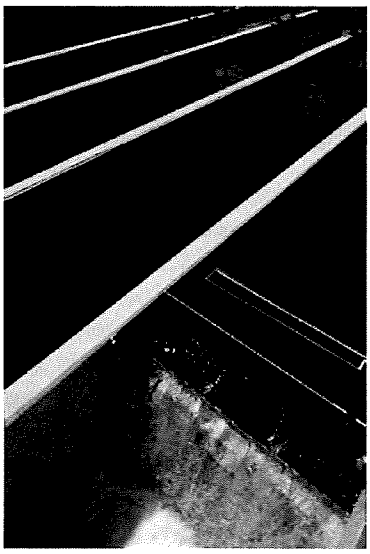
Furthermore, a project identified for inclusion in this plan update may not necessarily be selected for development by the utility. In accordance with Section 373.709(6), F.S., nothing contained in the water supply component of a regional water supply plan should be construed to require local governments, public or privately owned utilities, special districts, self-suppliers, multijurisdictional entities, and other water suppliers to select that identified project. If the projects identified in this plan update are not selected by a utility, the utility will need to identify another method to meet its needs and advise the SFWMD of the alternative projects(s), and a local government will need to include such information in its 10-year water supply facilities work plan.

Projects are also proposed for the other water use categories. AGR Self-Supply water users continue to use surface water and fresh groundwater and can benefit from projects, such as stormwater and tailwater recovery, and more efficient water conservation practices. Increases in demand for Recreation/Landscape (REC) Self-Supply uses for this planning horizon are expected to be met, for the most part, by the proposed reclaimed water projects. Power generation entities are planning power plants that will make use of brackish water, surface water, and reclaimed water where available.

A discussion of the demand and supply conditions for each of the six major water use categories follows. Because most of the growth in demand during the next 20 years will occur in the urban sector, and more specifically within the public water systems, emphasis is placed on evaluating future needs and recommending water supply projects within the PWS category.

Public Water Supply

PWS demand includes all potable uses served by public and private utilities with a pumping capacity equal to or greater than 0.1 MGD. The PWS net demand is projected to grow from 131.4 MGD in 2010 to 192.0 MGD by 2030, which is approximately 21 percent of the total projected net water demand by 2030. In **Appendix B**, current and future utility service area maps reflect the proposed changes in service area boundaries and legal municipal boundaries. Utilities that produce or pump less than 0.1 MGD on an annual basis were not evaluated and do not appear on the service area maps in the appendix.


Water Treatment Facility

The populations served by these smaller utilities are included in the Domestic Self-Supply (DSS) category. Utilities currently in this category include Silver Lakes Utilities in Glades County, Florida Government Utility Authority (FGUA) in Hendry County, and Charlotte County Correctional Institution in Charlotte County.

The facilities and service area of Charlotte County Utilities are evaluated and permitted by the Southwest Florida Water Management District. However, Charlotte County Utilities provides potable water supplies to Burnt Store Marina in Lee County, and this population is included in this plan update (see **Appendix B** and **Appendix D**). In addition, Charlotte County Utilities received a consumptive use permit from the SFWMD in 2011 to develop facilities at Babcock Ranch in southeastern Charlotte County, which is located in the LWC Planning Area. Both the Southwest Florida Water Management District and the SFWMD are coordinating their respective water supply plans to consider the future demands of Charlotte County, most of which falls under the Southwest Florida Water Management District's jurisdiction.

PWS demand is currently met through a combination of fresh groundwater from the SAS and intermediate aquifer system (IAS), brackish groundwater from the IAS and FAS, and fresh surface water. In addition, many utilities are responsible for wastewater management and most have implemented use of reclaimed water. For consistency in the water supply planning process, the SFWMD, local governments, and utilities worked closely with the Florida Department of Economic Opportunity to project demands and propose water supply projects for the future. **Table 25** lists the LWC Planning Area's PWS net demands for 2010 and 2030 by county.

Table 25. PWS net demand projections for 2010 and 2030.

County	2010 PWS Demand (MGD)	2030 Projected PWS Demand (MGD)[a]
Charlotte[b]	0.0	1.4
Collier	59.6	75.8
Glades[b]	0.5	0.8
Hendry[b]	2.8	3.0
Lee	68.5	111.0
Monroe[c]	0.0	0.0
LWC Net PWS Demand Total	131.4	192.0

a. Projected supplies include only potable water delivered by PWS systems. Areas served by only DSS are not included and shown as "zero" values.

b. Portion of county in the LWC Planning Area.

c. No development is anticipated in the mainland portion of Monroe County, which is the portion of the county within the LWC Planning Area.

Approximately 11 percent of projected PWS net demand is met using fresh groundwater supply. The availability of new supplies from the freshwater aquifers in the LWC Planning Area is limited due to existing water demands, source limitations, and resource issues, such as saltwater intrusion, environmental needs, and aquifer protection criteria (see **Chapter 3**).

The availability of and the ability to permit for freshwater supplies to meet projected water demands through 2030 are determined on an application-by-application basis. Some freshwater supply development may be feasible given local conditions, such as reductions in historical water use and availability of new resources. Therefore, only a few proposed freshwater supply projects are included in this plan update.

Data in the Utility Summaries

The individual utility summaries at the end of this chapter provide baseline information about finished water demands, existing permitted sources and allocations, proposed projects that create water capacity, and other related information. The population and water demands for each utility are based on the methodology and results provided in **Appendix A**. The water demand projections represent finished water per capita use rates (PCURs) and net water demands. These are different from raw water PCURs and gross demands that reflect water withdrawn at the source prior to treatment. There may be

significant differences in the quantity of raw water and finished water delivered due to differences in treatment process efficiencies.

This plan update uses permanent population for existing demand projections. This is consistent with the methodology used by the University of Florida's Bureau of Economic and Business Research (BEBR) for population estimates.

Tables 26 and **27** summarize the 36 projects proposed by PWS entities and the estimated new water supplies to be produced by 2030.

Table 26. Proposed potable water supply development projects and capacity for 2012–2030.

Water Source	Number of Multi-phased Projects[a]	Capacity[b] (MGD)
Fresh Water	6	8.8
Brackish Water	11	70.0
Project Total	17	78.8

a. Projects designed to expand distribution of treated water are not included because they do not generate new water.
b. One 3.40-MGD freshwater ASR project with storage in the FAS is not included in the new treatment capacity total.

Table 27. Proposed non-potable water supply projects and capacity for 2012–2030.

Water Source	Number of Multi-phased Projects[a]	Capacity (MGD)
Reclaimed Water	11	35.0
Surface Water/Captured Storm Water/ASR[b]	6	21.3
Fresh Water (Supplemental Groundwater)[b]	2	6.0
Project Total	19	62.3

a. Projects designed to expand distribution of treated water are not included because they do not generate new water.
b. Supplemental non-potable water supply for irrigation and one 3.40-freshwater ASR project with storage in the FAS.

The proposed potable water supply development projects (**Table 26**) will potentially create 78.8 MGD of new water treatment capacity to meet the PWS net demand of 192.0 MGD, exceeding the 60.6 MGD of net potable water needed from 2010 to 2030 to meet PWS demand. The new capacity consists of 70.0 MGD produced by brackish water source projects and an additional 8.8 MGD produced by freshwater source projects.

The brackish water projects proposed for the planning area include construction of reverse osmosis (RO) treatment plants, expansion of existing plants, and construction of new production wells. Brackish water projects are proposed by most of the major utilities requiring additional treatment capacity within the next 20 years. The design capacity listed for each project reflects finished water capacity.

The proposed non-potable water supply projects (**Table 27**) will potentially create 62.3 MGD of additional water supply for landscape irrigation and groundwater recharge. These proposed projects include multi-phased reclaimed water production facility construction and expansion projects, as well as reuse distribution line and storage facility projects.

Six of the non-potable supplemental water sources may provide up to 21.3 MGD of new non-potable water supply and include reclaimed water in ASR facilities, as well as fresh groundwater. It is important to note that although projects involving new distribution lines and other infrastructure may qualify for the Alternative Water Supply Funding Program, they are not included as reclaimed water projects because they do not generate new supply (see *Alternative Water Supply Funding Program* section later in this chapter).

The LWC Planning Area has achieved significant progress in reclaimed water use. The *2010 FDEP Reuse Inventory Report* (FDEP 2011) indicates that 95 percent of the wastewater generated in Lee County and 83 percent of the wastewater generated in Collier County is reclaimed and primarily used for irrigation and to recharge aquifers. Treated wastewater in Hendry County is reused 100 percent through aquifer recharge using spray fields and rapid infiltration basins. Glades County has no water reuse facilities.

The 78 water supply development projects funded by the Alternative Water Supply Funding Program in the LWC Planning Area between FY 2007 and FY 2012 have created a total of 104 MGD of new water capacity. The new sources of this water include 37 MGD of brackish water, 33 MGD of reclaimed water, 16 MGD of Hawthorn aquifer water, 3 MGD of ASR system water, and 15 MGD of surface water/stormwater and other projects.

Five utilities in the LWC Planning Area constructed ASR well systems within the past 10 years. These systems added storage to accommodate additional water supply during the dry season to meet peak potable water demands.

Domestic Self-Supply

DSS gross demands in the LWC Planning Area are projected to increase from 18.9 MGD in 2010 to 24 MGD in 2030. DSS refers to potable water from a private supply, usually a domestic well serving a private residence. DSS needs are met primarily with fresh groundwater.

All future needs in this use category are expected to be met using fresh groundwater supplies. However, residential areas of concentrated domestic wells, such as portions of Cape Coral and Lehigh Acres, have experienced well problems during the dry season because pumps become inoperable due to reduced water levels. Cape Coral Utilities has connected several sections of the city (city project areas Sections SW4 and SW5) to utility service to eliminate the need for domestic wells in these areas. The stress on wells still in use is reduced, and well problems have been eliminated in Sections SW4 and SW5. Utility service connecting the northern half of the city's service area is scheduled for 2018.

To minimize well problems in the Lehigh Acres area, the Lee County Department of Natural Resources modified the well construction standards for the southeastern portion of Lehigh Acres. Wells are now required to have deeper well casings, which allow the pumps to be set at greater depths to minimize problems caused by depressed water levels. However, continued urban development and resulting increases in domestic well installations in these areas may create additional well problems.

Declines in water levels of the Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers may reach maximum developable limits (MDLs) in an area that may preclude future well construction in the stress aquifer. Potential solutions include, but are not limited to, connection of such areas to PWS systems and adoption of additional landscape ordinances that serve to minimize outdoor irrigation. When public supply becomes available to a particular area, DSS wells that are no longer used require proper plugging and abandonment.

LAW / CODE

Maximum Developable Limit

MDL consumptive use permitting criteria provide reasonable assurances the proposed water use does not cause harmful drawdowns that overdraw semi-confined freshwater aquifers. The potentiometric head with the Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers is not allowed to drop to less than 20 feet above the top of the uppermost geologic strata that comprises the aquifer at any point during a 1-in-10 year drought condition (SFWMD 2010a).

Agricultural Self-Supply

AGR Self-Supply is expected to remain the largest water use category in the LWC Planning Area. Agricultural water use includes supplies for irrigated, commercially grown crops. Because agricultural demand projections are complex, ranges of projections are used. Gross agricultural demand over the next 20 years is projected to increase 10–18 percent from 630 MGD in 2010 to 695.9–740.9 in 2030. Actual demand depends on how much citrus transitional land (currently fallow) goes into production within the planning horizon. **Appendix A** provides more information about agricultural water use and projected demands.

Sugarcane in the Lower West Coast

The region's dominant crops in the area are citrus, small vegetables, and sugarcane, which account for over 93 percent of the projected 2030 AGR Self-Supply water use demand. Although active crop cultivation has declined in recent years, the agricultural industry considers this decline temporary. Therefore, the projections in this plan update show an increase in both agricultural water use demand and acreage.

The renewal process for irrigation class consumptive use permits in the LWC Planning Area began in 2004 and was mostly complete in 2006. Consumptive use permits renewed during that time are still in effect, and most are valid for 20 years.

Fresh surface water and groundwater are the primary water sources for agricultural irrigation in this region. However, historically used freshwater sources, including fresh surface water from lakes and canals and the SAS, are not adequate to meet all projected demands during a 1-in-10 year drought. As mentioned in **Chapter 3,** the Lake Okeechobee Service Area is designated as a Restricted Allocation Area. These criteria restrict the allocation of surface water derived from Lake Okeechobee water bodies for consumptive use. Lake Okeechobee water bodies include integrated conveyance systems that are hydraulically connected to and receive water from Lake Okeechobee, such as the Caloosahatchee River (C-43 Canal). These criteria apply to new projects, existing unpermitted projects, and modifications or renewals to existing projects located within the Lake Okeechobee Service Area. Permitted allocations cannot cause an increase in the volume of surface water withdrawn from Lake Okeechobee water bodies over the entire base condition water use unless one of the alternatives is identified as listed in Section 3.2.1 of the *Basis of Review for Water Use Permit Applications within the South Florida Water Management District*, referred to as simply the Basis of Review (SFWMD 2010a). For more information see the *2012 Lower East Coast Water Supply Plan Update* (SFWMD 2012b).

Development of groundwater and surface water may be practicable in some areas; however, permitting new freshwater supplies will essentially depend on local resource conditions, and some options are not available for all crop types. New water supply opportunities for agriculture may be available in the future by capture and use of water normally lost to a farm's water management system (tailwater recovery), capture and use of storm water (stormwater retention), and blending of brackish groundwater with fresh water. The storage and application of reclaimed water may be used for some crops, but there are no sources near the areas with agricultural needs. Furthermore, the use of more efficient irrigation systems for various agricultural operations could significantly reduce the amount of water needed to meet crop demands for an average year, but this would not provide the water needed in a 1-in-10 year drought.

The continued use of best management practices (BMPs), including water conservation, could reduce the amount of water needed to meet crop demands (FDACS 2010). These efforts are discussed in **Chapter 4**. In addition, the Florida Department of Agriculture and Consumer Services (FDACS) develops and adopts by rule agricultural BMPs addressing water quality. Some BMPs contain an implicit water conservation component. Growers who enroll in the FDACS BMP Program and implement the BMPs demonstrate their commitment to water resource protection, have a presumption of compliance with state water quality standards, and are eligible for technical and financial assistance toward meeting water resource protection goals.

Industrial/Commercial/Institutional Self-Supply

In the LWC Planning Area, the ICI Self-Supply use category includes citrus and sugar processing plants, and rock mines. The projected demand for this category is estimated to be 35.3 MGD by 2030, which is no change from current demands. This user group is not expected to exceed the high volume demands experienced in 2005. Many of these water users are supplied by PWS utilities. Other users are self-supplied because they are located away from PWS lines, and/or their use is under 0.1 MGD. Estimates in this plan update include larger self-supplied users, most of which have historically relied on fresh groundwater and, to a limited extent, fresh surface water.

The ICI Self-Supply use category has sufficient supply to meet future needs. Although fresh groundwater supplies are generally considered adequate to meet the relatively small new demands projected for this use category, alternative water supply options should be considered based on location and local conditions. If reclaimed water is available to meet existing and new industrial, commercial, and institutional water demands, the feasibility of such opportunities will be evaluated through consumptive use permitting.

Recreational/Landscape Self-Supply

The REC Self-Supply category includes irrigation for large landscaped areas, such as parks, golf courses, community common areas, and cemeteries. Historically, irrigation supplies for this category include local fresh groundwater and surface water captured from canals or ponds in stormwater management systems. In recent years, irrigation for new golf courses often includes reclaimed water and on-site blending of brackish groundwater with surface water, which satisfies consumptive use permit requirements and meets demands. In the LWC Planning Area, REC Self-Supply gross demand is projected to increase from 130.1 MGD in 2010 to 188.5 MGD in 2030.

Golf Course – Lower West Coast

The projected increase in growth for this category is expected to be met, for the most part, by currently proposed reclaimed water projects. In the LWC Planning Area, reclaimed water is used to irrigate large landscaped areas, such as golf courses, parks, and cemeteries, as well as residential and commercial parcels. Projects submitted by utilities and wastewater treatment facilities specify that significant additional reclaimed water will be made available in the future. Expanded wastewater treatment capacity is expected to add 46.5 MGD of reclaimed water by 2030. The additional supply may also provide an opportunity to

allow current irrigation to change from fresh water to reclaimed water. Where reclaimed water is not available, users may qualify for limited freshwater withdrawals on an application-by-application basis.

Power Generation Self-Supply

The Power Generation (PWR) Self-Supply water use category is projected to increase from 0.5 MGD in 2010 to 42.1 MGD in 2030. Florida Power & Light (FPL) may potentially expand its Fort Myers Plant facilities. FPL utilizes an assessment method incorporating generation and cooling technologies most appropriate for site-specific conditions, including water supply and wastewater disposal. The different technologies may require and utilize traditional and alternative water sources. Presently, cooling water for this facility is supplied primarily through an intake located on the Caloosahatchee River (C-43 Canal). The primary sources of water for a possible plant expansion may include traditional or alternative water sources such as captured excess stormwater, surface water, brackish water from the FAS, and reclaimed water. Because the availability of fresh water is limited in the LWC Planning Area, alternative water sources may be the most feasible options for meeting future PWR Self-Supply use.

