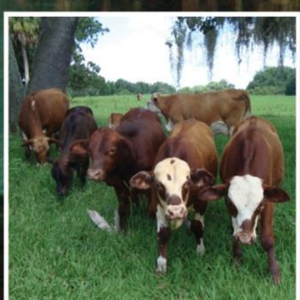
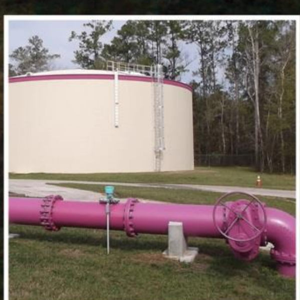
2015
Regional Water Supply Plan

Northern Planning Region





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Southwest Florida
Water Management District

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2015 Regional Water Supply Plan
Northern Planning Region

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Southwest Florida Water Management District

2015 Regional Water Supply Plan

This report is produced by the Southwest Florida Water Management District

November 17, 2015

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List of Abbreviations

AG	Agriculture
AR	Aquifer Recharge
ASR	Aquifer Storage and Recovery
AWEP	Agriculture Water Enhancement Program
BEBR	Bureau of Economic and Business Research
BMP	Best Management Practice
CAR	Consolidated Annual Report
CDD	Community Development District
CFI	Cooperative Funding Initiatives
CFS	Cubic Feet per Second
CFWC	University of Florida Conserve Florida Water Clearinghouse
CFWI	Central Florida Water Initiative
CUPcon	Consumptive Use Permitting Consistency
DEP	Florida Department of Environmental Protection
DFT	Dual Flush Toilets
DSS	Domestic Self Supply
DWRM	Districtwide Regulation Model
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ER	Environmental Restoration
ET	Evapotranspiration
ETB	Eastern Tampa Bay
ETBWUCA	Eastern Tampa Bay Water Use Caution Area
F.A.C.	Florida Administrative Code
FARMS	Facilitating Agricultural Resource Management Systems
FDACS	Florida Department of Agriculture and Consumer Services
FFL	Florida-Friendly Landscaping
F.S.	Florida Statutes
FTMR	Focus Telescopic Mesh Refinement
FWS	Florida Water Star
FY	Fiscal Year
GAL	Gallons
GIS	Geographic Information System
GPD	Gallons per Day
GRP	Gross Regional Product
HET	High-Efficiency Toilets
HRWUCA	Highlands Ridge Water Use Caution Area
I/C	Industrial/Commercial
ICI	Industrial/Commercial and Institutional
ICU	Intermediate Confining Unit
IFAS	Institute of Food and Agricultural Sciences
INTBM	Integrated Northern Tampa Bay Model
IPCC	Intergovernmental Panel on Climate Change
L/R	Landscape/Recreation
LFA	Lower Floridan aquifer
LFU	Low Flush Urinal
LHR	Lower Hillsborough River

MCU	Middle Confining Unit
MCU I	Middle Confining Unit I (1)
MCU II	Middle Confining Unit II (2)
M/D	Mining/Dewatering
MFL	Minimum Flows and Levels
MGD	Million Gallons per Day
MG/L	Milligrams per Liter
MIA	Most Impacted Area
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTB	Northern Tampa Bay
NTBWUCA	Northern Tampa Bay Water Use Caution Area
O&M	Operation and Maintenance
OFW	Outstanding Florida Water
OPPAGA	Office of Program Policy Analysis and Governmental Accountability
PG	Power Generation
PRMRWSA	Peace River Manasota Regional Water Supply Authority
PS	Public Supply
PSI	Pounds per Square Inch
QWIP	Quality of Water Improvement Program
RC&D	Florida West Coast Resource Conservation and Development Council
RIB	Rapid Infiltration Basin
RO	Reverse Osmosis
ROMP	Regional Observation Monitor-well Program
RWSP	Regional Water Supply Plan
SCADA	Supervisory Control and Data Acquisition
SHP	Stormwater Harvesting Program
SJRWMD	St. Johns River Water Management District
SMS	Soil Moisture Sensor
STAG	State and Tribal Assistance Grants
SWCFGWB	Southern West-Central Florida Groundwater Basin
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management Program
SWUCA	Southern Water Use Caution Area
TBC	Tampa Bypass Canal
TBW	Tampa Bay Water
TDS	Total Dissolved Solids
TECO	Tampa Electric Company
TMDL	Total Maximum Daily Load
UFA	Upper Floridan aquifer
ULFT	Ultra Low-Flow Toilet
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geologic Survey
WMD	Water Management District
WMIS	Water Management Information System
WMP	Watershed Management Program
WQMP	Water Quality Monitoring Program

WRAP	Water Resource Assessment Project or West-Central Florida Water Restoration Action Plan
WRD	Water Resource Development
WRPC	Withlacoochee Regional Planning Council
WRWSA	Withlacoochee Regional Water Supply Authority
WSD	Water Supply Development
WUCA	Water Use Caution Area
WUP	Water Use Permit
WUWPD	Water Use Well Package Database
WWTP	Wastewater Treatment Plant
ZLD	Zero Liquid Discharge

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Chapter 1. Introduction

The Regional Water Supply Plan (RWSP) for the Southwest Florida Water Management District (District) is an assessment of projected water demands and potential sources of water to meet these demands for the period from 2015 through 2035. The RWSP has been prepared in accordance with the Florida Department of Environmental Protection's (DEP) 2009 Format and Guidelines for Regional Water Supply Planning. The RWSP consists of four geographically-based volumes that correspond to the District's four (4) designated water supply planning regions: Northern, Tampa Bay, Southern and Heartland (Figure 1-1). This volume is the 2015 RWSP update for the Northern Planning Region, which includes Hernando, Citrus and Sumter counties and the portions of Lake, Levy and Marion counties within the District. In 2010, the RWSP update included the District's Northern Planning Region for the first time.