COORDINATION BETWEEN WATER SUPPLY PLANNING AND CONSUMPTIVE USE PERMITTING

The development and implementation of regional water supply plans at the SFWMD is done in close coordination with several units of the agency. In particular, the consumptive use permitting and intergovernmental coordination play key roles in the water supply plan process. Representatives of other units across the SFWMD serve as members of internal teams established for updating the water supply plans every five years. Meetings to identify and resolve issues related to water supply planning and permitting are held regularly throughout the year.

The importance of this coordination was underscored when the Florida Department of Environmental Protection (FDEP) issued a memorandum to the water management district's on March 23, 2012 providing guidance on improving linkages between regional water supply plans and consumptive use permitting. Key objectives in the memorandum included ensuring that water supply projects incorporated into regional water supply plans have a likelihood of being permittable and that staff would be knowledgeable of these projects and facilitate permitting.

Proposed projects are reviewed before inclusion in a water supply plan, but they are not analyzed at a level of detail necessary to determine if a project can meet all conditions for issuance of a consumptive use permit. Applications for new or expanded consumptive use allocations are still reviewed on an application-by-application basis in the consumptive use permitting process. The water management districts were directed to improve coordination between permitting and planning staff, and ensure planning staff know permit criteria

while permitting staff are knowledgeable of the recommended projects contained in the plans. Planning staff already participate in permit application reviews and provide input on population and demand projects, reuse and water conservation programs, and other aspects of the permitting process.

The SFWMD began implementation of the memorandum immediately by documenting the planning-level criteria used to screen proposed water supply projects for regional water supply plans and establishing a more formal coordination process between permitting and planning staff. Permitting staff has also taken on a more formal and better defined role in screening proposed water supply projects for inclusion in water supply plans.

All proposed projects considered for this plan update were reviewed by staff from Water Use Permitting and Water Supply Development using the following set of questions:

- Does the project propose use of a source of limited availability?
- Is the project located in a Restricted Allocation Area?
- Is the proposed source a MFL water body or is it connected, directly or indirectly, to a MFL water body? If yes, is the proposed use consistent with MFL recovery or prevention strategies?
- What other environmental water needs (e.g., Comprehensive Everglades Restoration Plan [CERP] targets and Water Reservations) may be impacted?
- What resource issues have been identified in recent permit applications in the general area for same source (e.g., wetlands, saltwater intrusion, and MFLs)?
- Have there been resource-related compliance issues of existing legal users of same source?
- Are there any new technical studies related to source availability?

Based on the planning-level screening, water supply projects are recommended in this plan to meet the demands projected for 2030 and generally have a likelihood of being permittable. If the screening process suggests that a new project may be less likely to be permitted due to resource constraints, the SFWMD may propose an alternative project in recognition that the more detailed, permit-level analysis may not result in full allocation needed to meet the applicant's demand.

FUNDING

Funding for water supply development and water conservation at the local level is the shared responsibility of water suppliers and users. The State of Florida and the water management districts have provided funding assistance to local water users developing alternative water supplies and measurable water conservation programs. In most cases, funding is allocated to projects included in a region's water supply plan update. Some projects not in this plan update, but consistent with the plan's goals, may also be funded. When the SFWMD deems it appropriate, a plan update may specifically identify the need for multijurisdictional approaches to project options based on analysis, financial and technical

feasibility, and feasibility of permitting. The SFWMD provides funding for alternative water supply and measurable water conservation through its Alternative Water Supply Funding and Water Savings Incentive Program (WaterSIP) programs. An alternative water supply project or water conservation project identified in this plan update makes that project eligible for future funding, although funding is not guaranteed. An application must be submitted and processed for the determination of an award.

Alternative Water Supply Funding Program

Alternative water supply sources in the LWC Planning Area include brackish water from the FAS, reclaimed water (treated wastewater), excess storm water during the rainy season, sources made available through the creation of new storage capacity, and any other sources designated as non-traditional. In addition, water conservation projects that result in quantifiable water savings are eligible for funding.

For the 2007–2012 period, the SFWMD, in cooperation with the State of Florida, provided more than $123 million in alternative water supply funding for 212 projects, with 78 projects occurring in the LWC Planning Area.

Between FY 2007 and FY 2012, water supply development projects funded by the Alternative Water Supply Funding Program in the LWC Planning Area have created a total of 104 MGD of new water capacity. The new sources of this water include 37 MGD of brackish water, 33 MGD of reclaimed water, 16 MGD of Hawthorn aquifer water, 3 MGD of ASR water, and 15 MGD of surface/storm water and other projects.

Water Savings Incentive Program

As described in **Chapter 5**, the WaterSIP provides 50-50 cost-share funding for implementation of water savings projects that reduce urban water use. The SFWMD provides matching funds up to $50,000 to water providers and users (i.e., cities, utilities, industrial groups, schools, hospitals, and homeowners associations) for water saving technologies. These technologies include low flow plumbing fixtures, rain sensors, fire hydrant flushing devices, and other hardware. Between FY 2007 and FY 2012, the SFWMD awarded $627,456 for 23 LWC Planning Area WaterSIP projects, representing a projected savings of 178 million gallons per year (MGY) (see **Chapter 4** and **Appendix E** of this plan update for more information).

SUMMARY

Meeting the projected increase in net water demand in the LWC Planning Area during the next 20 years requires continued emphasis on water supply development of brackish groundwater resources, reclaimed water, seasonally available surface water, and water conservation. Developing additional storage, such as ASR, is also critical to improve access

to seasonal supplies for future needs. Large-scale projects are needed to facilitate development of seasonal water supplies.

Population growth over the next 20 years will significantly increase the region's PWS demands, particularly within the urban sector. During this period, the PWS use category projects a 46 percent increase in net demand. The AGR Self-Supply category projects an increase in gross demand of 10–18 percent.

Fresh groundwater and surface water supplies are not adequate to meet all projected demands. The Lake Okeechobee Service Area is designated as a Restricted Allocation Area, which limits proposed use of surface water from Lake Okeechobee and hydraulically connected canals, such as the Caloosahatchee River (C-43 Canal). Although development of groundwater and surface water may be practicable in some areas, permitting new freshwater supplies will depend on local resource conditions.

To meet projected water demands, more than 36 new PWS multi-phased projects were evaluated for this plan update. The proposed potable drinking water supply development projects (**Table 26**) will potentially create 78.8 MGD of new water treatment capacity to meet the PWS net demand of 192.0 MGD, exceeding the 62.9 MGD of net potable water needed from 2010 to 2030 to meet PWS demand. The proposed design capacity includes the need for peak demands, backup capacity, and operational capacity of the treatment facility. Most water supply development options require significant upfront investments and ongoing maintenance costs. Individual utilities may find that a component of future water needs can be met in a more immediate and cost-effective way through a demand management program or reclaimed water project.

DSS gross demand is projected to increase 27 percent by 2030. Declining water levels in northern Cape Coral and Lehigh Acres, and the additional development of DSS wells, calls for the extension of public water service to these areas.

AGR Self-Supply gross demand is dependent on citrus transitional lands returning to production and any changes in crops that have different irrigation needs. Therefore, the AGR Self-Supply gross demand projection for 2030 is a range. It is expected to increase 10–18 percent. Traditional fresh surface water and groundwater sources are generally expected to be sufficient to meet this AGR Self-Supply projected increase in average rainfall years, but not during a 1-and-10 year drought. Additionally, some local conditions limit the volume of available fresh water. Agricultural users, as well as all water users, should investigate and implement alternative water supplies in basins where water availability is limited.

ICI Self-Supply demand is expected to remain stable. Water use in this category typically has a recycling component, which should continue and gain efficiency to reduce water demands in the future.

REC Self-Supply is another high growth water use category. Gross demand is projected to increase by 45 percent for this use category by the end of the 20-year planning horizon. Future water needs are expected to be met primarily by developing and using reclaimed

water systems, and blending surface water and brackish groundwater. Conservation methods using more efficient irrigation systems and Florida-Friendly Landscaping™ plants offer potential cost savings by reducing demands for water.

PWR Self-Supply needs are projected to increase significantly with the potential development of additional power generation at the Fort Myers Power Plant. Meeting the water needs for the new facility requires additional water source options, such as brackish groundwater or reclaimed water.

PUBLIC WATER SUPPLY UTILITY SUMMARIES

This section includes utility summaries for all the PWS utilities that provide potable water greater than 0.1 MGD for the LWC Planning Area. In May 2012, SFWMD staff updated the utility summaries by querying the FDEP website for both drinking water capacity (FDEP 2011) and reclaimed water capacity (FDEP 2010b). In addition, the proposed projects were updated with information supplied to the SFWMD in the statute-required November 2011 utility reports and from direct contact with the utilities during May–July 2012.

Potential future water conservation savings are not included in the following utility summaries unless a specific project is identified by the utility. **Chapter 4** of this plan update addresses conservation and potential water savings.

TOWN AND COUNTRY UTILITIES COMPANY

County: Charlotte County
Service Area: Unincorporated Charlotte County in the Babcock Ranch Special Development District

Description: Potable water supplies consist of 100 percent fresh groundwater from the Sandstone aquifer system and are projected to remain the same in the future.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	0.00	5,828	13,948
Per Capita (gallons per day [GPD] finished water)	0.00	100	100
Potable Water Demands (daily average annual finished water in MGD)	**0.00**	**0.58**	**1.39**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	**Permit Number 08-00122-W (expires 2017)**
IAS	0.43
Total Allocation	**0.43**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	**2012**	**2020**	**2030**
SAS	0.00	0.00	0.00
IAS	0.50	1.25	4.00
FAS	0.00	0.00	0.00
Total Capacity	**0.50**	**1.25**	**4.00**
NON-POTABLE WATER			
Reclaimed Water	0.20	0.20	0.20

PROJECTS SUMMARY				
Water Supply Projects	**Source**	**Total Capital Cost ($ Million)**	**Projected Cumulative Design Capacity (MGD) 2020**	**2030**
Potable Water				
0.75-MGD Expansion of Water Treatment Facility from 0.5 MGD to 1.25 MGD (2018)	Fresh Water	$7.0	0.75	0.75
1.25-MGD Expansion of Water Treatment Facility from 1.25 MGD to 2.5 MGD (2021)	Fresh Water	$8.0	0.00	1.25
1.5-MGD Expansion of Water Treatment Facility from 2.5 MGD to 4.0 MGD (2026)	Fresh Water	$11.0	0.00	1.50
Total Potable Water		**$26.0**	**0.75**	**3.50**
Non-potable Water				
0.8-MGD Expansion of Wastewater Treatment Facility from 0.2 MGD (2015) to 1.0 MGD (2018)	Reclaimed	$6.0	0.80	0.80
1.0-MGD Expansion of Wastewater Treatment Facility from 1.0 to 2.0 MGD (2021)	Reclaimed	$8.0	0.00	1.00
1.5-MGD Expansion of Wastewater Treatment Facility from 2.0 MGD to 3.5 MGD (2026)	Reclaimed	$12.0	0.00	1.50
Total Non-potable Water		**$26.0**	**0.80**	**3.30**
Total New Water		**$52.0**	**1.55**	**6.80**

Note: Original franchised area modified by the transfer of ownership to the State of Florida to include only the proposed Babcock Ranch Project.

AVE MARIA UTILITY COMPANY

County: Collier County
Service Area: Portion of unincorporated Collier County serving Ave Maria

Description: Potable water supplies consist of 100 percent fresh groundwater from the Lower Tamiami aquifer and are projected to be 61 percent fresh groundwater and 39 percent brackish water supplies in the future. This utility is reusing 100 percent (0.14 MGD) of its wastewater and 1.38 MGD with supplementations.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	1,435	4,850	16,378
Per Capita (GPD finished water)	121	121	121
Potable Water Demands (daily average annual finished water in MGD)	**0.17**	**0.59**	**1.98**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	**Permit Number 11-02298-W (expires 2017)**
SAS	1.02
Total Allocation	**1.02**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	**2012**	**2020**	**2030**
SAS	0.99	2.69	2.69
IAS	0.00	0.00	0.00
FAS	0.00	1.70	1.70
Total Capacity	**0.99**	**4.39**	**4.39**
NON-POTABLE WATER			
Reclaimed Water	0.90	3.90	5.20

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	**Source**	**Total Capital Cost ($ Million)**	**2020**	**2030**
Potable Water				
1.7-MGD Fresh and 1.7-MGD Brackish Water Treatment Facility Expansion	Fresh Water/ Brackish	$20.5	1.70	3.40
Total Potable Water		**$20.5**	**3.40**	**3.40**
Non-potable Water				
4.3-MGD Phase Expansion of Wastewater Treatment Facility	Reclaimed	$17.0	3.00	4.30
Total Non-potable Water		**$17.0**	**3.00**	**4.30**
Total New Water		**$37.5**	**6.40**	**7.70**

COLLIER COUNTY WATER-SEWER DISTRICT

County: Collier County
Service Area: Portions of unincorporated Collier County is served including Goodland and Golden Gate Estates, and a small portion of City of Naples, and Orange Tree in 2013

Description: Potable water supplies consist of 41 percent fresh groundwater and 59 percent brackish groundwater and are projected to be 38 percent fresh groundwater and 62 percent brackish water supplies in the future. This utility is reusing 86 percent (12.28 MGD) of its wastewater (FDEP 2010b) and has reused 92 percent of its wastewater over the past five years (2007–2011).

Bulk water: Provides potable water supply to Marco Shores in the City of Marco Island, and receives potable water supply from Marco Island Utilities for unincorporated Key Marco and Goodland.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	164,933	195,601	232,197
Per Capita (GPD finished water)	176	176	176
Potable Water Demands (daily average annual finished water in MGD)	**29.00**	**34.40**	**40.90**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	Permit Number 11-00249-W (expires 2026)
SAS	26.50
IAS	16.00
FAS	10.00
Total Allocation	**56.14**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	24.00	24.00	24.00
IAS	0.00	0.00	0.00
FAS	28.00	28.00	40.00
Total Capacity	**52.00**	**52.00**	**64.00**
NON-POTABLE WATER			
Reclaimed Water	40.10	42.60	42.60

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	Source	Total Capital Cost ($ Million)	2020	2030
Potable Water				
Construct 10.0-MGD Northeast County RO Water Treatment Facility (including Floridan wells) (2024)	Brackish	$120.0	0.00	10.00
2.0-MGD Expansion of North County Regional High Pressure RO Train (2030)	Brackish	$9.0	0.00	2.00
Total Potable Water		**$129.0**	**000**	**12.00**
Non-potable Water				
ASR (2013–2015)	Reclaimed	$5.0	2.50	2.50
Total New Water		**$134.0**	**2.50**	**14.50**

Notes: Franchise area of Orange Tree Utility Company is planned to be added to the county's service area in 2013. Pelican Bay Reclamation Facility (1.2MGD) was decommissioned in 2005. Collier County Water-Sewer District supplements their reclaimed water with fresh water from SFWMD permit number 11-00052-W and allocates 1.65 MGD from the Tamiami aquifer and 3.5 MGD from the water table aquifer.

CITY OF EVERGLADES

County: Collier County
Service Area: Everglades City and portions of unincorporated Collier County serving Plantation Island and Seaboard Village in Copeland

Description: Potable water supplies consist of 100 percent fresh groundwater and are projected to remain the same in the future. This utility is reusing 28 percent (0.07 MGD) of its wastewater that is reclaimed through a rapid infiltration basin.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	1,523	1,715	1,929
Per Capita (GPD finished water)	167	167	167
Potable Water Demands (daily average annual finished water in MGD)	**0.25**	**0.29**	**0.32**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	**Permit Number 11-00160-W (expired 2008, currently under review)**
SAS	0.29
Total Allocation	**0.29**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	**2012**	**2020**	**2030**
SAS	0.50	0.50	0.50
IAS	0.00	0.00	0.00
FAS	0.00	0.00	0.00
Total Capacity	**0.50**	**0.50**	**0.50**
NON-POTABLE WATER			
Reclaimed Water	0.16	0.16	0.16

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	**Source**	**Total Capital Cost ($ Million)**	**2020**	**2030**
No projects	-	-	-	-

FLORIDA GOVERNMENTAL UTILITY AUTHORITY (FGUA)-GOLDEN GATE

County: Collier County
Service Area: Portion of unincorporated Collier County serving Golden Gate

Description: Potable water supplies consist of 100 percent fresh groundwater and are projected to remain the same in the future. This utility is reusing 43 percent (1.2 MGD) of its wastewater that is reclaimed through a rapid infiltration basin.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	27,890	29,727	31,711
Per Capita (GPD finished water)	54	54	54
Potable Water Demands (daily average annual finished water in MGD)	**1.51**	**1.61**	**1.71**
SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)			
Potable Water Source	**Permit Number 11-00148-W (expires 2030)**		
SAS	3.42		
Total Allocation	**3.42**		
POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	**2012**	**2020**	**2030**
SAS	2.10	2.40	2.40
IAS	0.00	0.00	0.00
FAS	0.00	0.00	0.00
Total Capacity	**2.10**	**2.40**	**2.40**
NON-POTABLE WATER			
Reclaimed Water	1.50	1.50	1.50

PROJECTS SUMMARY				
		Total Capital Cost	Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	**Source**	**($ Million)**	**2020**	**2030**
Potable Water				
0.3-MGD Expansion of Fresh Water Treatment Facility (with RO Treatment) and SAS wells, Phase 4	Fresh Water	$1.9	0.30	0.30
Total Potable Water		**$1.9**	**0.30**	**0.30**
Non-potable Water				
No projects	-	-	-	-
Total New Water		**$1.9**	**0.30**	**0.30**

Note: Combined RO and lime softening treatment, 1.1 MGD and 1.3 MGD, respectively, due to poor water quality.

IMMOKALEE WATER AND SEWER DISTRICT

County: Collier County
Service Area: Portion of unincorporated Collier County serving Immokalee

Description: Potable water supplies consist of 100 percent fresh groundwater from the Lower Tamiami aquifer and are projected to to be 65 percent fresh groundwater and 35 percent brackish water supplies in the future. This utility is reusing 36 percent (0.54 MGD) of its wastewater through a spray field.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	27,273	30,426	33,947
Per Capita (GPD finished water)	95	95	95
Potable Water Demands (daily average annual finished water in MGD)	**2.59**	**2.89**	**3.22**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	**Permit Number 11-00013-W (expires 2031)**
SAS	3.45
FAS	0.70
Total Allocation	**4.15**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	**2012**	**2020**	**2030**
SAS	5.60	5.60	5.60
IAS	0.00	0.00	0.00
FAS	0.00	0.00	3.00
Total Capacity	**5.60**	**5.60**	**8.60**
NON-POTABLE WATER			
Reclaimed Water	2.50	5.50	5.50

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	**Source**	**Total Capital Cost ($ Million)**	**2020**	**2030**
Potable Water				
2.5-MGD RO Water Treatment Facility and Floridan Wells (2020)	Brackish	$10.0	2.50	2.50
Total Potable Water		**$10.0**	**2.50**	**2.50**
Non-potable Water				
3.0-MGD Wastewater Treatment Facility (2013)	Reclaimed	$2.0	3.00	3.00
Total Non-potable Water		**$2.0**	**3.00**	**3.00**
Total New Water		**$12.0**	**5.50**	**5.50**

Note: Wastewater treatment facilities require improvements before public access irrigation is possible.

MARCO ISLAND UTILITIES

County: Collier County
Service Area: City of Marco Island, including Key Marco, and a portion of unincorporated Collier County serving Goodland

Description: Potable water supplies consist of 53 percent surface water from the Henderson Creek/Marco Lakes ASR System, and 47 percent IAS groundwater from the Mid-Hawthorn aquifer and is projected to be 63 percent surface water and 37 percent brackish water in the future. This utility is reusing 82 percent (1.55 MGD) of its wastewater that is reclaimed through a rapid infiltration basin and public access irrigation.

Bulk water: Marco Island Utilities provides potable water to unincorporated Goodland and Key Marco in Collier County. Marco Island Utilities receives potable water from Collier County Water-Sewer District to serve Marco Shores.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population[a]	19,424	19,560	19,707
Per Capita (GPD finished water)	428	428	428
Potable Water Demands (daily average annual finished water in MGD)	**8.31**	**8.37**	**8.43**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	Permit Number 11-00080-W (expires 2016)
SAS	4.38
IAS	4.00
FAS	4.38
Total Allocation	**12.43**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	6.70	10.03	10.03
IAS	6.00	6.00	6.00
FAS	0.00	0.00	0.00
Total Capacity	**12.70**	**16.03**	**16.03**
NON-POTABLE WATER			
Reclaimed Water	3.80	4.10	4.10

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	Source	Total Capital Cost ($ Million)	2020	2030
Potable Water				
3.3-MGD North Water Treatment Facility Expansion with Two Pall Membrane Trains Followed by Replacement of Lime Softening System with Low Pressure RO	Fresh	$10.0	3.33	3.33
Total Potable Water		**$10.0**	**3.33**	**3.33**
Non-potable Water				
Marco Island Wastewater Treatment Facility (existing capacity 4.92 MGD) Two Pipeline Extensions (Club Marco and West Elkcam)[b]	Reclaimed	$6.2	0.00	0.00
0.3-MGD Expansion of Marco Shores Wastewater Treatment Facility	Reclaimed	$1.6	0.30	0.30
Total Non-potable Water		**$7.8**	**0.30**	**0.30**
Total New Water		**$17.8**	**3.63**	**3.63**

a. Does not include a large seasonal population.
b. Not included as new treatment capacity.

CITY OF NAPLES UTILITY DEPARTMENT

County: Collier County
Service Area: City of Naples and portion of Collier County serving unincorporated East Naples

Description: Potable water supplies consist of 100 percent fresh groundwater from the Lower Tamiami aquifer and is projected to remain the same in the future. This utility is reusing 71 percent (4.65 MGD) of its wastewater that is reclaimed through public access irrigation.

Additions: Provides potable water to serve East Naples in unincorporated Collier County, which accounts for 56 percent of the total area served.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	66,645	70,123	73,348
Per Capita (GPD finished water)	260	260	260
Potable Water Demands (daily average annual finished water in MGD)	**17.33**	**18.23**	**19.09**
SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)			
Potable Water Source	**Permit Number 11-00017-W (expires 2030)**		
SAS	18.42		
Total Allocation	**18.42**		
POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	30.00	30.00	30.00
IAS	0.00	0.00	0.00
FAS	0.00	0.00	0.00
Total Capacity	**30.00**	**30.00**	**30.00**
NON-POTABLE WATER			
Reclaimed	10.00	10.00	10.00
Surface Water	0.00	10.00	10.00
ASR Wells	0.00	4.00	4.00
Total Capacity	**10.00**	**24.00**	**24.00**

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	**Source**	**Total Capital Cost ($ Million)**	**2020**	**2030**
Potable Water				
No projects	-	-	-	-
Total Potable Water	-	-	-	-
Non-potable Water				
Construct 4.0-MGD ASR Wells to Supplement Reclaimed Water During Dry Season with Surface and/or Reclaimed Water	ASR	$6.0	4.00	4.00
Construct 10.0-MGD Pump Station and Transmission Main from Golden Gate Canal to Wastewater Treatment Facility	Surface	$5.5	10.00	10.00
Total Non-potable Water		**$11.5**	**14.00**	**14.00**
Total New Water		**$11.5**	**14.00**	**14.00**

ORANGE TREE UTILITY COMPANY

County: Collier County
Service Area: Portion of unincorporated Collier County serving Orange Tree

Description: Potable water supplies consist of 100 percent fresh groundwater from the Lower Tamiami aquifer.

Additions: Collier County Water-Sewer District plans to add this franchise area in 2013.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	1,261	0	0
Per Capita (GPD finished water)	238	0	0
Potable Water Demands (daily average annual finished water in MGD)	**0.30**	**0.00**	**0.00**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	Permit Number 11-00419-W (expired 2009, currently under review)
SAS	1.30
Total Allocation	**1.30**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	0.75	0.75[a]	0.75
IAS	0.00	0.00	0.00
FAS	0.00	0.00	0.00
Total Capacity	**0.75**	**0.75**	**0.75**
NON-POTABLE WATER			
Reclaimed Water	0.40	0.40	0.40

PROJECTS SUMMARY				
Water Supply Projects	Source	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD) 2020	2030
No projects	-	-	-	-

a. Capacity will be added to Collier County Water-Sewer District.

PORT OF THE ISLANDS COMMUNITY IMPROVEMENT DISTRICT

County: Collier County
Service Area: Portion of unincorporated Collier County serving the Port of the Islands

Description: Potable water supplies consist of 100 percent fresh groundwater from the SAS and is projected to remain the same in the future. This utility is reusing 100 percent (0.05 MGD and 0.19 MGD with supplementation) of its wastewater that is reclaimed through public access irrigation.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	568	682	819
Per Capita (GPD finished water)	174	174	174
Potable Water Demands (daily average annual finished water in MGD)	**0.10**	**0.12**	**0.14**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	Permit Number 11-00372-W (expires 2029)
SAS	0.55
Total Allocation	**0.55**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	0.44	0.44	0.44
IAS	0.00	0.00	0.00
FAS	0.00	0.00	0.00
Total Capacity	**0.44**	**0.44**	**0.44**
NON-POTABLE WATER			
Reclaimed Water	0.20	0.20	0.20

PROJECTS SUMMARY				
		Total Capital Cost	Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	Source	($ Million)	2020	2030
No projects	-	-	-	-

MOORE HAVEN UTILITIES

County: Glades County
Service Area: City of Moore Haven and unincorporated Glades County

Description: Potable water supplies consist of 100 percent fresh groundwater from the SAS and is projected to remain the same in the future. Wastewater use not reported in the FDEP inventory.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	2,927	3,721	4,735
Per Capita (GPD finished water)	140	140	140
Potable Water Demands (daily average annual finished water in MGD)	**0.41**	**0.52**	**0.66**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	**Permit Number 22-00045-W (expires 2028)**
SAS	0.89
Total Allocation	**0.89**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	**2012**	**2020**	**2030**
SAS	0.96	0.96	0.96
IAS	0.00	0.00	0.00
FAS	0.00	0.00	0.00
Total Capacity	**0.96**	**0.96**	**0.96**
NON-POTABLE WATER			
Reclaimed Water	0.20	0.20	0.20

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	**Source**	**Total Capital Cost ($ Million)**	**2020**	**2030**
No projects	-	-	-	-

CLEWISTON UTILITIES

County: Hendry County
Service Area: City of Clewiston and portions of unincorporated Hendry and Glades counties

Description: Potable water supplies consist of 100 percent brackish groundwater from the FAS and is projected to remain the same in the future. This utility is reusing 100 percent (1.18 MGD) of its wastewater that is reclaimed through a spray field and two rapid infiltration basins.

Bulk water: Provides potable water to South Shore Water Association, serving Harlem and Airglades Airport.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	15,287	15,618	16,001
Per Capita (GPD finished water)	104	104	104
Potable Water Demands (daily average annual finished water in MGD)	**1.59**	**1.62**	**1.66**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	Permit Number 26-00769-W (expires 2025)
FAS	2.58
Total Allocation	**2.58**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	0.00	0.00	0.00
IAS	0.00	0.00	0.00
FAS	3.00	3.00	3.00
Total Capacity	**3.00**	**3.00**	**3.00**
NON-POTABLE WATER			
Reclaimed Water	1.50	2.25	2.25

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	Source	Total Capital Cost ($ Million)	2020	2030
Potable Water				
No projects	-	-	-	-
Total Potable Water	-	-	-	-
Non-potable Water				
0.75-MGD Water Treatment Facility for Public Access Irrigation (Golf Course) (2014)	Reclaimed	$1.5	0.75	0.75
Total Non-potable Water		**$1.5**	**0.75**	**0.75**
Total New Water		**$1.5**	**0.75**	**0.75**

Note: No longer associated with U.S. Sugar Corporation (Consumptive Use Permit 26-00024-W).

HENDRY COUNTY CORRECTIONAL INSTITUTION
FLORIDA DEPARTMENT OF CORRECTIONS

County: Hendry County
Service Area: Portion of unincorporated Hendry County serving Hendry County Correctional Institution

Description: Potable water supplies consist of 100 percent fresh groundwater from the SAS and is projected to go to nothing in the future. This utility is reusing 100 percent (0.24 MGD) of its wastewater that is reclaimed through a spray field and two rapid infiltration basins.

In 2010, this institution's average inmate population was 1,450. This correctional facility closed in June 2011 and the work camp (350 people) is projected to close in July 2012.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	0	0	0
Per Capita (GPD finished water)	not applicable	not applicable	not applicable
Potable Water Demands (daily average annual finished water in MGD)	0.25	0.25	0.25

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	Permit Number 26-00164-W (expires 2031)
SAS	0.07
Total Allocation	**0.07**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	0.60	0.60	0.60
IAS	0.00	0.00	0.00
FAS	0.00	0.00	0.00
Total Capacity	**0.60**	**0.60**	**0.60**
NON-POTABLE WATER			
Reclaimed Water	0.36	0.36	0.36

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	Source	Total Capital Cost ($ Million)	2020	2030
No projects	-	-	-	-

CITY OF LABELLE DEPARTMENT OF PUBLIC WORKS

County: Hendry County
Service Area: City of LaBelle and a portion of unincorporated Hendry County

Description: Potable water supplies consist of 100 percent fresh groundwater from the SAS and is projected to be 40 percent fresh water and 60 percent brackish water in the future. This utility is reusing 100 percent (0.33 MGD) of its wastewater that is reclaimed through an infiltration basin.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	5,804	6,298	6,831
Per Capita (GPD finished water)	124	124	124
Potable Water Demands (daily average annual finished water in MGD)	**0.72**	**0.78**	**0.85**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	Permit Number 26-00105-W (expires 2031)
SAS	0.93
FAS	0.12
Total Allocation	**1.06**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	1.00	1.00	1.00
IAS	0.00	0.00	0.00
FAS	0.00	1.50	1.50
Total Capacity	**1.00**	**2.50**	**2.50**
NON-POTABLE WATER			
Reclaimed Water	0.75	1.05	1.05

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	Source	Total Capital Cost ($ Million)	2020	2030
Potable Water				
Construct 1.5-MGD RO Water Treatment Facility and FAS (Lower Hawthorn) Wells (2011–2013)	Brackish	$18.0	1.50	1.50
Total Potable Water		**$18.0**	**1.50**	**1.50**
Non-potable Water				
0.3-MGD Wastewater Treatment Facility Expansion	Reclaimed	$4.0	0.30	0.30
Total Non-potable Water		$4.0	0.30	0.30
Total New Water		**$22.0**	**1.80**	**1.80**

Notes: Potable water previously purchased from Port LaBelle Utility System of Hendry County has been discontinued. Potable water treatment facility is adding membrane treatment to keep current treatment capacity and to resolve the FDEP Consent Order to replace the plant.

PORT LABELLE UTILITY SYSTEM OF HENDRY COUNTY

County: Hendry County
Service Area: Portions of unincorporated Hendry and Glades counties

Description: Potable water supplies consist of 100 percent fresh groundwater from the Sandstone aquifer system and is projected to remain the same in the future. This utility is reusing 100 percent (0.23 MGD) of its wastewater that is reclaimed through a rapid infiltration basin.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	3,957	5,294	7,084
Per Capita (GPD finished water)	85	85	85
Potable Water Demands (daily average annual finished water in MGD)	**0.34**	**0.45**	**0.60**
SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)			
Potable Water Source	**Permit Number 26-00096-W (expires 2015)**		
IAS	0.56		
Total Allocation	**0.56**		
POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	0.00	0.00	0.00
IAS	0.90	0.90	0.90
FAS	0.00	0.00	0.00
Total Capacity	**0.90**	**0.90**	**0.90**
NON-POTABLE WATER			
Reclaimed Water	0.50	0.50	0.50

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	**Source**	**Total Capital Cost ($ Million)**	**2020**	**2030**
No projects	-	-	-	-

Note: Bulk potable water sales to the City of LaBelle have been discontinued.

BONITA SPRINGS UTILITIES

County: Lee County
Service Area: City of Bonita Springs and a portion of unincorporated Lee County serving Estero

Description: Potable water supplies consist of 58 percent fresh water from the Lower Tamiami aquifer and 42 percent brackish groundwater from the FAS and is projected to be 48 percent fresh water and 52 percent brackish water in the future. This utility is reusing 99 percent (3.88 MGD) of its wastewater that is reclaimed through public access irrigation (7.20 MGD).

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population[a]	50,866	66,849	87,845
Per Capita (GPD finished water)	199	199	199
Potable Water Demands (daily average annual finished water in MGD)	**10.12**	**13.30**	**17.48**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)		
Potable Water Source	Permit Number 36-00008-W (expires 2027)	Permit Number 36-04062-W (expires 2021)
SAS[b]	5.74	0.00
FAS	0.00	13.07
Total Allocation	**5.74**	**13.07**
Total Permitted Allocation	**18.81**	

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	9.00	9.00	9.00
IAS	0.00	0.00	0.00
FAS	6.60	9.60	9.60
Total Capacity	**15.60**	**18.60**	**18.60**
NON-POTABLE WATER			
Reclaimed Water[c]	11.00	11.00	11.00

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	Source	Total Capital Cost ($ Million)	2020	2030
Potable Water				
3.0-MGD Water Treatment Facility RO Expansion, Phase 2 (2020)	Brackish	$30.0	3.00	3.00
Total Potable Water		**$30.0**	**3.00**	**3.00**
Non-potable Water				
No projects	-	-	-	-
Total New Water		**$30.0**	**3.00**	**3.00**

a. Does not include a large seasonal population.
b. Limitations on source (Lower Tamiami aquifer).
c. All reclaimed water is supplied to Resource Conservation Services.
Note: Bonita Springs Utility has two-way interconnects in place for Lee and Collier counties. Other than testing purposes, the interconnects have not been utilized since 2008.