The purpose of the RWSP is to provide the framework for future water management decisions in the District. The RWSP for the Northern Planning Region shows that demand for water through 2035 can be met with fresh groundwater through the use of all available reclaimed water and implementation of comprehensive water conservation measures.

The RWSP also identifies hundreds of potential options and associated costs for developing alternative sources, as well as fresh groundwater. The options are not intended to represent the District's most preferable options for water supply development (WSD). They are, however, provided as reasonable concepts that water users in the planning region can pursue to meet their water supply planning needs. Water users can select a water supply option as presented in the RWSP or combine elements of different options that suit their water supply needs, provided such options are consistent with the intent and direction of the RWSP. Additionally, the RWSP provides information to assist water users in developing funding strategies to implement water supply projects.

The requirement for regional water supply planning originated from legislation passed in 1997 that significantly amended Chapter 373, Florida Statutes (F.S.). Regional water supply planning requirements are codified in Part VII of Chapter 373 (373.709), F.S., and this RWSP was prepared pursuant to these provisions. Key components of this legislation include:

- Designation of one or more water supply planning regions within the District.
- Preparation of a Districtwide water supply assessment.
- Preparation of a RWSP for areas where existing and reasonably anticipated sources of water were determined to be inadequate to meet future demand, based upon the results of the water supply assessment.

Regional water supply planning requirements were amended as a result of the passage of Senate Bill 444 during the 2005 legislative session. The bill substantially strengthened requirements for the identification and listing of WSD projects. In addition, the legislation intended to foster better communications among water planners, local government planners and local utilities. Local governments are now allowed to develop their own water supply assessments, which the water management districts (WMDs) are required to consider when developing their RWSPs. Finally, a trust fund was created that provides the WMDs with state matching funds to support the development of alternative water supplies by local governments, water supply authorities and other water users.

Since 2001, the District has completed RWSPs for the 10-county area from Pasco County to Charlotte County. In this area, excessive groundwater withdrawals from the Upper Floridan aquifer (UFA) caused significant environmental impacts. Water supply planning was necessary to determine how the region’s future water supply demands could be met and environmental impacts mitigated through the development of alternative sources.

The Northern Planning Region was excluded from the RWSP until 2010. The decision to include the region in the plan was in response to the Governing Board’s concerns with the future water demand of thousands of undeveloped vested lots, effects of groundwater withdrawals on springs, lakes and other water resources, and the St. Johns River Water Management District’s (SJRWMD) focused monitoring and study in Lake and Marion counties. The intent was to ensure that a proactive, preventive approach is taken to water management in the region. Principal goals of the approach are to develop both short- and long-term measures that can be implemented to optimize the use of available groundwater to meet future demands while preventing unacceptable impacts to the resources. The Northern Planning Region strategy emphasizes three primary courses of action to address the issues of water demand and water supply: resource monitoring, enhanced conservation and regional water supply planning. Each element of this strategy will be discussed in this volume. The goal is to implement the strategy in advance of the significant water resource impacts that have occurred in the Tampa Bay, Heartland and Southern planning regions.