CAPE CORAL UTILITIES

County: Lee County
Service Area: City of Cape Coral

Description: Potable water supplies consist of 100 percent brackish groundwater from the FAS. This utility is reusing 99 percent of its wastewater that is reclaimed through public access irrigation (23.39 MGD).

Bulk water: Provides potable water to Greater Pine Island Water Association as needed.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	136,694	199,249	290,717
Per Capita (GPD finished water)	101	101	101
Potable Water Demands (daily average annual finished water in MGD)	**13.81**	**20.12**	**29.36**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	Permit Number 36-00046-W (expires 2029)
FAS	39.25
Total Allocation	**39.25**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	0.00	0.00	0.00
IAS	0.00	0.00	0.00
FAS	30.00	54.00	54.00
Total Capacity	**30.00**	**54.00**	**54.00**
NON-POTABLE WATER			
Reclaimed	20.00	20.00	20.00
Canal system	0.00	1.80	1.80
Total Capacity	**20.00**	**21.80**	**21.80**

PROJECTS SUMMARY				
Water Supply Projects	Source	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD) 2020	2030
Potable Water				
24.0-MGD Expansion of the North RO Water Treatment Facility, Expansion from 12 MGD to 36 MGD, Phase 1	Brackish	$134.0	24.00	24.00
Total Potable Water		**$134.0**	**24.00**	**24.00**
Non-potable Water				
1.8-MGD Canal Weir Improvements	Surface	$3.5	1.80	1.80
Total Non-potable Water		**$3.5**	**1.80**	**1.80**
Total New Water		**$137.5**	**25.80**	**25.80**

Note: The Water Independence for Cape Coral system combines reclaimed water and surface water for irrigation (Consumptive Use Permit 36-00998-W).

CITRUS PARK RV RESORT

County: Lee County
Service Area: Citrus Park located within the City of Bonita Springs

Description: Potable water supplies consist of 100 percent fresh groundwater from the Lower Tamiami aquifer. This utility is reusing 100 percent of its wastewater that is reclaimed through a rapid infiltration basin (0.09 MGD).

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	1,706	1,749	1,795
Per Capita (GPD finished water)	113	113	113
Potable Water Demands (daily average annual finished water in MGD)	**0.19**	**0.20**	**0.20**
SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)			
Potable Water Source	**Permit Number 36-00208-W (expires 2013)**		
SAS[a]	0.21		
Total Allocation	**0.21**		
POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	**2012**	**2020**	**2030**
SAS	0.54	0.54	0.54
IAS	0.00	0.00	0.00
FAS	0.00	0.00	0.00
Total Capacity	**0.54**	**0.54**	**0.54**
NON-POTABLE WATER			
Reclaimed Water	0.20	0.20	0.20

PROJECTS SUMMARY				
		Total Capital Cost	Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	**Source**	**($ Million)**	**2020**	**2030**
No projects	-	-	-	-

a. Source limitation on Lower Tamiami aquifer

FLORIDA GOVERNMENTAL UTILITY AUTHORITY (FGUA)- LAKE FAIRWAYS

County: Lee County
Service Area: A portion of Lee County serving unincorporated North Fort Myers

Description: Potable water supplies consist of 100 percent fresh groundwater from the Mid-Hawthorn aquifer. This utility is reusing 50 percent of its wastewater that is reclaimed through public access irrigation (0.09 MGD).

Additions: Potable water and wastewater treatment is currently provided by the Florida Government Utility Authority (FGUA) – North Fort Myers, which purchased Lake Fairways/Pine Lakes in 2010.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	3,322	0	0
Per Capita (GPD finished water)	57	57	57
Potable Water Demands (daily average annual finished water in MGD)	**0.19**	**0.00**	**0.00**
SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)			
Potable Water Source	**Permit Number 36-00081-W (expires 2025)**		
IAS	0.10		
Total Allocation	**0.10**		
POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	0.00	0.00	0.00
IAS	0.20	0.20	0.20
FAS	0.00	0.00	0.00
Total Capacity	**0.20**	**0.20**	**0.20**
NON-POTABLE WATER			
Reclaimed Water[a]	0.30	0.30	0.30

PROJECTS SUMMARY				
Water Supply Projects	**Source**	**Total Capital Cost ($ Million)**	**Projected Cumulative Design Capacity (MGD) 2020**	**2030**
Potable Water				
No projects	-	-	-	-

a. Reclaimed water available from North Fort Myers Utility.

FLORIDA GOVERNMENT UTILITY AUTHORITY (FGUA)- LEHIGH ACRES

County: Lee County
Service Area: A portion of unincorporated Lee County serving Lehigh Acres

Description: Potable water supplies consist of 100 percent fresh groundwater from the Sandstone aquifer, and are projected to be 27 percent fresh groundwater and 73 percent brackish in the future. This utility is reusing 86 percent of its wastewater that is reclaimed through public access irrigation (1.70 MGD).

Bulk water: FGUA has an interlocal agreement with City of Fort Myers to purchase up to 1.0 MGD in the future and is currently receiving between 0.1 to 0.5 MGD water.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	29,050	53,431	98,298
Per Capita (GPD finished water)	80	80	80
Potable Water Demands (daily average annual finished water in MGD)	**2.32**	**4.27**	**7.86**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	Permit Number 36-00166-W (expires 2014)
SAS	3.30
Total Allocation	**3.30**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	0.00	0.00	0.00
IAS	4.70	4.70	4.701
FAS	0.00	10.00	10.00
Total Capacity	**4.70**	**14.70**	**14.70**
NON-POTABLE WATER			
Reclaimed Water	2.50	2.50	2.50

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	Source	Total Capital Cost ($ Million)	2020	2030
Potable Water				
10.0-MGD Phased Expansion of Mirror Lakes RO Water Treatment Facility including FAS Wells and Distribution Lines (contingent upon growth)	Brackish	$91.0	10.00	10.00
Total Potable Water		**$91.0**	**10.00**	**10.00**
Non-potable Water				
No projects	-	-	-	-
Total New Water		**$91.0**	**10.00**	**10.00**

CITY OF FORT MYERS PUBLIC UTILITY

County: Lee County
Service Area: City of Fort Myers and a few areas in unincorporated Lee County

Description: Potable water supplies consist of 100 percent brackish groundwater from the FAS, and are projected to remain the same in the future. This utility is reusing 45 percent of its wastewater that is reclaimed through public access irrigation (2.56 MGD).

Bulk water: Potable water sold to Florida Government Utility Authority (FGUA) – Lehigh Acres, which may receive up to 1.0 MGD in the future.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	62,964	72,929	84,528
Per Capita (GPD finished water)	133	133	133
Potable Water Demands (daily average annual finished water in MGD)	**8.37**	**9.70**	**11.24**
SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)			
Potable Water Source	**Permit Number 36-00035-W (expires 2020)**		
FAS	11.95		
Total Allocation	**11.95**		
POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	**2012**	**2020**	**2030**
SAS	0.00	0.00	0.00
IAS	0.00	0.00	0.00
FAS	13.00	13.00	13.00
Total Capacity	**13.00**	**13.00**	**13.00**
NON-POTABLE WATER			
Reclaimed Water	11.00	34.00	34.00

PROJECTS SUMMARY				
Water Supply Projects	**Source**	**Total Capital Cost ($ Million)**	**Projected Cumulative Design Capacity (MGD) 2020**	**2030**
Potable Water				
No projects	-	-	-	-
Non-potable Water				
12.0-MGD Expansion of the South Advanced Wastewater Treatment Reclamation Facility (2013)	Reclaimed	$13.2	12.00	12.00
11.0-MGD Upgrades at the Central Advanced Wastewater Treatment Facility (2011–2014)	Reclaimed	$10.0	11.00	11.00
Total Non-potable Water		**$23.2**	**23.00**	**23.00**
Total New Water		**$23.2**	**23.00**	**23.00**

GREATER PINE ISLAND WATER ASSOCIATION

County: Lee County
Service Area: A portion of unincorporated Lee County serving Pine Island and Matlacha, and a portion of Cape Coral

Description: Potable water supplies consist of 100 percent brackish groundwater from the Lower Hawthorn aquifer, and are projected to remain the same in the future. This utility is reusing 100 percent of its wastewater that is reclaimed through a spray field and rapid infiltration basin (0.09 MGD).

Bulk water: Receives potable water from Cape Coral Utilities as needed.

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	13,877	17,781	22,795
Per Capita (GPD finished water)	110	110	110
Potable Water Demands (daily average annual finished water in MGD)	**1.53**	**1.96**	**2.51**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	Permit Number 36-00045-W (expires 2015)
FAS	2.44
Total Allocation	**2.44**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	2012	2020	2030
SAS	0.00	0.00	0.00
IAS	0.00	0.00	0.00
FAS	3.30	3.30	3.30
Total Capacity	**3.30**	**3.30**	**3.30**
NON-POTABLE WATER			
Reclaimed Water	0.25	0.25	0.25

PROJECTS SUMMARY				
			Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	Source	Total Capital Cost ($ Million)	2020	2030
No projects	-	-	-	-

Note: Lee County Utilities provides wastewater service.

ISLAND WATER ASSOCIATION

County: Lee County
Service Area: Sanibel and a portion of unincorporated Lee County serving Captiva

Description: Potable water supplies consist of 100 percent brackish groundwater from the FAS. This utility is reusing 72 percent of its wastewater that is reclaimed through public access irrigation (1.03 MGD).

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population[a]	8,509	9,042	9,605
Per Capita (GPD finished water)	377	377	377
Potable Water Demands (daily average annual finished water in MGD)	**3.21**	**3.41**	**3.62**

SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)	
Potable Water Source	**Permit Number 36-00034-W (expires 2017)**
FAS	4.96
Total Allocation	**4.96**

POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	**2012**	**2020**	**2030**
SAS	0.00	0.00	0.00
IAS	0.00	0.00	0.00
FAS	6.00	6.00	6.00
Total Capacity	**6.00**	**6.00**	**6.00**
NON-POTABLE WATER			
Reclaimed Water	2.38	2.38	2.38

PROJECTS SUMMARY				
		Total Capital Cost	Projected Cumulative Design Capacity (MGD)	
Water Supply Projects	**Source**	**($ Million)**	**2020**	**2030**
No projects	-	-	-	-

a. Does not include a large seasonal population.

Note: City of Sanibel and South Seas Plantation provide wastewater service.

LEE COUNTY UTILITIES

County: Lee County
Service Area: Unincorporated Lee County and some parcels in the City of Fort Myers

Description: Potable water supplies consist of 20-percent brackish groundwater from the FAS, 65 percent fresh water from the SAS and IAS, and 15 percent fresh surface water from the Caloosahatchee River (C-43 Canal). This utility is reusing 82 percent of its wastewater that is reclaimed through public access irrigation (8.35 MGD).

POPULATION AND FINISHED WATER DEMAND (MGD)			
	Existing	Projected	
	2010	2020	2030
Population	233,637	272,484	317,567
Per Capita (GPD finished water)	121	121	121
Potable Water Demands (daily average annual finished water in MGD)	**28.27**	**32.97**	**38.43**
SFWMD CONSUMPTIVE USE PERMITTED ALLOCATION (MGD)[a]			
Potable Water Source	**Permit Number 36-00152-W (expires 2028)**	**Permit Number 36-00003-W (expires 2031)**	**Permit Number 36-00122-W (expires 2014)**
Surface water	0.00	4.43	0.00
SAS	0.25	7.84	2.29
IAS	0.56	10.61	0.74
FAS	9.98	14.21	3.06
Total Allocation	**10.79**	**34.47**	**6.10**
Total Permitted Allocation	**51.36**		
POTABLE WATER TREATMENT CAPACITY			
	Cumulative Facility & Project Capacity (MGD)		
	Existing	Projected	
FDEP Permitted Capacity	**2012**	**2020**	**2030**
SAS	5.00	5.00	5.00
IAS	28.10	28.10	28.10
FAS	14.30	24.30	24.30
Total Capacity	**47.40**	**57.40**	**57.40**
NON-POTABLE WATER			
Reclaimed	21.55	21.55	21.55
ASR	0.00	3.00	3.00
Fresh	0.00	2.60	2.60
Total Capacity	**21.55**	**27.15**	**27.15**

a. Limitations on sources.

Note: Potable water interconnects with the Cities of Cape Coral, Fort Myers, and Bonita Springs for emergency use.

LEE COUNTY UTILITIES (CONTINUED)

PROJECT SUMMARY				
Water Supply Projects	Source	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD) 2020	2030
Potable Water				
Green Meadows Water Treatment Facility RO Expansion (includes FAS wells). (This water treatment facility currently has 9 MGD of freshwater capacity.) (2011–2013)	Brackish	$53.4	5.00	5.00
North Lee County Water Treatment Facility 5.0-MGD RO Expansion from 10.0 MGD to 15.0 MGD (2025)	Brackish	$21.0	0.00	5.00
Olga Water Treatment Facility RO Expansion from 5 MGD to 10 MGD (2025)	Brackish	$40.0	0.00	5.00
Green Meadows ASR Wells for Potable Water – FAS Storage (2018)[a]	Fresh	$21.0	3.40	3.40
Total Potable Water		**$135.4**	**8.40**	**18.40**
Non-potable Water				
Construct the 2.0-MGD West ASR Wells for Reclaimed Water Storage (2018)	ASR	$5.4	2.00	2.00
Construct the 1.0-MGD Gateway Wastewater Treatment Facility ASR Well System for Reclaimed Water Storage (2018)	ASR	$2.5	1.00	1.00
2.6-MGD Three Oaks Irrigation Quality Water Supplemental Reclaimed Supply (2013)	Fresh Water	$0.7	2.60	2.60
Total Non-potable Water		**$8.6**	**5.60**	**5.60**
Total New Water		**$144.0**	**14.00**	**24.00**

a. Not included as new treatment capacity.

7
Future Direction

This chapter summarizes the future direction for water supply in the Lower West Coast (LWC) Planning Area. As this plan update confirms, utilities serving the LWC Planning Area have established or identified water source options to address the water supply needs of the region through at least 2030. This plan update also concludes that the future water demands of the region can continue to be met through the 2030 planning horizon with appropriate management and continued diversification of water supply sources. Several steps are needed to achieve this conclusion:

TOPICS

- Water Sources
- Coordination
- Climate Change
- Conclusion

- Completion of water supply utility projects
- Evaluation of site-specific refinement of groundwater availability
- Completion of the Comprehensive Everglades Restoration Plan (CERP) Caloosahatchee River (C-43) West Basin Storage Reservoir Project.

Any increase in Lake Okeechobee's regulation schedule as a result of the Herbert Hoover Dike repairs by the United States Army Corps of Engineers (USACE) will be evaluated by the USACE through a National Environmental Policy Act analysis. It is anticipated the additional water from Lake Okeechobee as a result of Herbert Hoover Dike repairs and a revised regulation schedule would return the lake to Minimum Flow and Level (MFL) prevention status, enhance the level of certainty to existing permitted users now receiving less than 1-in-10 level of certainty, and support other environmental objectives.

The water supply needs for natural systems are discussed in **Chapter 3** and **Appendices G** and **H** and are considered a limitation on water available for allocation. These water supply needs are addressed through a variety of regulatory mechanisms and projects.

The guidance offered in this chapter should be considered in developing water source options to meet future needs. Statutory requirements, existing conditions, resource constraints (including protection tools and criteria), and the needs of all water users are addressed, with emphasis placed on alternative water supply development, water conservation, and storage for environmental needs. The South Florida Water Management District's (SFWMD's) future direction for water supply planning in the LWC Planning Area also involves coordination between utilities and other water users and monitoring to respond to sea level rise.

The renewal process for irrigation class consumptive use permits in the LWC Planning Area began in 2004 and was mostly complete in 2006, except for the Lake Okeechobee Service Area. In addition, many of the permits for Public Water Supply (PWS) have been renewed for 20-year durations since the *2005–2006 Lower West Coast Water Supply Plan Update* (2005–2006 LWC Plan Update; SFWMD 2006) was published. The water source options from these permits were used in the development of this plan update.