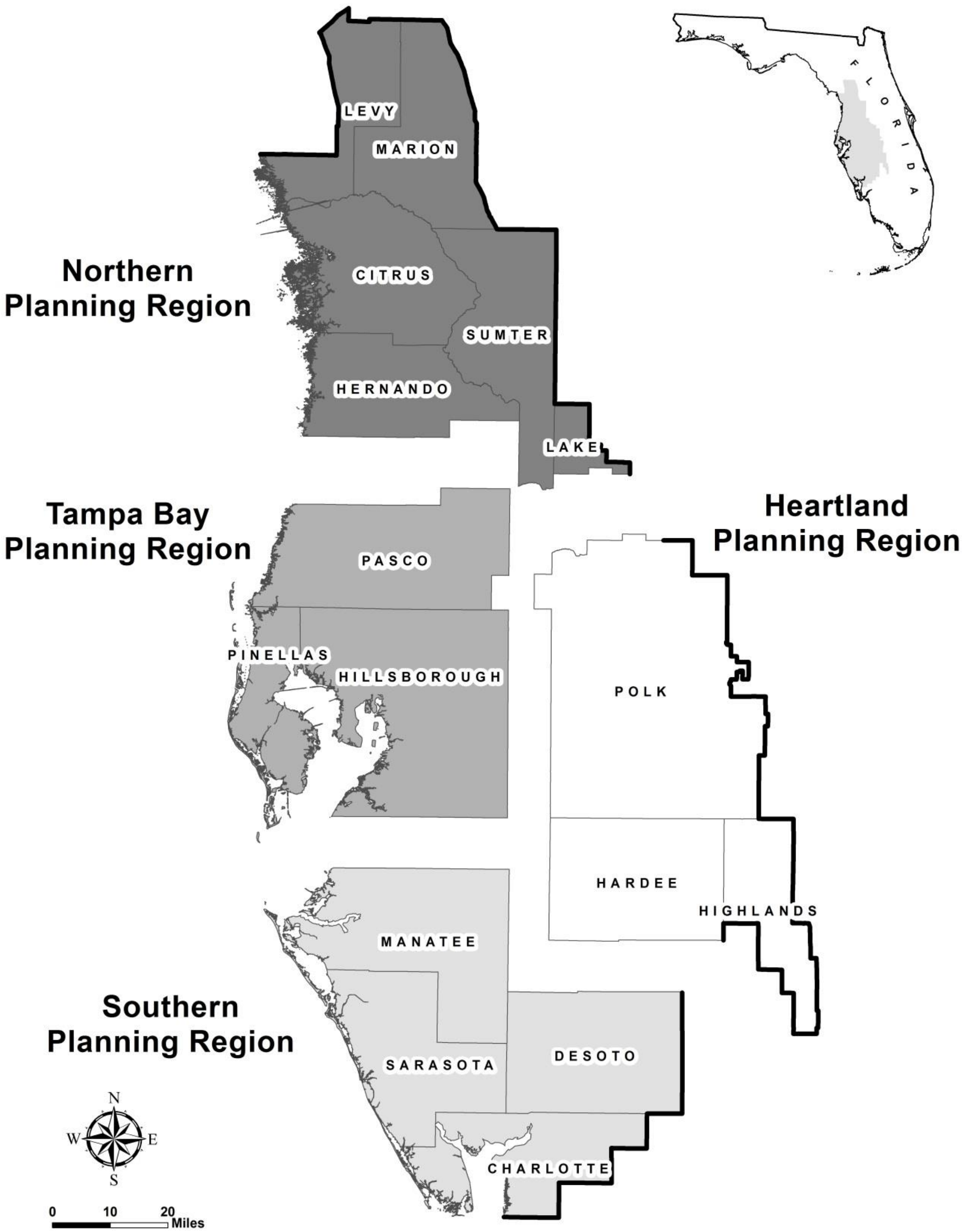


Figure 1-1. *Location of the four water supply planning regions within the District*

Part A. Introduction to the Northern Planning Region RWSP

The following describes the content of the RWSP for the Northern Planning Region: Chapter 1, Introduction, contains an overview of water supply planning accomplishments in the planning region prior to the development of this RWSP; a description of the land use, population, physical characteristics, hydrology, geology/hydrogeology of the region; and a description of the technical investigations that provide the basis for the District's water resource management strategies. Chapter 2, Resource Protection Criteria, addresses the resource protection strategies that the District has implemented or is considering implementing, including water use caution areas (WUCAs) and the District's minimum flows and levels (MFLs) program. Chapter 3, Demand Estimates and Projections, is a quantification of existing and reasonably projected water supply demand through the year 2035 for public supply, agricultural, industrial/commercial, mining/dewatering, power generation and landscape/recreation users and environmental restoration. Chapter 4, Evaluation of Water Sources, is an evaluation of the future water supply potential of traditional and alternative sources. Chapter 5, Water Supply Development Component, presents a list of WSD options for local governments and utilities, including surface and stormwater, reclaimed water and water conservation. For each option, the estimated amount of water available for use and the estimated cost of developing the option are provided. Chapter 6 is an overview of WSD projects that are currently under development and receiving District funding assistance. Chapter 7, Water Resource Development Component, is an inventory of the District's ongoing data collection and analysis activities and water resource projects that are classified as water resource development. Chapter 8, Overview of Funding Mechanisms, provides an estimate of the capital cost of water supply and water resource development projects proposed by the District and its cooperators to meet the water supply demand projected through 2035 and to restore MFLs to impacted natural systems. An overview of mechanisms available to generate the necessary funds to implement these projects is also provided.

Part B. Accomplishments since Completion of the 2010 RWSP

This section is a summary of the water supply planning accomplishments in the planning region prior to the development of this RWSP.

Section 1. Conservation and Reclaimed Water Development

1.0 Water Conservation

The District continues to promote and cooperatively fund water conservation efforts to make more efficient use of existing water supplies. In the public supply sector, this includes cooperatively funded projects for plumbing retrofits, toilet and rain sensor device rebates, water efficient landscape and irrigation evaluations, and soil moisture sensor device and pre-rinse spray valve rebates. Since 2010, the District has funded conservation projects undertaken by Citrus and Marion counties, the Withlacoochee Regional Water Supply Authority, and the Bay Laurel Community Development District.

In the agricultural water use sector, the District's primary initiative for water conservation is the Facilitating Agricultural Resource Management Systems (FARMS) Program. Established in 2003 in partnership with the Florida Department of Agriculture and Consumer Services (FDACS), FARMS is a cost-share reimbursement program for production-scale best management practices to reduce groundwater use and improve water quality. To date, more than 134 operational projects Districtwide are providing a groundwater offset of more than 18 mgd. An additional 30 projects in the planning, design or construction phase are expected to yield another 4 mgd of offset. In the northern region, there are seven operational projects and one project under construction.

2.0 Reclaimed Water

The District has continued its highly successful program to cooperatively fund projects that make reclaimed water available for beneficial reuse. These include more than 356 projects between FY1987 and FY2015 for the design and construction of transmission mains, recharge, natural system enhancement, storage and pumping facilities, feasibility studies, reuse master plans, and metering and research projects. As a consequence of District and utility cooperation, reuse projects were developed that will result in the 2020 Districtwide utilization of reclaimed water of up to 245 mgd and a water resource benefit of more than 150 mgd. Utilities are well on their way to achieving the 2035 Districtwide goals of 316 mgd utilization (70 percent) and 221 mgd of water resource benefit (70 percent efficiency).