Suburban Collier County

WATER SOURCES

Withdrawals from the surficial aquifer system (SAS) are limited due to potential impacts on wetlands, as well as the increased potential for saltwater intrusion into freshwater sources. Withdrawals from the freshwater portion of the intermediate aquifer system (IAS) are also limited due to potential saltwater intrusion, or the potential for reaching maximum developable limits (MDLs). Therefore, new or increased allocations from the SAS and IAS will be reviewed on an application-by-application basis to determine if the project meets consumptive use permitting criteria. The Floridan aquifer system (FAS) is the source planned to meet many of the future PWS water demands in the LWC Planning Area. Most PWS utilities in the LWC Planning Area have diversified supply sources, and plan to increase their use of the FAS in the future. Blending brackish water from the FAS with fresh water may be a practical solution for meeting some of region's PWS and irrigation demands. In addition, the use of reclaimed water has increased significantly since the 2005–2006 LWC Plan Update, offsetting the use of groundwater to meet future water supply needs.

Water needed to meet increased future PWS demand in the LWC Planning Area is expected to be developed primarily through the continued development of brackish groundwater resources, surface water captured during wet weather, new storage capacity of both surface water and groundwater, and expansion of reclaimed water systems. Power generation entities are planning power plants that will make use of brackish, surface, and reclaimed water where available. Agricultural water users continue to use surface water and fresh groundwater. Some water users can benefit from projects, such as stormwater and tailwater recovery, and more efficient water conservation practices.

Primary surface water sources in the LWC Planning Area include the Caloosahatchee River (C-43 Canal) and connected canals, such as the Townsend Canal, Roberts Canal, and City Ditch. The Cape Coral and Big Cypress Basin canal systems also provide surface water supply, and to a lesser extent, local irrigation needs are met using stormwater ponds. Agricultural (AGR) Self-Supply is the largest water use category in the planning area, and

AGR Self-Supply is the primary user of surface water for crop irrigation. Traditional sources may or may not be available to meet all new irrigation requirements depending on the specific locations for new operations. Fresh groundwater may be available, but quantities will depend on local conditions, including other uses in the area.

Water availability from the Caloosahatchee River (C-43 Canal) and its tributaries is significantly limited due to implementation of the 2008 Lake Okeechobee Regulation Schedule (2008 LORS) and recently adopted SFWMD consumptive use permit criteria. Concerns about the integrity of the Herbert Hoover Dike, which surrounds Lake Okeechobee, have resulted in a lowered operating schedule that, in turn, has reduced the level of certainty of Lake Okeechobee Service Area users experiencing water shortage restrictions only every 1-in-10 years to experiencing restrictions every 1-in-6 years. The estimated completion date for the Herbert Hoover Dike rehabilitation is 2022. Currently, a dam safety modification report is being prepared, which is expected to be completed in 2016. The report will include results from pilot tests. Findings in this report may influence the expected 2022 completion date (S. Kaynor, USAC E, personal communication).

The SFWMD offers recommendations and guidance in the following sections for consideration by local governments, utilities, other water users, and SFWMD water supply managers and staff as a basis for the future direction of water supply planning in the LWC Planning Area.

Groundwater

Increased use of fresh groundwater sources to meet future demand in the LWC Planning Area is highly dependent on location, source limitations, natural system requirements, reclaimed water availability, and water conservation measures. Approximately 50 percent of the PWS demand in 2009 was met using fresh groundwater. Fresh groundwater is the primary source of supply for potable drinking water consumption and urban irrigation in the LWC Planning Area. Opportunities may exist for limited development of fresh groundwater sources through the following:

- Careful design of wellfield locations, configurations, and pumping regimes to maximize withdrawals while not impacting water quality or natural systems.
- Blending multiple alternative water sources to achieve acceptable water quality and distribute potential impacts across these multiple sources.
- Additional efforts to better understand the aquifer system, including the Mid-Hawthorn and Sandstone aquifers, and identification of areas of available fresh water are needed to meet future needs, especially agricultural water demands.

Surficial Aquifer System

- The potential use of the SAS for new or increased allocations will be evaluated on an application-by-application basis to determine if the project meets consumptive use permitting criteria. To reduce the LWC Planning Area's reliance on the SAS, water users are encouraged to continue developing alternative water sources to meet future water demands.
- Utilities should consider using concentrate water from membrane softening of SAS water beneficially (e.g., blending with reclaimed water if feasible).
- Coordinated saltwater intrusion monitoring is essential to ensure resource protection of the SAS and the Lower Tamiami aquifer. The Lower West Coast Surficial Aquifer (LWCSAS) Model was developed by the SFWMD to simulate groundwater flow and levels to represent existing and potential future hydrologic conditions in the LWC Planning Area. The model will be updated to include simulation of the IAS, and following this, a peer review of the updated model will be conducted in Fiscal Year (FY) 2014.

Intermediate Aquifer System

- Aquifer water level in the Sandstone/Mid-Hawthorn aquifer in the Cape Coral area is declining over time. Additionally, in the Sandstone aquifer in Lehigh Acres, there appears to be a slight overall downward trend in water levels over the last 10 years, with some evidence of a slight rise in water levels over the last three years. The 2005–2006 LWC Plan Update indicated that accelerating the extension of PWS lines to such communities coupled with mandatory hook-up to available municipal lines and required proper abandonment of Domestic Self-Supply (DSS) wells should be considered.
- Facilitate discussions with local governments to assist with a long-term water supply strategy for sustainable DSS in the Lehigh Acres area.
- Mapping of the top of the Sandstone aquifer in Lehigh Acres should be undertaken using available data from all sources, including the SFWMD, United States Geological Survey (USGS), and Lee County, to better determine the MDL at any location. Joint data collection is encouraged when drilling activity is occurring in the area.

Floridan Aquifer System

- Local utilities are proposing significant increases in FAS water source development over the next 20 years. Local water users and utilities developing FAS well drilling programs and gathering data are encouraged to collaborate with the SFWMD. Water quality, water level, and hydrologic data from these wells can be utilized in SFWMD models, and to increase the knowledge and understanding of the FAS. Brackish water from the FAS may be blended with groundwater and surface water in stormwater ponds to produce acceptable irrigation quality water. Blended water supplies are dependent on the water sources, volume of stored water, and natural system requirements, and require monitoring to ensure acceptable water quality.

- Local governments, such as Collier and Lee counties and the City of Cape Coral, have developed numerical groundwater flow models to address their needs. These modeling tools may be integrated with or adapted to future SFWMD modeling efforts.
- The Lower West Coast Floridan Aquifer System (LWCFAS) Model focuses primarily on the various production zones that comprise the FAS in the study area within Charlotte, Glades, Lee, Hendry, and Collier counties. The recalibrated and revised transient model will be used in water supply planning efforts regarding the use of the FAS and potential impacts of water withdrawals on the resource and existing users.
- Landowners are encouraged to plug and abandon inactive or dysfunctional FAS wells in accordance with existing rules and regulations.
- An incremental wellfield development approach should be used by utilities to design, test, and monitor production wells to minimize sudden changes in water quality due to inconsistencies in the FAS and overstressing production zones.

Collier County Water-Sewer District South County Regional Water Plant

Surface Water

- The Caloosahatchee River (C-43 Canal) is subject to Restricted Allocation Area criteria, which limit surface water withdrawals within the Lake Okeechobee Service Area. Accordingly, no allocations may cause a net increase in the volume of surface water withdrawn from the Lake Okeechobee Waterbody over a defined base condition water use (SFWMD 2010a). See the *2012 Lower East Coast Water Supply Plan Update* for more information (SFWMD 2012b).
- The CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project should be implemented to help meet the MFL criteria for the Caloosahatchee River. Implementation of local storage projects is encouraged. A Water Reservation rule is currently under development for the CERP Caloosahatchee River (C-43) West Basin Storage Reservoir.
- Local governments and utilities are encouraged to create additional storage capacity for surface water, when feasible.
- Irrigation for new golf courses should use reclaimed water when available or continue to include on-site blending of brackish groundwater with surface water, if consumptive use permit criteria are met.

Reclaimed Water

- To plan for and increase the use of reclaimed water, local governments should consider requiring construction of reclaimed water infrastructure in new development projects exceeding specified acreage thresholds, and use of reclaimed water (where appropriate) when it becomes available as part of their building codes and land development regulations.
- Local utilities are urged to expand the use of reclaimed water and minimize deep well disposal practices.

Expansion and Regionalization of Reclaimed Water Use is Encouraged

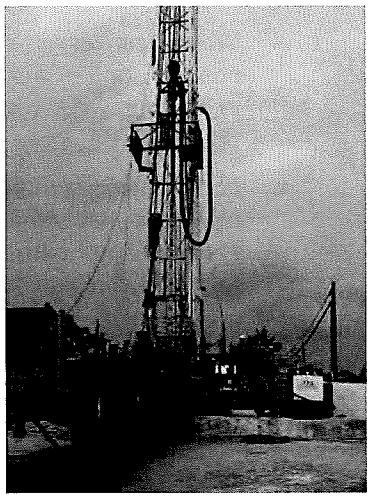
- To maximize the use of reclaimed water, utilities should continue to implement feasible options to extend their supply of reclaimed water, such as supplemental sources, metering for residential customers, tiered rate structures, limiting days of the week for landscape irrigation, and interconnects with other reclaimed water utilities.
- Development of additional reclaimed water lines for landscape irrigation can decrease dependence on DSS and Recreational/Landscape (REC) Self-Supply surface water pumps and wells.
- Technical assistance to establish mandatory reuse zones will be provided to local governments by the SFWMD. Reuse zones are geographic areas designated by local governments through ordinance where reclaimed water use is required.
- The amendments to Section 373.250, Florida Statutes (F.S.) recognize the use of "substitution credits" and "impact offsets" to promote increased availability and distribution of reclaimed water and decrease impacts on traditional sources of water. Rulemaking is under way by the Florida Department of Environmental Protection (FDEP) to include this language into Chapter 62-40, Florida Administrative Code (F.A.C.). Once the FDEP concludes its rulemaking effort, the SFWMD will adopt the changes into their rules to be consistent with Chapter 62-40, F.A.C., where appropriate.
- The use of supplemental water supplies to meet peak demands for reclaimed water may enable a water utility to extend its supply of reclaimed water system over a larger area. However, during times of drought, availability of supplemental water sources such as surface water, groundwater, or storm water to supplement reclaimed water supplies may be limited in some areas. Use of these sources to supplement reclaimed water supplies is subject to consumptive use permitting by the SFWMD.

New Storage Capacity for Surface Water or Groundwater

- New uses of surface water are possible only when new storage and stormwater capture options are developed. In the LWC Planning Area, potential types of water storage include aquifer storage and recovery (ASR) wells, reservoirs, and surface water impoundments and ponds. Six supplemental PWS utility water projects are proposed by 2030. These projects will add 11.8 million gallons per day (MGD) from captured storm water in canal systems. In addition, reclaimed water stored in ASR facilities may provide 9.5 MGD of seasonal capacity. Proposed projects that develop new storage and create additional water supply may be considered alternative water sources. The Dispersed Water Management Program sponsored by the SFWMD is designed to encourage property owners to retain water on their land rather than drain it, accept regional runoff for storage, or use both options.
- Improvements have been made to the Golden Gate Canal System to retain storm water. The effect of this project on local groundwater and its role during periods of atypical rainfall should be monitored for discussion in future plan updates.
- Construction of new or retrofitted surface water storage systems for agricultural operations could provide additional supply for irrigation and maintenance of wetland hydroperiods.

Aquifer Storage and Recovery

- Continued use of ASR and other viable storage options is needed to extend the use of current water resources to meet future demands. ASR extends water supplies for use during peak demand periods. Permitting considerations should be included in the evaluation process.
- Studies to address local and regional ASR issues such as arsenic mobilization should continue.



Cape Coral ASR Well Project

Seawater

- Where appropriate, utilities may consider the use of desalinated seawater from the Gulf of Mexico as an additional water source option for the LWC Planning Area.

Water Conservation

- The implementation of robust water conservation programs throughout the LWC Planning Area offers water use savings potential to reduce future water demand. All water users are urged to implement water conservation measures to further reduce water supply needs.

- The SFWMD will continue to implement the 2008 Comprehensive Water Conservation Program, and plans to continue supporting programs such as the Big Cypress Basin Mobile Irrigation Lab (MIL), Water Savings Incentive Program (WaterSIP), Water Conservation Hotel and Motel Program (Water CHAMP), and Florida Water Star℠.
- Local governments should evaluate the implementation of water conservation measures appropriate for their jurisdiction. PWS utilities are encouraged to use a water conservation planning tool to develop plans to implement water conservation measures with a numerical goal for achievable water savings. As a guideline, water conservation measures should include general policy considerations and technology retrofits as described in this plan update. SFWMD staff is available to provide assistance with the use of the Conserve Florida Water Clearinghouse's *EZ Guide* (2009).
- Utilities are encouraged to develop goal-based water conservation plans. SFWMD staff is available to assist utilities in developing such plans.
- Local governments should develop or enhance existing ordinances to be consistent with Florida-Friendly Landscaping™ provisions (Section 373.185, F.S.).
- Implementation of advanced irrigation technology, improved landscape design and management practices, and implementation of recognition programs can further increase landscape water use efficiency in this sector.
- Water conservation public education programs help instill a year-round conservation ethic. Local governments and utilities are encouraged to continue providing water conservation-related educational programs in cooperation with the SFWMD.
- Local governments are encouraged to implement two-day-per-week landscape irrigation ordinances. Upon request, SFWMD staff is available to assist local governments with model ordinance methodologies, as well as to assist in implementing such an ordinance.
- When applicable, agricultural water users are encouraged to use the Florida Automated Weather Network (FAWN) irrigation tools.
- Installation of higher efficiency irrigation systems by agricultural water users is encouraged where applicable and appropriate for specific crop types.
- Implementation of best management practices (BMPs) to improve water conservation and water use efficiency are economical measures to help meet future demands.
- Industrial, commercial, and institutional entities are encouraged to utilize the *Water Efficiency Self-Assessment Guide for Commercial and Institutional Managers* (SFWMD 2011b), to improve water use efficiency and reduce operating costs.

COORDINATION

- Coordination and collaboration throughout the water supply planning process is essential among regional and local governments, and utility planning entities.
- 10-year water supply facilities work plans are due within 18 months of the adoption of this plan update. Local governments and utilities need to provide linkage and coordination between this plan update and the local government water supply-related components of comprehensive plans.
- Agricultural communities and agencies need to work together to develop methodologies and data sources for future crop projections.

CLIMATE CHANGE

Climate change has the potential to affect hydrologic conditions and thus water supply sources, as well as patterns of water demand. The degree of climate change in various regions and the possible impacts to those regions is highly uncertain. Despite uncertainties, the SFWMD is considering climate change and related effects on hydrologic conditions in the water supply planning process.

Some types of change in climate and subsequent effects on hydrologic conditions have been observed by the scientific community. Long-term data show increasing temperatures and a corresponding sea level rise. For planning purposes, the SFWMD is estimating a sea level rise of 5 to 20 inches in south Florida by 2060 (SFWMD 2009a). The anticipated rise in sea level may change the hydrodynamics of the coastal estuaries and the location and shape of the freshwater–seawater interface, and may increase the intrusion of salt water into coastal aquifers. Analysis is needed to identify the potential impact of sea level rise on utility wellfields and other users at risk of saltwater intrusion within the SFWMD. In addition, comprehensive monitoring is needed to accurately characterize and measure aquifer conditions and saltwater movement.

The following direction and guidance is provided for climate change and sea level rise within the SFWMD's water supply planning areas:

- Saltwater intrusion monitoring may be reviewed for adequacy by utilities and the SFWMD. Recommendations may be needed for additional or revised monitoring regimes.
- Use existing and future modeling tools that integrate density-dependent flow and solute transport to evaluate the consequences of sea level rise and cumulative impacts to existing legal users.

CONCLUSION

Future challenges in water resource development and natural resource protection require concerted efforts to monitor, characterize current hydrologic conditions, and predict future

conditions. Existing analytical and numerical tools should be used to assess and reduce uncertainty, and to optimize the use and protection of water resources and other natural resources. Successful implementation of this plan update requires close coordination with other regional and local governments, and utility water supply planning entities. Collaboration among stakeholders is also essential for directing implementation of the preceding guidance. Public and private partnering can ensure that water resources in the LWC Planning Area are prudently managed and available to meet future demands.

Glossary

1-in-10 year drought A drought of such intensity that it is expected to have a return frequency of once in 10 years. A drought in which below normal rainfall occurs and has a 90 percent probability of being exceeded over a 12-month period. A drought event that results in an increase in water demand to a magnitude that would have a 10 percent probability of being exceeded during any given year.

1-in-10 year level of certainty (see *Level of Certainty*)

Acre-foot, acre-feet The volume of water that covers 1 acre to a depth of 1 foot; the equivalent of 43,560 cubic feet, 1,233.5 cubic meters, or 325,872 gallons, which is approximately the amount of water it takes to serve two typical families for one year.

Agricultural best management practice (Agricultural BMP) A practice or combination of agricultural practices, based on research, field testing, and expert review, determined to be the most effective and practicable means of improving water quality or quantity while maintaining or even enhancing agricultural production.

Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) Model A simple water budget model for estimating irrigation demands that estimates demand based on basin-specific data. The AFSIRS Model calculates both net and gross irrigation requirements for average and 1-in-10 year drought irrigation requirements. A crop's net irrigation requirement is the amount of water delivered to the root zone of the crop, while the gross irrigation requirement includes both the net irrigation requirement and the losses incurred in the process of delivering irrigation to the crop's root zone.

Agricultural (AGR) Self-Supply The water used to irrigate crops, water livestock, and for aquaculture (e.g., fish production) that is not supplied by a Public Water Supply utility.

Alternative water supply "Salt water; brackish surface water and groundwater; surface water captured predominately during wet-weather flows; sources made available through the addition of new storage capacity for surface water or groundwater, water that has been reclaimed after one or more public supply, municipal, industrial, commercial, or agricultural uses; the downstream augmentation of water bodies with reclaimed water; storm water; and, any other water supply source that is designated as non-traditional for a water supply planning region in the applicable regional water supply plan" (Section 373.019, Florida Statutes).

Aquatic preserve Water body set aside by the state to be maintained in essentially natural or existing condition for protection of fish and wildlife and public recreation so the aesthetic, biological, and scientific values may endure for the enjoyment of future generations.

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

Aquifer storage and recovery (ASR) The underground storage of storm water, surface water, fresh groundwater, drinking water, or reclaimed water that is treated to appropriate standards (dependent upon the water quality of the receiving aquifer). The aquifer (typically the Floridan aquifer system in south Florida) acts as an underground reservoir for the injected water. The water is stored with the intent to recover it for use in the future.

Aquifer system A heterogeneous body of (interbedded or intercalated) permeable and less permeable material that functions regionally as a water-yielding hydraulic unit and may be composed of more than one aquifer separated at least locally by confining units that impede groundwater movement, but do not greatly affect the hydraulic continuity of the system.

Artesian A commonly used expression, generally synonymous with "confined," referring to subsurface (ground) bodies of water, which, due to underground drainage from higher elevations and confining layers of soil material above and below the water body (referred to as an artesian aquifer), result in groundwater at pressures greater than atmospheric pressures.

Available supply The maximum amount of reliable water supply including surface water, groundwater, and purchases under secure contracts.

Base flow Sustained flow of a stream in the absence of direct runoff. It includes natural and human-induced stream flows. Natural base flow is sustained largely by groundwater discharges.

Baseline condition A specified period of time during which collected data are used for comparison with subsequent data.

Basin (groundwater) A hydrologic unit containing one large aquifer or several connecting and interconnecting aquifers.

Basin (surface water) A tract of land drained by a surface water body or its tributaries.

Basis of Review The publication *Basis of Review for Water Use Permit Applications within the South Florida Water Management District* (SFWMD 2010a). Read in conjunction with Chapters 40E-2 and 40E-20, Florida Administrative Code, the Basis of Review further specifies the general procedures and information used by South Florida Water Management District staff for review of consumptive use permit applications with the primary goal of meeting South Florida Water Management District water resource objectives.

Biscayne aquifer A portion of the surficial aquifer system, which provides most of the fresh water for Public Water Supply and Agricultural Self-Supply within Miami-Dade, Broward, and southeastern Palm Beach County. It is highly susceptible to contamination due to its high permeability and proximity to the land surface in many locations.

Boulder Zone A highly transmissive, cavernous zone of limestone within the Lower Floridan aquifer used to dispose of secondary treated effluent from wastewater treatment plants and concentrate from membrane water treatment plants via deep injection wells.

Brackish water Water with a chloride level greater than 250 milligrams per liter and less than 19,000 milligrams per liter (Basis of Review; SFWMD 2010a).

Capacity Represents the ability to treat, move, or reuse water. Typically, capacity is expressed in million gallons of water per day.

Comprehensive Everglades Restoration Plan (CERP) The federal-state partnership framework and guide for the restoration, protection, and preservation of the south Florida ecosystem. The CERP also provides for water-related needs of the region, such as water supply and flood protection.

Confining unit A body of significantly less permeable material than the aquifer or aquifers that it stratigraphically separates. The hydraulic conductivity may range from nearly zero to some value significantly lower than that of the adjoining aquifers, and impedes the vertical movement of water.

Conservation (see *water conservation*)

Conservation rate structure (see *water conservation rate structure*)

Consumptive use Any use of water that reduces the supply from which it is withdrawn or diverted.

Consumptive use permitting The issuance of permits by the South Florida Water Management District, under the authority of Chapter 40E-2, Florida Administrative Code, allowing withdrawal of water for consumptive use.

Control structure An artificial structure designed to regulate the level/flow of water in a canal or other water body (e.g., weirs, dams).

Cubic feet per second (cfs) A rate of flow (e.g., in streams and rivers) equal to a volume of water 1 foot high and 1 foot wide flowing a distance of 1 foot in 1 second. One cfs is equal to 7.48 gallons of water flowing each second. For example, if a car's gas tank was 2 feet by 1 foot by 1 foot (2 cubic feet), then gas flowing at a rate of 1 cfs would fill the tank in two seconds.

Consumptive Use Permitting Consistency (CUPcon). A statewide effort led by the Florida Department of Environmental Protection to improve consistency in the Consumptive Use Permitting Programs implemented by the water management districts. The individual water management district consumptive use permitting rules, while all developed under the authority of Chapter 373, Florida Statutes, are inconsistent. While some of the differences may be based on differing physical and natural characteristics, others are the result of development of separate rules and procedures over time. Goals of the effort include making programs less confusing for applicants, treat applicants equitably statewide, provide consistent protection of the environment, streamline the process, and incentivize behavior that protects water resources, including conservation.

DBHYDRO The South Florida Water Management District's corporate environmental database, storing hydrologic, meteorologic, hydrogeologic, and water quality data.

Demand The quantity of water needed to fulfill a requirement.

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

Desalination A process that treats saline water to remove or reduce chlorides and dissolved solids resulting in the production of fresh water.

Discharge The rate of water movement past a reference point, measured as volume per unit of time (usually expressed as cubic feet or meters per second).

Disinfection The process of inactivating microorganisms that cause disease. All potable water requires disinfection as part of the treatment process prior to distribution. Disinfection methods include chlorination, ultraviolet radiation, and ozonation.

Disposal Effluent disposal involves the wasteful practice of releasing treated effluent back to the environment using ocean outfalls, surface water discharges, and deep injection wells.

Dissolved oxygen The concentration of oxygen dissolved in water, sometimes expressed as percent saturation, where saturation is the maximum amount of oxygen that theoretically can be dissolved in water at a given altitude and temperature.

Domestic Self-Supply (DSS) The water used by households whose primary source of water is water treatment facilities and/or private wells with pumpages of less than 100,000 gallons per day.

Drainage basin Land area where precipitation runs off into streams, rivers, lakes, and reservoirs. It is a land feature that can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge. The drainage basin is a part of the earth's surface that is occupied by a drainage system, which consists of a surface stream with all its tributaries and impounded bodies of water. It is also known as a watershed, a catchment area, or a drainage area.

Drawdown 1) The vertical distance between the static water level and the surface of the cone of depression, 2) A lowering of the groundwater surface caused by pumping.

Drought A long period of abnormally low rainfall, especially one that adversely affects growing or living conditions.

Ecology The study of the inter-relationships of plants and animals to one another and to their physical and biological environment.

Ecosystem Biological communities together with their environment, functioning as a unit.

Ecosystem restoration The process of reestablishing to as near its natural condition as possible, the structure, function, and composition of an ecosystem.

Effective rainfall The portion of rainfall that infiltrates the soil and is stored for plant use in the crop root zone.

Effluent Treated water that is not reused after flowing out of any plant or other works used for treating, stabilizing, or holding wastes. Effluent is "disposed" of.

Electrodialysis Dialysis that is conducted with the aid of an electromotive force applied to electrodes adjacent to both sides of the membrane.

Elevation The height in feet above mean sea level according to National Geodetic Vertical Datum (NGVD) or North American Vertical Datum (NAVD). May also be expressed in feet above mean sea level as reference datum.

Environmental impact statement Required under United States environmental law by the National Environmental Policy Act for federal government agency actions "significantly affecting the quality of the human environment." An environmental impact statement evaluates the positive and negative environmental effects of a proposed agency action.

Estuary The part of the wide lower course of a river where the current is met by ocean tides or an arm of the sea at the lower end of a river where fresh water and salt water meet.

Evapotranspiration (ET) The total loss of water to the atmosphere by evaporation from land and water surfaces and by transpiration from plants.

Exceedance The violation of the pollutant levels permitted by environmental protection standards.

Existing legal use of water A water use authorized under a South Florida Water Management District consumptive use permit or existing and exempt from permit requirements.

Fallow Land left unseeded during a growing season. The act of plowing land and leaving it unseeded. The condition or period of being unseeded.

Finished water Water that has completed a purification or treatment process. Water that has passed through all the processes in a water treatment plant and is ready to be delivered to consumers. Contrast with *raw water*.

Finished water demand (see *Net water demand*)

Fiscal Year (FY) The South Florida Water Management District's fiscal year begins on October 1 and ends on September 30 the following year.

Florida Administrative Code (F.A.C.) The Florida Administrative Code is the official compilation of the administrative rules and regulations of Florida state agencies.

Florida-Friendly Landscaping™ Quality landscapes that conserve water, protect the environment, are adaptable to local conditions, and are drought tolerant. The principles of such landscaping include planting the right plant in the right place, efficient watering, appropriate fertilization, mulching, attraction of wildlife, responsible management of yard pests, recycling yard waste, reduction of stormwater runoff, and waterfront protection. Additional components include practices such as landscape planning and design, soil analysis, the appropriate use of solid waste compost, minimizing the use of irrigation, and proper maintenance.

Florida Statutes (F.S.) A permanent collection of state laws organized by subject area into a code made up of titles, chapters, parts, and sections. The Florida Statutes are updated annually by laws that create, amend, or repeal statutory material.

Floridan aquifer system (FAS) A highly used aquifer system composed of the Upper Floridan and Lower Floridan aquifers. It is the principal source of water supply north of Lake Okeechobee. The Upper Floridan aquifer is used for drinking water supply in parts of Martin and St. Lucie counties. From Jupiter to south Miami, water from the FAS is mineralized (total dissolved solids are greater than 1,000 milligrams per liter) along coastal areas and in south Florida.

Flow The actual amount of water flowing by a particular point over some specified time. In the context of water supply, flow represents the amount of water being treated, moved, or reused. Flow is frequently expressed in million gallons of water per day.

Fresh water An aqueous solution with a chloride concentration less than or equal to 250 milligrams per liter (Basis of Review; SFWMD 2010a).

Geophysical log A record of the structure and composition of the earth with depth encountered when drilling a well or similar type of test or boring hole.

Gross irrigation demand or **gross irrigation requirement** (term used in AFSIRS Model) The amount of water that must be withdrawn from the source in order to be delivered to the plant's root zone. Gross irrigation demand includes both the net irrigation requirement and the losses incurred irrigating the plant's root zone.

Gross water demand (or *raw water demand*) is the amount of water withdrawn from the water resource to meet a particular need of a water user or customer. Gross demand is the amount of water allocated in a consumptive use permit. Gross or raw water demands are nearly always higher than net or user/customer water demands.

Groundwater Water beneath the surface of the ground, whether or not flowing through known and definite channels. Specifically, that part of the subsurface water in the saturated zone, where the water is under pressure greater than the atmosphere.

Harm As defined in Chapter 40E-8, Florida Administrative Code, the temporary loss of water resource functions that result from a change in surface or groundwater hydrology and takes a period of one to two years of average rainfall conditions to recover.

Headwater 1) Water that is typically of higher elevation (with respect to tailwater) or on the controlled side of a structure, 2) The waters at the highest upstream point of a natural system that are considered the major source waters of the system.

Hydrogeology The geology of groundwater, with particular emphasis on the chemistry and movement of water.

Hydrologic condition The state of an area pertaining to the amount and form of water present.

Hydrology The scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Impoundment Any lake, reservoir, or other containment of surface water occupying a depression or bed in the earth's surface and having a discernible shoreline.

Indian River Lagoon A lagoon extending 156 miles from north of Cape Canaveral to Stuart along the east coast of Florida. The lagoon is one of America's most diverse estuaries, home to thousands of plant and animal species.

Industrial/Commercial/Institutional (ICI) Self-Supply Water used by industrial, commercial, or institutional operations withdrawing a water quantity of 100,000 gallons per day (0.1 million gallons per day) or greater from individual, on-site wells.

Infiltration The movement of water through the soil surface into the soil under the forces of gravity and capillarity.

Inflow 1) The act or process of flowing in or into. 2) The measured quantity of water that has moved into a specific location.

Injection well Refers to a well constructed to inject treated wastewater directly into the ground. Wastewater is generally forced (pumped) into the well for dispersal or storage in a designated aquifer. Injection wells are generally drilled below freshwater levels, or into unused aquifers or aquifers that do not deliver drinking water.

Intermediate aquifer system (IAS) This aquifer system consists of five zones of alternating confining and producing units. The producing zones include the Sandstone and Mid-Hawthorn aquifers.

Irrigation efficiency 1) A measure of the effectiveness of an irrigation system in delivering water to a plant for irrigation and freeze protection purposes. It is expressed as the ratio of the volume of water used for supplemental plant evapotranspiration to the volume pumped or delivered for use. 2) The average percent of total water pumped for use that is delivered to the root zone of a plant. 3) As a modeled (AFSIRS Model) factor, irrigation efficiency refers to the average percent of total delivered water applied to the plant's root zone.

Irrigation water use Uses of water for supplemental irrigation purposes, including agricultural lands, as well as golf courses, nurseries, recreational areas, and landscapes.

Landscape irrigation The outside watering of shrubbery, trees, lawns, grass, ground covers, vines, gardens, and other such flora, not intended for resale, which are planted and are situated in such diverse locations as residential and recreational areas, cemeteries, public, commercial and industrial establishments, and public medians and rights-of-way.

Leaching The process by which soluble materials in the soil, such as salts, nutrients, pesticide chemicals, or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

Leak detection Systematic method to survey the distribution system and pinpoint the exact locations of hidden underground leaks.

Level of Certainty A water supply planning goal to assure at least a 90 percent probability during any given year that all the needs of reasonable-beneficial water uses will be met, while sustaining water resources and related natural systems during a 1-in-10 year drought event.

Marsh A frequently or continually inundated unforested wetland characterized by emergent herbaceous vegetation adapted to saturated soil conditions.

Maximum developable limit (MDL) Maximum developable limit consumptive use permitting criteria provide reasonable assurances that the proposed water use does not cause harmful drawdowns to semi-confined freshwater aquifers. In the Lower West Coast Planning Area, the potentiometric head within the Lower Tamiami, Sandstone, and Mid-Hawthorn aquifers shall not be allowed to drop to less than 20 feet above the top of the uppermost geologic strata that comprises the aquifer at any point during a 1-in-10 year drought condition.

Microirrigation The application of small quantities of water on or below the soil surface as drops or tiny streams of spray through emitters or applicators placed along a water delivery line. Microirrigation includes a number of methods or concepts, such as bubbler, drip, trickle, mist or microspray, and subsurface irrigation.

Million gallons of water per day (MGD) A rate of flow of water equal to 133,680.56 cubic feet per day, or 1.5472 cubic feet per second, or 3.0689 acre-feet per day. A flow of one million gallons per day for one year equals 1,120 acre-feet (365 million gallons). To hold one million gallons of water, a swimming pool approximately 267 feet long (almost as long as a football field), 50 feet wide, and 10 feet deep would be needed.

Minimum Flow and Level (MFL) The point at which further withdrawals would cause significant harm to the water resources or natural systems. An MFL is established by water management districts pursuant to Sections 373.042 and 373.0421, Florida Statutes, for a given water body and set forth in Parts II and III of Chapter 373, Florida Statutes.

Mobile irrigation laboratory (MIL) A vehicle furnished with irrigation evaluation equipment that is used to carry out on-site evaluations of irrigation systems and to provide recommendations on improving irrigation efficiency.

Model A computer model is a representation of a system and its operations, and provides a cost-effective way to evaluate future system changes, summarize data, and help understand interactions in complex systems. Hydrologic models are used for evaluating, planning, and simulating the implementation of operations within the South Florida Water Management District's water management system under different climatic and hydrologic conditions. Water quality and ecological models are also used to evaluate other processes vital to the health of ecosystems.

MODFLOW A modular, three-dimensional, finite-difference groundwater modeling code created by the United States Geological Survey, which is used to simulate the flow of groundwater through aquifers. The South Florida Water Management District uses it for subregional groundwater modeling.

Monitor well Any human-made excavation by any method to monitor fluctuations in groundwater levels, quality of underground waters, or the concentration of contaminants in underground waters.

National Geodetic Vertical Datum of 1929 (NGVD) A geodetic datum derived from a network of information collected in the United States and Canada. It was formerly called the "Sea Level Datum of 1929" or "mean sea level." Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific coasts, it does not necessarily represent local mean sea level at any particular place.

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

Net irrigation demand or **net irrigation requirement** (term used in the AFSIRS Model) The amount of water the plant needs in addition to anticipated rainfall. This is an estimate of the amount of water (expressed in inches per year) that should be delivered to the plant's root zone.

Net water demand (or *finished water demand*) is the water demand of the end user after accounting for treatment and process losses, and inefficiencies. When discussing Public Water Supply, the term "finished water demand" is commonly used to denote net demand.

Outflow 1) The act or process of flowing out of. 2) The measured quantity of water that has left.

Per capita use rate (PCUR) 1) The average amount of water used per person during a standard time period, generally per day. 2) Total use divided by the total population served.

Permeability The capacity of a porous rock, sediment, or soil for transmitting a fluid.

Planning Area The area within the South Florida Water Management District's jurisdiction is divided into four areas within which planning activities are focused: Kissimmee Basin, Upper East Coast, Lower West Coast (LWC), and Lower East Coast.

Potable water Water that is safe for human consumption.

Potentiometric head or **potentiometric surface** A surface that represents the hydraulic head in an aquifer and is defined by the level to which water will rise above a datum plane in wells that penetrate the aquifer.

Power Generation (PWR) Self-Supply The difference in the amount of water withdrawn by electric power generating facilities for cooling purposes and the water returned to the hydrologic system near the point of withdrawal.

Process water Water used for non-potable industrial usage, e.g., mixing cement.

Public Water Supply (PWS) Water supplied by water treatment facilities for potable use (drinking quality) with projected average pumpages equal to or greater than 100,000 gallons per day (0.1 million gallons per day).

Public Water Supply (PWS) demand All potable (drinking quality) water supplied by water treatment facilities with projected average pumpages of 100,000 gallons per day (0.1 million gallons per day) or greater to all types of customers, not just residential.

Rapid infiltration basin A wastewater treatment method by which wastewater is applied in deep and permeable deposits of highly porous soils for percolation through deep and highly porous soil.

Raw water 1) Water that is direct from the source — groundwater or surface water — without any treatment. 2) Untreated water, usually entering the first unit of a water treatment plant. Contrast with *finished water.*

Raw water demand (see *gross water demand*)

Reasonable-beneficial use Use of water in such quantity as is needed for economic and efficient use for a purpose, which is both reasonable and consistent with the public interest.

Recharge (groundwater) The natural or intentional infiltration of surface water into the ground to raise groundwater levels.

Recharge (hydrologic) The downward movement of water through soil to groundwater, the process by which water is added to the zone of saturation, or the introduction of surface water or groundwater to groundwater storage, such as an aquifer. Recharge or replenishment of groundwater supplies consists of three types:

1) Natural recharge, which consists of precipitation or other natural surface flows making their way into groundwater supplies.

2) Artificial or induced recharge, which includes actions specifically designed to increase supplies in groundwater reservoirs through various methods, such as water spreading (flooding), ditches and pumping techniques.

3) Incidental recharge, which consists of actions, such as irrigation and water diversion, which add to groundwater supplies, but are intended for other purposes. Recharge may also refer to the amount of water so added.

Reclaimed water Water that has received at least secondary treatment and basic disinfection and is reused after flowing out of a domestic wastewater treatment facility (Rule 62-610.200, Florida Administrative Code).

Recreational/Landscape (REC) Self-Supply Water used for landscape and golf course irrigation. The landscape subcategory includes water used for parks, cemeteries, and other irrigation applications of 100,000 gallons per day (0.1 million gallons per day) or greater. The golf course subcategory includes those operations not supplied by a Public Water Supply or regional reuse facility.

Regional irrigation distribution system An interconnection pipeline system to deliver irrigation water, which incorporates reuse and alternative water supplies, such as supplemental surface water.

Regional Simulation Model (RSM) A regional hydrologic model developed principally for application in south Florida. The RSM is developed on a sound conceptual and mathematical framework that allows it to be applied generically to a wide range of hydrologic situations. The RSM simulates the coupled movement and distribution of groundwater and surface water throughout the model domain using a Hydrologic Simulation Engine to simulate the natural hydrology and a Management Simulation Engine to provide a wide range of operational capability.

Restricted Allocation Areas Areas designated within the South Florida Water Management District for which allocation restrictions are applied with regard to the use of specific sources of water. The water resources in these areas are managed in response to specific sources of water in the area for which there is a lack of water availability to meet the projected needs of the region from that specific source of water (Basis of Review; SFWMD 2010a).

Retention The prevention of stormwater runoff from direct discharge into receiving waters. Included as examples are systems that discharge through percolation, exfiltration, filtered bleed-down, and evaporation processes.

Retrofit 1) Indoor: the replacement of existing water fixtures, appliances, and devices with more efficient fixtures, appliances, and devices for the purpose of water conservation. 2) Outdoor: the replacement or changing out of an existing irrigation system with a different irrigation system, such as a conversion from an overhead sprinkler system to a microirrigation system (Basis of Review; SFWMD 2010a).

Reuse The deliberate application of reclaimed water for a beneficial purpose. Criteria used to classify projects as "reuse" or "effluent disposal" are contained in Rule 62-610.810, Florida Administrative Code The term "reuse" is synonymous with "water reuse."

Reverse osmosis (RO) A membrane process for desalting water using applied pressure to drive the feedwater (source water) through a semipermeable membrane.

Runoff That component of rainfall, which is not absorbed by soil, intercepted and stored by surface water bodies, evaporated to the atmosphere, transpired and stored by plants, or infiltrated to groundwater, but which flows to a watercourse as surface water flow.

Saline water 1) An aqueous solution with a chloride concentration greater than 250 milligrams per liter and less than that of seawater (Basis of Review; SFWMD 2010a).

Saltwater interface The hypothetical surface of chloride concentration between fresh water and seawater where the chloride concentration is 250 milligrams per liter at each point on the surface.

Saltwater intrusion The invasion of a body of fresh water by a body of salt water due to its greater density. It can occur either in surface water or groundwater bodies. The term is applied to the flooding of freshwater marshes by seawater, the upward migration of seawater into rivers and navigation channels, and the movement of seawater into freshwater aquifers along coastal regions.

Salinity Of or relating to chemical salts usually measured in parts per thousand, milligrams per liter, or practical salinity units.

Salt water (see *seawater*)

Seasonal capacity The planned storage available from recharge and recovery operations, to assist in meeting peak demands. Seasonal capacity is not factored into total new treatment capacity.

SEAWAT A program developed to simulate three-dimensional, variable density, transient groundwater flow in porous media. The source code for SEAWAT was developed by combining MODFLOW and MT3DMS into a single program that solves the coupled flow and solute transport equations.

Seawater Water with a chloride concentration at or above 19,000 milligrams per liter (Basis of Review; SFWMD 2010a).

Sedimentation The action or process of forming or depositing sediment.

Seepage irrigation Irrigation that conveys water through open ditches. Water is either applied to the soil surface (possibly in furrows) and held for a period of time to allow infiltration, or is applied to the soil subsurface by raising the water table to wet the root zone.

Seepage irrigation system A means to artificially supply water for plant growth that relies primarily on gravity to move the water over and through the soil, and does not rely on emitters, sprinklers, or any other type of device to deliver water to the vicinity of expected plant use.

Self-supplied The water used to satisfy a water need, not supplied by a Public Water Supply utility.

Semi-confined aquifer A completely saturated aquifer that is bounded above by a semi-pervious layer, which has a low, though measurable permeability, and below by a layer that is either impervious or semi-pervious.

Serious harm As defined in Chapter 40E-8, Florida Administrative Code, the long-term, irreversible, or permanent loss of water resource functions resulting from a change in surface water or groundwater hydrology.

Service area The geographical region in which a water supplier has the ability and the legal right to distribute water for use.

Significant harm As defined in Chapter 40E-8, Florida Administrative Code, the temporary loss of water resource functions, which result from a change in surface water or groundwater hydrology, that takes more than two years to recover, but which is considered less severe than serious harm.

Storm water Water that does not infiltrate, but accumulates on land as a result of storm runoff, snowmelt runoff, irrigation runoff, or drainage from areas, such as roads and roofs.

Stormwater treatment area A system of constructed water quality treatment wetlands that use natural biological processes to reduce levels of nutrients and pollutants from surface water runoff.

Submersed aquatic vegetation Aquatic plants that exist completely below the water surface.

Substrate The physical surface upon which an organism lives. The natural or artificial surface upon which an organism grows or to which it is attached.

Surface water Water above the soil or substrate surface, whether contained in bounds, created naturally or artificially, or diffused. Water from natural springs is classified as surface water when it exits from the spring onto the earth's surface.

Surficial aquifer system (SAS) Often the principal source of water for urban uses within certain areas of south Florida. This aquifer is unconfined, consisting of varying amounts of limestone and sediments that extend from the land surface to the top of an intermediate confining unit.

Tailwater Water that is typically of lower elevation or on the discharge side of the structure.

Time series A statistical process analogous to the taking of data at intervals of time.

Treatment facility Any facility or other works used for the purpose of treating, stabilizing, or holding water or wastewater.

Turbidity The measure of water clarity caused by suspended material in a liquid.

Ultralow-volume fixtures Water-conserving plumbing fixtures that meet industry standards at a test pressure of 80 pounds per square inch.

Unconfined aquifer 1) A permeable geologic unit or units only partly filled with water and overlying a relatively impervious layer. Its upper boundary is formed by a free water table or phreatic surface under atmospheric pressure. Also referred to as water table aquifer. 2) An aquifer containing water that is not under pressure. The water level in a well is the same as the water table outside the well.

Upconing Process by which saline water underlying fresh water in an aquifer rises upward into the freshwater zone as a result of pumping water from the freshwater zone.

Uplands An area with a hydrologic regime that is not sufficiently wet to support vegetation typically adapted to life in saturated soil conditions. Uplands are non-wetlands. Upland soils are non-hydric soils.

Utility Any legal entity responsible for supplying potable water for a defined service area.

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

Water budget An accounting of total water use or projected water use for a given location or activity.

Water conservation The permanent, long-term reduction of daily water use. Permanent water use reduction requires the implementation of water saving technologies and measures that reduce water use while satisfying consumer needs. Water conservation is considered a water source option because it reduces the need for future expansion of the water supply infrastructure.

Water Conservation Areas (WCAs) Part of the original Everglades ecosystem that is now diked and hydrologically controlled for flood control and water supply purposes. These are located in the western portions of Miami-Dade, Broward and Palm Beach counties, and preserve over 1,350 square miles, or about 50 percent of the original Everglades.

Water conservation rate structure A water rate structure designed to conserve water. Examples of conservation rate structures include, but are not limited to, increasing block rates, seasonal rates, and quantity-based surcharges.

Water quality 1) A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose. 2) The physical, chemical, and biological condition of water as applied to a specific use. Federal and state guidelines set water quality standards based on the water's intended use, whether it is for recreation, fishing, drinking, navigation, shellfish harvesting, or agriculture.

Water Reservation A Water Reservation is a legal mechanism to set aside water for the protection of fish and wildlife or the public health and safety from consumptive water use. The reservation is composed of a quantification of the water to be protected, which includes a seasonal and a location component.

Water Resources Advisory Commission (WRAC) The South Florida Water Management District Water Resources Advisory Commission serves as an advisory body to the Governing Board. It is the primary forum for conducting workshops, presenting information, and receiving public input on water resource issues affecting central and south Florida.

Water resource development The formulation and implementation of regional water resource management strategies, including 1) the collection and evaluation of surface water and groundwater data, 2) structural and non-structural programs to protect and manage the water resources, 3) the development of regional water resource implementation programs, 4) the construction, operation and maintenance of major public works facilities to provide for flood control, surface and groundwater storage, and groundwater recharge augmentation, and 5) related technical assistance to local governments and to government-owned and privately owned water utilities (Section 373.019, Florida Statutes).

Watershed A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water. Watersheds conform to federal hydrologic unit code standards and can be divided into sub-watersheds and further divided into catchments, the smallest water management unit recognized by South Florida Water Management District operations. Unlike drainage basins, which are defined by rule, watersheds are continuously evolving as the drainage network evolves.

Water Shortage Plan This effort includes provisions in Chapters 40E-21 and 40E-22, Florida Administrative Code, and identifies how water supplies are allocated to users during declared water shortages. The plan allows for supply allotments and cutbacks to be identified on a weekly basis based on the water level within Lake Okeechobee, demands, time of year and rainfall forecasts.

Water supply development 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, Florida Statutes)

Water Supply Plan Detailed water supply plan developed by the South Florida Water Management District under Section 373.709, Florida Statutes, providing an evaluation of available water supply and projected demands at the regional scale. The planning process projects future demand for 20 years and recommends projects to meet identified needs.

Water table The surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere. Defined by the level where water within an unconfined aquifer stands in a well.

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

Wellfield One or more wells producing water from a subsurface source. A tract of land that contains a number of wells for supplying a large municipality or irrigation district.

Wetland An area that is inundated or saturated by surface water or groundwater with vegetation adapted for life under those soil conditions (e.g., swamps, bogs, and marshes).

Wild and Scenic River A river as designated under the authority of the of Public Law 90-542, the *Wild and Scenic Rivers Act,* as amended. This designation is a means to preserve selected free flowing rivers in their natural condition and protect the water quality of such rivers. A portion of the North Fork of the Loxahatchee River was federally designated as the first Wild and Scenic River in Florida on May 17, 1985.

Withdrawal Water removed from a groundwater or surface water source for use.

Yield The quantity of water (expressed as rate of flow or total quantity per year) that can be collected for a given use from surface or groundwater sources.

References

BEBR. 2006. Projections of Florida population by county 2005–2030. In *Florida Population Studies.* Volume 39, Bulletin 144, Bureau of Economic and Business Research, University of Florida, Gainesville, FL. (Authors: S.K. Smith and S. Rayer)

BEBR. 2009. Projections of Florida population by county 2008–2035. In *Florida Population Studies.* Volume 42, Bulletin 153. Bureau of Economic and Business Research, University of Florida, Gainesville, FL. (Authors: S.K. Smith and S. Rayer)

BEBR. 2010. Number of households and average household size in Florida: April 1, 2009. In *Florida Population Studies,* Volume 43, Bulletin 155, Bureau of Economic and Business Research, University of Florida, Gainesville, FL. (Authors: S,K. Smith and S. Cody)

BEBR. 2011. *Projections of Florida Population by County, 2010–2040.* In *Florida Population Studies* Volume 44, Bulletin 159, Bureau of Economic and Business Research, University of Florida, Gainesville, FL. (Authors: S.K. Smith and S. Rayer).

Bloetscher, F., D.H. Meeroff and B.N. Heimlich. 2009. *Improving the Resilience of a Municipal Water Utility Against the Likely Impacts of Climate Change—A Case Study: City of Pompano Beach Water Utility*. Florida Atlantic University, Boca Raton, FL.

Burns, W.S. 1983. *Well Plugging Applications to the Inter-aquifer Migration of Saline Groundwater in Lee County, Florida*. South Florida Water Management District, West Palm Beach, FL. Technical Publication 83-8.

Cardenas-Lailhacar, B., M.D. Dukes and G.L. Miller. 2010. Sensor-based automation of irrigation on Bermudagrass during dry weather conditions. *Journal of Irrigation and Drainage Engineering* 136(3):161-223.

Carollo Engineers, Inc. 2009. *Water Desalination Concentrate Management and Piloting*. Prepared by Carollo Engineers, Inc., Sunrise, FL, for South Florida Water Management District, West Palm Beach, FL.

CDM. 2006a. *Big Cypress Basin, Southwest Florida Feasibility Study: Hydrologic Model Development, Final Report.* Prepared by Camp Dresser & McKee, Inc., Naples, FL, for South Florida Water Management District, West Palm Beach, FL.

CDM. 2006b. *Tidal Caloosahatchee Basin Modification of Hydrologic Model.* Prepared by Camp Dresser & McKee, Inc., Naples, FL, for South Florida Water Management District, West Palm Beach, FL.

CDM. 2006c. *Estero River Basin Modification of Hydrologic M*odel. Prepared by Camp Dresser & McKee, Inc., Naples, FL, for South Florida Water Management District, West Palm Beach, FL.

CDM. 2007a. *Water Supply Cost Estimation Study.* Prepared by Camp Dresser & McKee, Inc., Naples, FL, for South Florida Water Management District, West Palm Beach, FL.

CDM. 2007b. *Water Supply Cost Estimation Study – Phase II Addendum.* Prepared by Camp Dresser & McKee, Inc., Naples, FL, for South Florida Water Management District, West Palm Beach, FL.

Conserve Florida Water Clearinghouse. 2009. *EZ Guide, Version 1.1.* University of Florida, Gainesville, FL.

DHI, Inc. and Stanley Consultants, Inc. 2005. *C-43 Basin Hydraulic Model: C-43 Basin Phase 1 Storage Reservoir Project Implementation Report.* Prepared for South Florida Water Management District, Fort Myers, FL.