Reclaimed water storage tank in Brooksville

In 2010, utilities within the region were utilizing approximately 54 percent or 9 mgd of the 16.8 mgd of available wastewater treatment plant flows resulting in an estimated 6.7 mgd of water resource benefits (74 percent efficiency). Since 2010, nine additional reclaimed water projects in the planning region were jointly funded with Marion and Citrus counties, On Top of the World, and the cities of Brooksville, Inverness, Crystal River, and Bushnell. Of particular significance is the Crystal River to Duke Energy reclaimed water project, which involves the supply of 0.75 mgd of reclaimed water from Crystal River to a power station in western Citrus County. As a result of these projects, an additional 4.65 mgd is anticipated to be supplied by 2020.

Section 2. Support for Water Supply Planning

In April 2014, the Withlacoochee Regional Water Supply Authority (WRWSA), with District funding assistance, completed the Water Supply Plan Update, which is an update to its 2005 Master Regional Water Supply Plan and 2010 Phase II Detailed Water Supply Feasibility Analysis. This plan is a 20-year assessment of water demands and potential water sources for meeting these demands. The objective of the Update is to assist water supply utilities within the WRWSA's four-county region by developing implementable water supply options and strategies to meet future demands. Information from the Update has been incorporated in this RWSP update for the Northern Planning Region.

The District is actively involved in providing technical support to local governments as they prepare statutorily required Water Supply Facilities Work Plans and related updates as part of their comprehensive plans. District staff worked with the Department of Economic Opportunity and its predecessor (Department of Community Affairs), the DEP and the other WMDs to develop a guidance document for preparing the work plans. Staff provides ad hoc assistance to local governments and instituted a utility services program to assist utilities with planning, permitting and information/data needs.

Section 3. Minimum Flows and Levels Establishment

1.0 Established MFLs

The MFLs established in the planning region since 2010 include those adopted in 2013 for the Chassahowitzka and Homosassa river and springs systems, lakes Bonable, Little Bonable, and Tiger in Marion County, and Tooke Lake and Whitehurst Pond in Hernando County. A number of additional priority water bodies in the planning region are scheduled for MFLs establishment, and the MFLs adopted for the Chassahowitzka and Homosassa river and springs systems are scheduled to be reevaluated (see Chapter 2, Part B, and Appendix 2).

2.0 MFLs Recovery Initiatives

MFLs established in the planning region to date are currently being met and, therefore, recovery strategies are not required. The reduction in groundwater withdrawals from Tampa Bay Water (TBW) wellfields in Pasco County associated with the recovery strategy for the Northern Tampa Bay Water Use Caution Area (NTBWUCA), in addition to reduced water demand for public supply in western Hernando County, has had some beneficial effect on groundwater levels, springflows, and lakes in Hernando County. In addition, groundwater use in the remainder of the Northern Planning Region has generally remained flat or slightly declined over the last five years.

Section 4. Regulatory and Other Initiatives

Since 2011, the District has been working with public water supply utilities, the St. Johns River and South Florida WMDs, DEP, FDACS, and multiple stakeholders on the Central Florida Water Initiative (CFWI), which includes portions of Polk and Lake counties and all or parts of four other counties in central Florida outside of the District (see Figure 2). This is an area where the WMDs have previously determined, through water supply planning efforts and real-time monitoring, that groundwater availability is limited. The CFWI mission is to help protect, develop, conserve and restore central Florida's water resources by collaborating to address central Florida's current and long-term water supply needs. The CFWI is led by a Steering Committee that includes a public water supply utility representative, a Governing Board member from each of the three WMDs, and representatives from DEP and FDACS. The Steering Committee oversees the CFWI process and provides guidance to the technical teams and technical oversight/management committees that are developing and refining information on central Florida's water resources. The Steering Committee has guided the technical and planning teams in the development of the CFWI RWSP, which ensures the protection of water resources and related natural systems and identifies sustainable water supplies for all water users in the CFWI region through 2035. Those efforts, which are reflected in this 2015 RWSP update for the Northern Planning Region, will lead to adoption of new rules and management strategies. More detailed information concerning the CFWI is available on the CFWI website at http://cfwiwater.com/planning.html.

In 2014, the District revised its water use permitting rules as part of the statewide Consumptive Use Permitting Consistency (CUPcon) effort. Changes were made to Chapter 40D-2, Florida Administrative Code (F.A.C.), and the *Water Use Permit Information Manual, Part B, Basis of Review*, including renaming the manual to the *Water Use Permit Applicant's Handbook*. The purpose of this effort, which involved the DEP, all five WMDs, and stakeholder input, was to reduce confusion for the regulated public, treat applicants more equitably statewide, provide more consistent environmental protections, streamline the permitting process, and incentivize behavior that protects water resources, including water conservation.

The District partnered with the WRWSA, The Villages of Sumter County and the City of Wildwood to expand groundwater monitoring and data collection in northern Sumter County. This project, called the North Sumter Data Plan, was completed in 2012. In addition, the District continued its deep exploratory drilling and testing program that included several sites close to the boundary between the District and the SJRWMD in Marion and Sumter counties. This is a high-growth area that is hydrogeologically complex. Information gained from this work was incorporated into the latest version of the Northern District groundwater flow model which was completed in late 2013 (HydroGeoLogic, 2013). The model was used in the RWSP to assess current and future groundwater withdrawal impacts on lake levels, spring flows and the Withlacoochee River.

Part C. Description of the Northern Planning Region

Section 1. Land Use and Population

The Northern Planning Region is characterized by a diversity of land use types (Table 1-1). The area encompasses extensive tracts of federal, state and District-owned conservation lands that include the Withlacoochee State Forest, the Annutteliga Hammock, the Chassahowitzka Wildlife Management Area, the Weekiwachee Preserve, the Flying Eagle Preserve, Potts Preserve and the Lake Panasoffkee tract. These protected public lands are used and maintained for timber management; ecological restoration; public recreation; and conservation of hardwood swamps, fresh and saltwater marshes, river frontage, sandhill-dwelling plants and prime black bear habitat. Limestone mining activities occur primarily in Hernando, Sumter and Levy counties and numerous inactive mines are scattered throughout the northern counties. Significant agricultural activities are carried out in the region. Forestry and pasture dominate agricultural use in terms of acres, and Marion County is known for its thoroughbred horse breeding industry. Ornamental production is growing, particularly in Sumter County. Watermelons are a primary crop, with Levy County leading the region. Other crops farmed at a much smaller scale include sweet peppers, squash, cucumbers, cantaloupes and sweet corn.

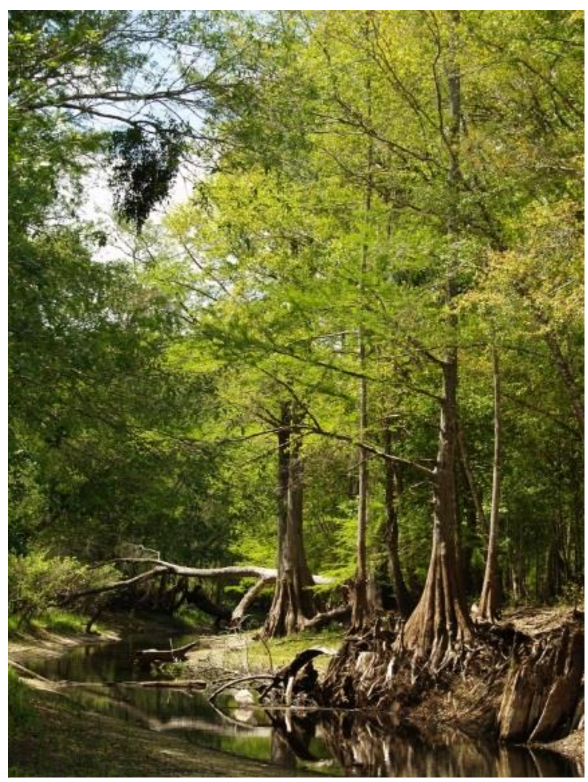
The population of the planning region is projected to grow from approximately 556,278 in 2010 to 881,447 in 2035. This is an increase of approximately 325,169 new residents; a 58 percent increase over the planning period. Marion, Lake and Sumter counties include sections of The Villages retirement communities, the largest residential development in central Florida. A future expansion of the Suncoast Parkway may result in an increase in commercial and industrial land uses and bring new residents to Citrus and Levy counties. Residential and commercial development has also been concentrated along U.S. 19 in Hernando and Citrus counties and along SR 200 southwest of Ocala in Marion County.

Table 1-1. *Land use/land cover in the Northern Planning Region (2011)*

Land Use/Land Cover Types (2011)	Acres	Percent
Urban and Built-up	410,353.57	24.04
Agriculture	373,079.26	21.86
Rangeland	26,586.37	1.56
Upland Forest	484,371.85	28.38
Water	21,602.61	1.27
Wetlands	340,562.25	19.95
Barren Land	4,455.52	0.26
Transportation, Communication and Utilities	21,271.77	1.25
Industrial and Mining	24,631.45	1.44
Total	**1,706,914.64**	**100**

Source: SWFWMD 2011 LULC GIS layer (SWFWMD, 2011).

Section 2. Physical Characteristics



Withlacoochee River watershed

The planning region is divided along the Brooksville Ridge physiographic region into two distinct watersheds. The Springs Coast watershed consists of the Coastal Swamp in western Hernando and Citrus counties along the Gulf of Mexico. It also encompasses the Gulf Coastal Lowlands between the Coastal Swamp and the Brooksville Ridge, which consists of relatively flat plains to rolling sandhills. The Withlacoochee River watershed (the second largest in the District) encompasses parts of Marion, Levy, Citrus and Hernando counties and all of Sumter County, and portions of Pasco and Polk counties outside of the Northern Planning Region.

The Brooksville Ridge runs northwest-southeast across the planning region through the central portions of Citrus and Hernando counties. Elevations along the Brooksville Ridge range from 70 to 275 feet above sea level. The Brooksville Ridge has an irregular surface due to the prevalence of karst features and is mantled with clay-rich soils. The Tsala-Apopka Chain of Lakes lies between the Brooksville Ridge and the Withlacoochee River within the recharge area of the coastal springs. It has a large number of interconnected lakes that are divided by peninsulas and islands. Elevations range from 35 to 75 feet above sea level.

Section 3. Hydrology

Figure 1-2 depicts the major hydrologic features in the planning region including rivers, lakes and springs.

1.0 Rivers

Rivers in the Springs Coast watershed include the Weeki Wachee and Mud rivers in Hernando County and the Chassahowitzka, Homosassa, Halls and Crystal rivers in Citrus County. The rivers are relatively short (less than 10 miles in length) and their flow is derived primarily from spring discharge. The Withlacoochee River's tributaries include the Rainbow River in Marion County, the Little Withlacoochee River in northeast Hernando County and Sumter County, and Jumper Creek and the Panasoffkee Outlet River in Sumter County. From its headwaters in the Green Swamp, the Withlacoochee River traverses eight counties before discharging into the Gulf of Mexico. The Green Swamp is also the source of the Hillsborough, Peace and Ocklawaha rivers.