Duever, M.J., D.P. Spangler, R.L. Myers, T.R. Alexander and L.A. Riopelle. 1986. *The Big Cypress National Preserve.* National Audubon Society, New York, NY.

Dukes, M.D. and M. Baum-Haley. 2009. *Evaluation of Soil Moisture-Based On-Demand Irrigation Controllers, Phase II, Final Report.* Agricultural and Biological Engineering Department, Institute for Food and Agricultural Sciences, University of Florida, Gainesville, FL.

Dziegielewski, B., J. Kiefer, E. Opitz, G. Porter, G. Lantz, W. DeOreo, P. Mayer and J. Nelson. 2000. *Commercial and Industrial End Uses of Water.* American Water Works Association Research Foundation, Denver, CO.

ECWCD. 2008. *East County Water Control District Consolidated Plan for Water Management.* East County Water Control District, Lehigh Acres, FL.

Florida Atlantic University and SFWMD. 2008. *A Density-Dependent Groundwater Flow Model of the Lower West Coast Florida Aquifer System.* Prepared by Florida Atlantic University, Boca Raton, FL in association with South Florida Water Management District, West Palm Beach, FL.

FDACS. 2010. Email message to L. Hoppes, December 8, 2010. From Florida Department of Agriculture and Consumer Services, West Palm Beach, FL to South Florida Water Management District, West Palm Beach, FL.

FDEP. 1995. 1994 *Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 1996. *1995 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 1997. *1996 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 1998. *1997 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 1999. *1998 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2000. *1999 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2001. *2001 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2002. *2002 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2003. *2003 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2004. *2004 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2005. *2005 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2006. *2006 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2007. *2007 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2010a. *2008 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2010b. *2009 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL.

FDEP. 2011. *2010 Reuse Inventory*. Water Reuse Program. Florida Department of Environmental Protection, Tallahassee, FL. Available at http://www.dep.state.fl.us/water/reuse/inventory.htm.

FDEP. 2012. *Guidance for Improved Linkage between Regional Water Supply Plans and the Consumptive Use Permitting Process.* Florida Department of Environmental Protection, Tallahassee, FL. Memo dated March 23, 2012.

FDEP and University of Florida. 2009. *Florida-Friendly Landscape Guidance Models for Ordinances, Covenants, and Restrictions.* Florida Department of Environmental Protection, Tallahassee, FL, and University of Florida, Gainesville, FL. Available at www.dep.state.fl.us/water/nonpoint/docs/nonpoint/ffl-mo-ccr-1-09.pdf.

Hazen and Sawyer. 2008. *City of Plantation Final Report Advanced Wastewater Treatment Pilot Project.* Prepared by Hazen and Sawyer Environmental Engineers & Scientists, Hollywood, FL, for the City of Plantation, Plantation, FL.

HDR Engineering and HSW Engineering, Inc. 2009. *St. Lucie and Indian River Counties Water Resources Study: Final Summary Report.* Prepared by HDR Engineering, Jacksonville, FL, and HSW Engineering, Inc., Tampa, FL, for South Florida Water Management District, West Palm Beach, FL, and St. Johns River Water Management District, Palatka, FL.

Hoppes, L. 2009. Chapter 5A: Five-Year Water Resource Development Work Program. In *2009 South Florida Environmental Report,* South Florida Water Management District, West Palm Beach, FL.

Jawitz, J.W., R. Munoz-Carpena, S. Muller, K.A. Grace and A.I. James. 2008. *Development, Testing, and Sensitivity and Uncertainty Analyses of a Transport and Reaction Simulation Engine (TaRSE) for Spatially Distributed Modeling of Phosphorous in South Florida Peat Marsh Wetlands.* Florida Integrated Science Center, United States Geological Survey, Reston, VA. Scientific Investigations Report 2008-5029.

Johnston, R.H, and P.W. Bush. 1988. *Summary of the Hydrology of the Floridan Aquifer System in Florida and in Parts of Georgia, South Carolina, and Alabama.* United States Geological Survey, Washington, D.C. Professional Paper 1403-A.

Liebermann, T.D. 2006. Estimation of spatially distributed future land use in a rapidly developing area: A case study for southwest Florida. In *Proceedings in American Water Resources Association (AWRA) Spring Specialty Conference on GIS and Water Resources IV, May 8–10, 2006,* available from American Water Resources Association, Middleburg, VA, or www.awra.org/proceedings/cdrom.html.

Maddaus Water Management. 2009. *Conservation Technical Analysis.* Prepared by the Maddaus Water Management, Alamo, CA, for East Bay Municipal Utility District, Oakland, CA.

Marella, R.L. 2008. *Water Use in Florida, 2005 and Trends 1950–2005.* United States Geological Survey, Orlando, FL. Fact Sheet Series 2008-3080. Available at pubs.usgs.gov/fs/2008/3080/.

Marella, R.L. 2009. *Water Withdrawals, Use, and Trends in Florida, 2005.* United States Geological Survey, Orlando, FL. Scientific Investigations Report 2009-5125. Available at pubs.usgs.gov/sir/2009/5125/.

Marco Water Engineering, Inc. 2006. *Lower West Coast Surficial Aquifer System Model Report.* Prepared by Marco Water Engineering, West Palm Beach, FL, for South Florida Water Management District, West Palm Beach, FL.

Martin, P.J. 2010. Chapter 5A: Five-Year Water Resource Development Work Program. In *South Florida Environmental Report – Volume II,* South Florida Water Management District, West Palm Beach, FL.

Martin, P.J. 2011. Chapter 5A: Five-Year Water Resource Development Work Program. In *2011 South Florida Environmental Report,* South Florida Water Management District, West Palm Beach, FL.

Martin, P.J. 2012. Chapter 5A: Five-Year Water Resource Development Work Program. In *2012 South Florida Environmental Report,* South Florida Water Management District, West Palm Beach, FL.

Mayer, P.W., W.B. DeOreo, E.M. Opitz, J.C. Kiefer, W.Y. Davis, B. Dziegielewski and J.O. Nelson. 1999. *Residential End Uses of Water.* American Water Works Association Research Foundation, Denver, CO.

McCready, M.S., M.D. Dukes and G.L. Miller, 2009. Water conservation potential of smart irrigation controllers on St. Augustine grass. *Agricultural Water Management* 96(11):1623–1632.

Metcalf & Eddy. 2006. *Technical and Economic Feasibility of Co-located Desalination Facilities.* Prepared by Metcalf & Eddy, Wakefield, MA, for South Florida Water Management District, West Palm Beach, FL.

Miami-Dade County. 2007. *Miami-Dade County Water Use Efficiency 20-Year Plan.* Miami-Dade County Water and Sever Department, Miami, FL.

Morales, M.A., J.M. Martin and J.P. Heaney. 2009. Methods for estimating commercial, industrial and institutional water use. In *Proceedings of Florida Section of American Water Works Association Fall 2009 Conference, Orlando, FL.* Florida Section of the American Water Works Association, St. Cloud, FL.

Murley, J., B.N. Heimlich and N. Bollman. 2008. *Florida's Resilient Coasts — A State Policy Framework for Adaptation to Climate Change.* Center for Urban and Environmental Solutions and National Commission on Energy Policy, Florida Atlantic University, Fort Lauderdale, FL.

MWH Global, Inc. 2008a. *Southwest Wastewater Treatment Facility Advanced Wastewater Treatment (AWT) and Reuse Pilot Testing Program, Final Report.* Prepared by MWH Global, Inc., Sunrise, FL, for the City of Sunrise, Sunrise, FL.

MWH Global, Inc. 2008b. *W-10 Water Supply Resource Study, City of Cape Coral, Groundwater Flow and Solute Transport Model.* Prepared by MWH Global, Inc., Fort Myers, FL, for Cape Coral Utilities, Cape Coral, FL.

NAHB and Bank of America Home Equity. 2007. *Study of Life Expectancy of Home Components.* National Association of Home Builders and Bank of America Home Equity, Washington, D.C.

Pottorff, L., D. Whiting and C. Wilson. 2010. *Efficient Landscape Irrigation during Drought and with Limited Water Availability in Colorado.* Colorado State University Extension, Fort Collins, CO. Available at http://www.ext.colostate.edu/drought/eff landscape.html.

RMA GeoLogic Consultants, Inc. 2007. *Water Use Permit Application Modification and Supporting Documentation for the North Lee County Reverse Osmosis WTP Lower Hawthorn Aquifer Wellfield.* Prepared by RMA GeoLogic Consultations, Inc., Fort Myers, FL for Lee County Utilities, Lee County, Fort Myers, FL.

D. Scavia, J.C. Field, D.F. Boesch, R.W. Buddemeier, V. Burkett, D.R. Cayan, M. Fogarty, M.A. Harwell, R.W. Howarth, C. Mason, D.J. Reed, T.C. Royer, A.H. Sallenger, and J.G. Titus. 2002. Climate change impacts on U.S. coastal and marine ecosystems. *Estuaries* 25(2):149-164.

Schers, G.J. S. Kopko, A. Fenske, M. Cason, G.P. Kennedy, and MWH . 2007. Reducing adverse impacts of declining water quality on RO WTP by implementing operational changes to the wellfield. In *82nd Annual Florida Water Resources Conference Technical Program and Proceedings,* Orlando, FL, Florida Water Resources Conference, Inc., Bradenton, FL.

Schlumberger Water Services. 2010. *Big Cypress Basin Saltwater Intrusion Pilot Modeling Study, Phase 2.* Prepared for the South Florida Water Management District, Big Cypress Basin, Naples, FL.

Schlumberger Water Services and SFWMD. 2011. *Lower West Coast Floridan Aquifer System Model Development.* Prepared for the South Florida Water Management District, Big Cypress Basin, Naples, FL.

Schmerge, D.L. 2001. *Distribution and Origin of Salinity in the Surficial and Intermediate Aquifer Systems, Southwestern Florida*. United Society Geological Society, Tallahassee, FL. Water Resource Investigations Report 01-4159.

SDI Environmental Services, Inc., BPC Group Inc. and DHI, Inc. 2008. *Southwest Florida Feasibility Study Integrated Hydrologic Model, Model Documentation Report.* Prepared for the South Florida Water Management District, West Palm Beach, FL.

SFWMD. 1994. *1994 Lower West Coast Water Supply Plan.* South Florida Water Management District, West Palm Beach, FL

SFWMD. 2000a. *2000 Lower East Coast Regional Water Supply Plan.* South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2000b. *2000 Lower West Coast Water Supply Plan.* South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2006. *2005–2006 Lower West Coast Water Supply Plan Update.* South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2009a. *Climate Change and Water Management in South Florida.* South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2009b. *Water Utilities Water Demand Reduction during the 2007–2009 Water Shortage.* South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2010a. *Basis of Review for Water Use Permit Application within the South Florida Water Management District.* South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2010b. *Big Cypress Basin Strategic Plan 2010–2015.* SFWMD, West Palm Beach, FL.

SFWMD. 2011b. *Water Efficiency Self-Assessment Guide for Commercial and Institutional Facility Managers.* South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2012a. *2011–2012 Water Supply Plan Support Document.* SFWMD, West Palm Beach, FL.

SFWMD. 2012b. *2012 Lower East Coast Water Supply Plan Update.* South Florida Water Management District, West Palm Beach, FL.

SFWMD, FDEP and FDACS. 2009. *Caloosahatchee River Watershed Protection Plan.* South Florida Water Management District, West Palm Beach, FL; Florida Department of Environmental Protection, Tallahassee, FL; Florida Department of Agriculture and Consumer Services, Tallahassee, FL.

Sherwood, C.B. and H. Klein. 1963. Saline groundwater in southern Florida. *Groundwater* 1(2):4-8.

Shoemaker, W.B. and K.M. Edwards. 2003. *Potential for Saltwater Intrusion into the Lower Tamiami Aquifer near Bonita Springs, Southwestern Florida.* United States Geological Survey, Tallahassee, FL. Water Resources Investigations Report 03-4262.

Shoemaker, W.B., C.D. Lopez and M.J. Duever. 2011. *Evapotranspiration over Spatially Extensive Plant Communities in Big Cypress National Preserve, Southern Florida, 2007–2010.* United States Geological Survey, United States Department of the Interior, Washington, DC. SIR 2011-5212. Available at http://pubs.usgs.gov/sir/2011/5212/.

Smajstrla, A.G. 1990. *Technical Manual, Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) Model, Version 5.5.* Prepared by Agricultural Engineering Department, University of Florida, Gainesville, FL, for St. Johns River Water Management District, Palatka, FL. Special Publication SJ2008-SP17.

Smith, K. 1990. *A Three-Dimensional Finite Difference Ground Water Flow Model of Hendry County.* South Florida Water Management District, West Palm Beach, FL. Technical Publication 90-04.

Spechler, R.M. 2010. *Hydrogeology and Groundwater Quality of Highlands County, Florida.* United States Geological Survey, Reston, VA. Scientific Investigations Report 2010-5097.

SWFRPC and CHNEP. 2009. *Comprehensive Southwest Florida/Charlotte Harbor Climate Change Vulnerability Assessment.* Southwest Florida Regional Planning Council, Fort Myers, FL, and Charlotte Harbor National Estuary Program, Fort Myers, FL. Technical Report 09-3. September 15, 2009.

USACE. 2007. *Final Environmental Impact Statement Including Appendices A through G – Lake Okeechobee Regulation Schedule.* United States Army Corps of Engineers, Jacksonville, FL.

USACE. 2008. *Central and Southern Florida Project Water Control Plan for Lake Okeechobee and Everglades Agricultural Area.* United States Army Corps of Engineers, Jacksonville, FL.

USACE and SFWMD. 2009. *Draft Southwest Florida Feasibility Study Draft Integrated Feasibility Report and Environmental Impact Statement.* United States Army Corps of Engineers, Jacksonville, FL, and South Florida Water Management District, West Palm Beach, FL.

U.S. Census Bureau. 2001. *Florida 2000 Census of Population and Housing.* United States Census Bureau, United States Department of Commerce, Economics and Statistics Administration, Washington, DC. Available at http://www.census.gov/.

U.S. Census Bureau. 2010. *2010 Census.* United States Census Bureau, United States Department of Commerce, Economics and Statistics Administration, Washington, DC. Available at http://2010.census.gov/2010census/

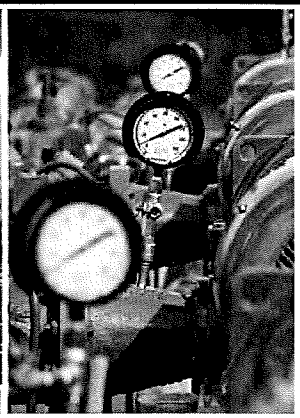
USDA–NASS. 2004, 2006, 2008, 2009. *Commercial Citrus Inventory.* United States Department of Agriculture – National Agriculture Statistics Service, Orlando, FL. Available at http://www.nass.usda.gov/Statistics_by_State/Florida/Publications/Citrus/index.asp.

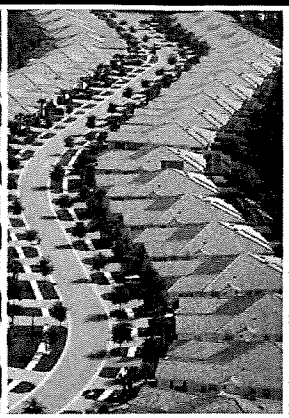
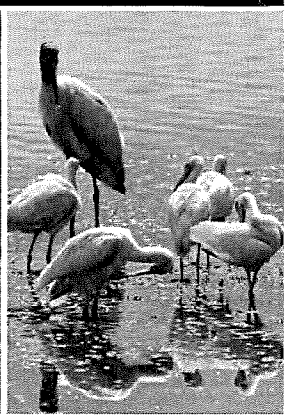
USEPA. 2011. *WaterSense/Outdoor, Smart Outdoor Practices.* United States Environmental Protection Agency, Washington, DC. Available at www.epa.gov/WaterSense/outdoor/.

USFWS. 2010. *National Wetlands Inventory*. National Wetlands Inventory Program, Branch of Resource and Mapping Support, United States Fish and Wildlife Service, Washington, DC. Available at http://wetlands.fws.gov.

Vickers, A. 2001. *Handbook of Water Use and Conservation*. Waterplow Press, Amherst, MA.

White, D. and R.C. Stroh, Sr. 2010. *The State of Florida's Housing, 2009*. Shimberg Center for Housing Studies, University of Florida, Gainesville, FL. Available at http://flhousingdata.shimberg.ufl.edu/.

Meeting South Florida's water supply needs while safeguarding its natural systems requires innovative solutions, cohesive planning, and a shared vision.

South Florida Water Management District

Committed to managing and protecting our region's water resources

South Florida Water Management District
3301 Gun Club Road • West Palm Beach, Florida 33406
561-686-8800 • FL WATS 1-800-432-2045 • www.sfwmd.gov
MAILING ADDRESS: P.O. Box 24680 • West Palm Beach, FL 33416-4680

sfwmd.gov