2.0 Lakes

Major lakes in the planning region include Lake Panasoffkee in Sumter County (4,460 acres), Bonable Lake in Marion County (211 acres), Lake Rousseau in Levy County (3,657 acres) and the Tsala-Apopka Chain of Lakes in Citrus County (23,300 acres). The Tsala-Apopka chain consists of interconnected ponds, marshes and the open water portions of primary pools at Floral City (9,100 acres), Inverness (8,000 acres) and Hernando (6,200 acres). Figure 1-2 depicts the locations of lakes in the planning region greater than 20 acres in size.

3.0 Springs

Several first-magnitude springs (discharge exceeds 100 cubic feet per second [cfs]) are located in the planning region. These include the Rainbow Springs Group in Marion County, the Crystal River Group (Kings Bay), Chassahowitzka and Homosassa springs groups in Citrus County, and the Weeki Wachee Springs Group in Hernando County. The Rainbow Springs Group consists of multiple springs, which are the source of the Rainbow River. The river flows for approximately 5.7 miles before merging with the Withlacoochee River upstream of Lake Rousseau and, based on United States Geological Survey (USGS) data, the river has an average discharge of 677 cfs (438 mgd).

The Gum Slough springs in Sumter County feed the Withlacoochee River

The Crystal River Group and the Chassahowitzka and Homosassa springs groups are located on Citrus County's gulf coast. Crystal River springs, discharging into the tidally influenced Kings Bay (600 acres), are the headwaters of the Crystal River Group and are part of a complex network of more than 70 springs. These springs have an estimated average discharge of 450 cfs (291 mgd) (HydroGeoLogic, 2008). The springs are located within the saltwater interface (the boundary between fresh water and salt water in the UFA). Consequently, most of the springs discharge water that is brackish to varying degrees. The Homosassa Springs Group discharges approximately 250 cfs (162 mgd) and, together with springs on the Halls River, provides the majority of flow for the Homosassa River. The quality of water discharging from the main spring at the head of the Homosassa River is brackish. Chassahowitzka Springs consists of a group of springs with a combined average discharge of 115 cfs (74 mgd). The springs are the primary source of water for the Chassahowitzka River. The quality of water discharging from the largest spring at the head of the river is also brackish. The Weeki Wachee Main Spring is located at the head of the Weeki Wachee River and discharges at an average rate of 172 cfs (111 mgd). Because the spring is located considerably further inland than the springs discussed above, water discharging from the spring is always fresh. Several smaller springs discharge brackish water into the Weeki Wachee River downstream of the main spring (Jones et al., 1997).

Lake Panasoffkee, Sumter County

Numerous smaller springs that are second-magnitude or less (discharge between 10 cfs and 100 cfs) are located in the planning region, but many are unnamed and difficult to locate. Springs in the Lake Panasoffkee area are good examples. Fenny Springs, a second-magnitude spring located in Sumter County, flows to Lake Panasoffkee and the Withlacoochee River. Gum Slough, a four-mile-long spring run that flows into the Withlacoochee River, is fed by several springs located at the head of the slough in northwestern Sumter County. The Aripeka Springs Group includes Hammock Creek and is composed of numerous small springs clustered in a one-square-mile area of southwestern Hernando County.

4.0 Wetlands

Prior to significant development, approximately 54 percent of Florida was covered by wetlands. However, due to drainage and development, only approximately 30 percent of the state currently remains covered by wetlands. Wetlands in the planning region can be grouped into saltwater and freshwater types. Saltwater wetlands are found bordering estuaries that are coastal wetlands influenced by the mixing of fresh water and seawater. Salt grasses and mangroves are common estuarine plants. The Withlacoochee Gulf Preserve is a large estuary located west of Yankeetown in Levy County. Significant coastal wetlands are located along the western portions of Hernando and Citrus counties. Freshwater wetlands occur in low-lying areas near lakes and the Withlacoochee River. Hardwood-cypress swamps and marshes are two major freshwater wetland systems. Both systems are found either bordering lakes and rivers or standing alone as isolated wetlands. The hardwood-cypress swamps are forested systems with water at or above land surface for a considerable portion of the year. Marshes are typically shallower systems vegetated by herbaceous plants rather than trees. Wet prairies, are vegetated with a range of mesic herbaceous species and hardwood shrubs and are inundated during the wettest times of the year.

Extensive hardwood swamps and wet prairies occur throughout the Withlacoochee River watershed. The Green Swamp covers the entire southern end of Sumter County with isolated wetlands typically vegetated by herbaceous plants. Nearly half of Levy County is designated as freshwater wetlands that extend from the forested systems of the Goethe State Forest into Alachua County. The hardwood-cypress swamps in the Hálpata-Tastanaki tract are a major freshwater system in southwest Marion County.

5.0 Karst Hydrology

Intensive karst development characterizes much of the planning region including the Coastal Swamps Lowlands, the Brooksville Ridge and the Tsala-Apopka Plain. Numerous sinkholes, lack of surface drainage, and undulating topography play a dominant role in moving groundwater through the Floridan aquifer. In karst areas, the dissolution of limestone has created and enlarged cavities along fractures in the limestone, which eventually collapse and form sinkholes. Sinkholes capture surface water drainage and funnel it underground, which promotes further dissolution of limestone. This leads to progressive integration of voids beneath the surface and allows larger and larger amounts of water to be funneled into the underground drainage system. Many of these paths or conduits lie below the present water table and greatly facilitate groundwater flow. Because the altitude of the water table has shifted in response to historic changes in sea level, many vertical and lateral paths have developed in the underlying carbonate strata in the area (Jones et al., 1997).

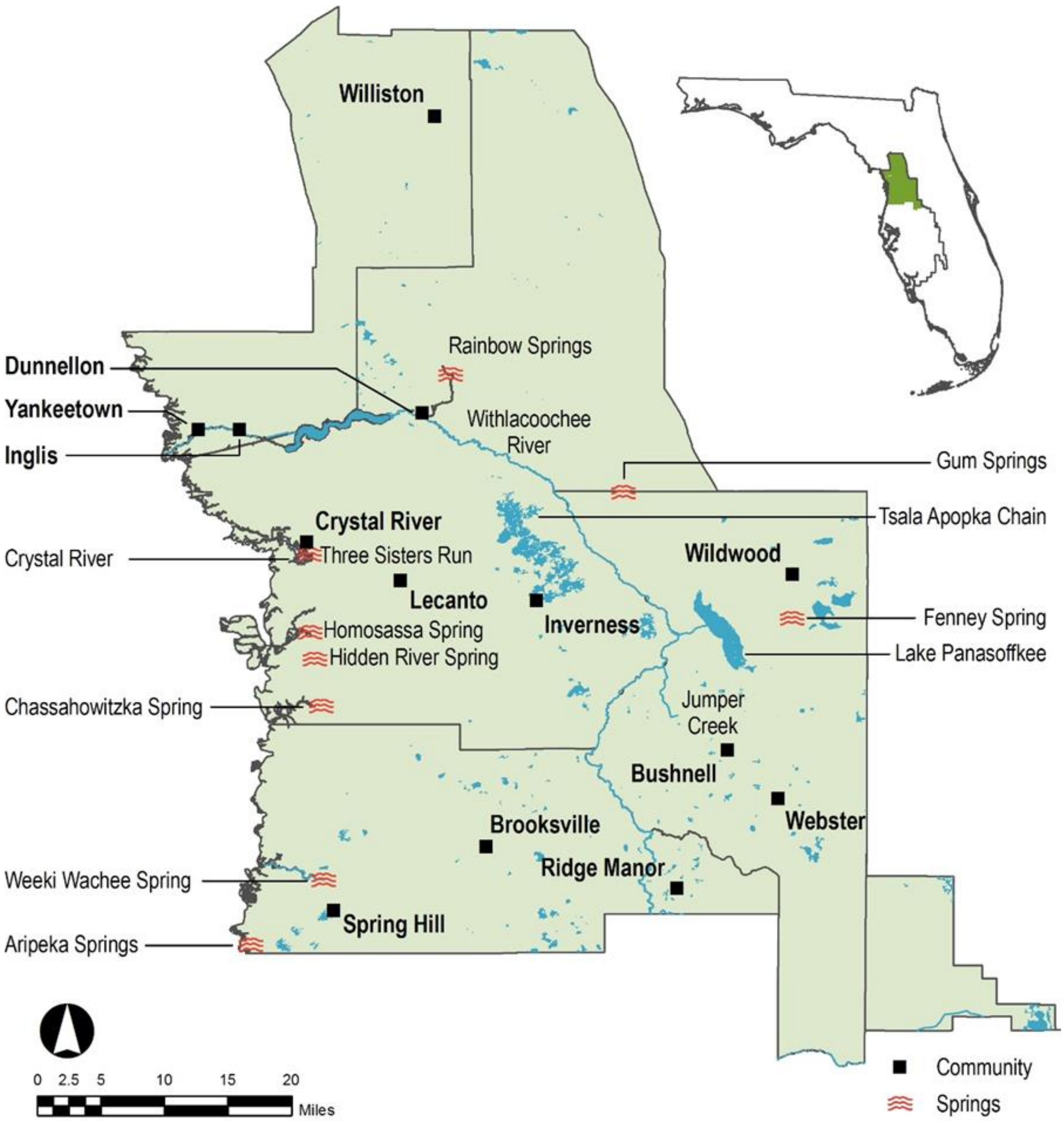


Figure 1-2. *Major hydrologic features in the Northern Planning Region*

Section 4. Geology/Hydrogeology

The UFA is the principal source of groundwater in the planning region. Figure 1-3 is a generalized north-south cross section of the hydrogeology of the District and Figure 1-4 shows the West-Central Florida groundwater basins. As seen in the figures, the Central West-Central Florida Groundwater Basin (CWCFGWB) constitutes a hydrogeologic transition between the southern and northern parts of the District. From the Southern Planning Region to the Tampa Bay Planning Region, the intermediate aquifer system and its associated clay confining units decrease in thickness and eventually become a single confining unit in the central portion of the Tampa Bay Planning Region (the intermediate confining unit). The unit becomes discontinuous and disappears entirely in the Northern Planning Region. As a result, the UFA becomes regionally unconfined over most of the planning region (SWFWMD, 1987, HydroGeoLogic, 2013).

The UFA consists of a thick sequence of marine carbonate deposits and is the main source for water supply within the planning region. A relatively thin sequence of sands, silts and clays overlies the carbonate deposits. The upper several hundred feet of limestone and dolomite comprise the most productive and utilized portion of the UFA. Stratigraphic units of the UFA (in order of increasing geologic age and depth) include the Suwannee Limestone, the Ocala Limestone and the Avon Park Formation.

The Suwannee Limestone is approximately 300 feet thick and is present at or near land surface in Hernando County (Yon and Hendry, 1972). It contains many solution channels and forms part of the upper flow zone for the UFA, which is the source for most of the spring discharge observed in the region (SWFWMD, 1987). The Ocala Limestone is the first water-bearing unit in the UFA over most of the planning area north of Hernando County. The Ocala Limestone averages 300 feet in thickness and outcrops in southern Sumter County within the Green Swamp area. Extensive karst features can be observed in the surface outcrops and karst plains associated with both the Suwannee and Ocala Limestone.

The Avon Park Formation averages approximately 600 feet in thickness and is composed of interbedded limestones and dolostones with gypsum beds found in the middle and lower portion of the formation over most of the planning region. Where gypsum is present, it forms the bottom confining bed of the freshwater flow system and is named Middle Confining Unit 2 (MCU II) (Miller, 1986). The formation underlies the entire planning region and outcrops in several areas of limited extent, mainly within Levy and southwest Marion counties. The Avon Park Formation is the deepest potable water-bearing formation and forms the lower flow zone for the UFA over most of the planning region.

In northeast Sumter County, the MCU II unit is absent and another confining unit is present in the upper Avon Park Formation. This unit consists of a tight, dense, carbonate lithology and is referred to as middle confining unit 1 (MCU I) (Miller, 1986). The Avon Park Formation below MCU I contains fresh groundwater and is referred to as the Lower Floridan aquifer (LFA). MCU I and the LFA extend eastward from Sumter County into the SJRWMD.

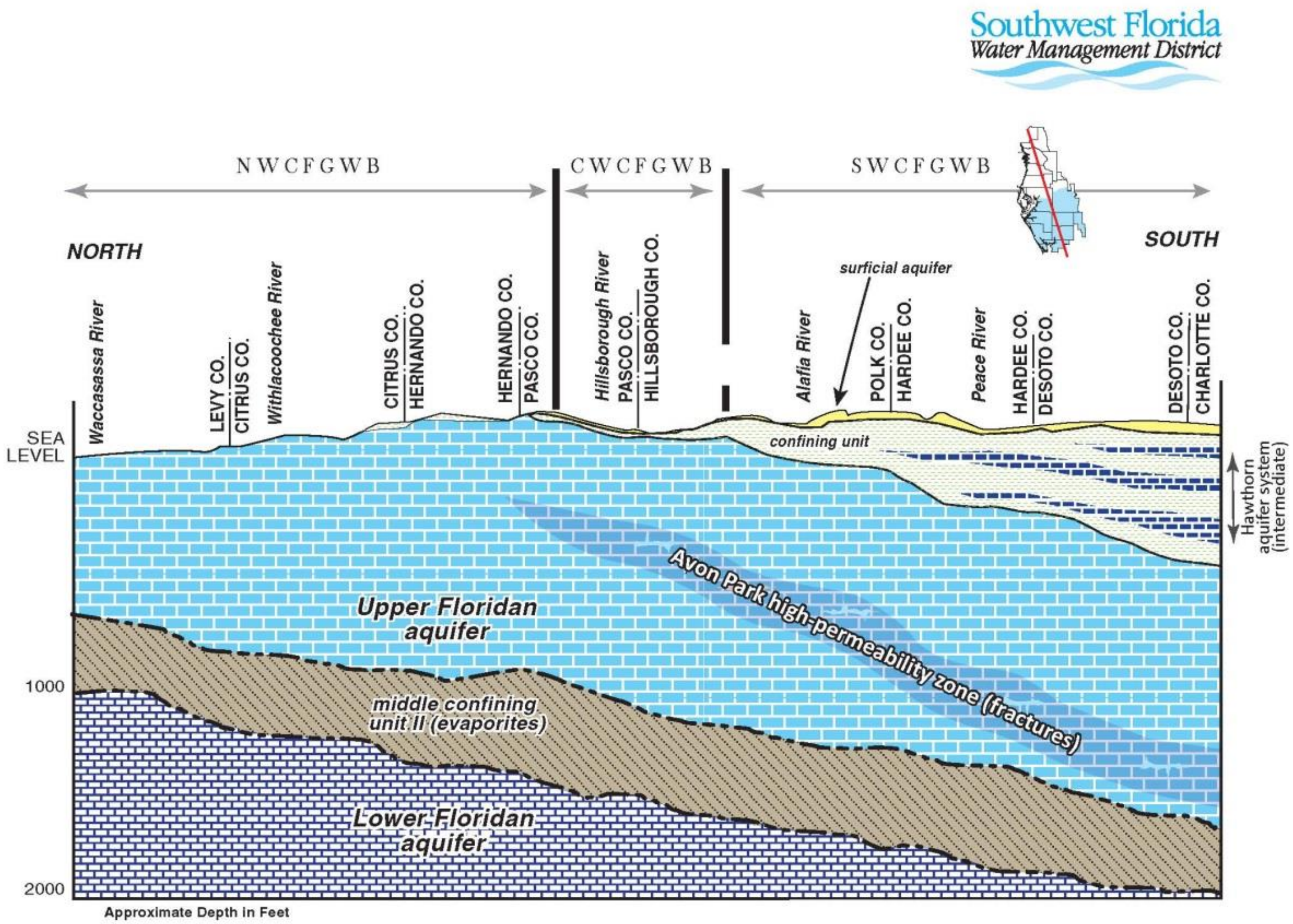


Figure 1-3. *Generalized north-south geologic cross section through the District*

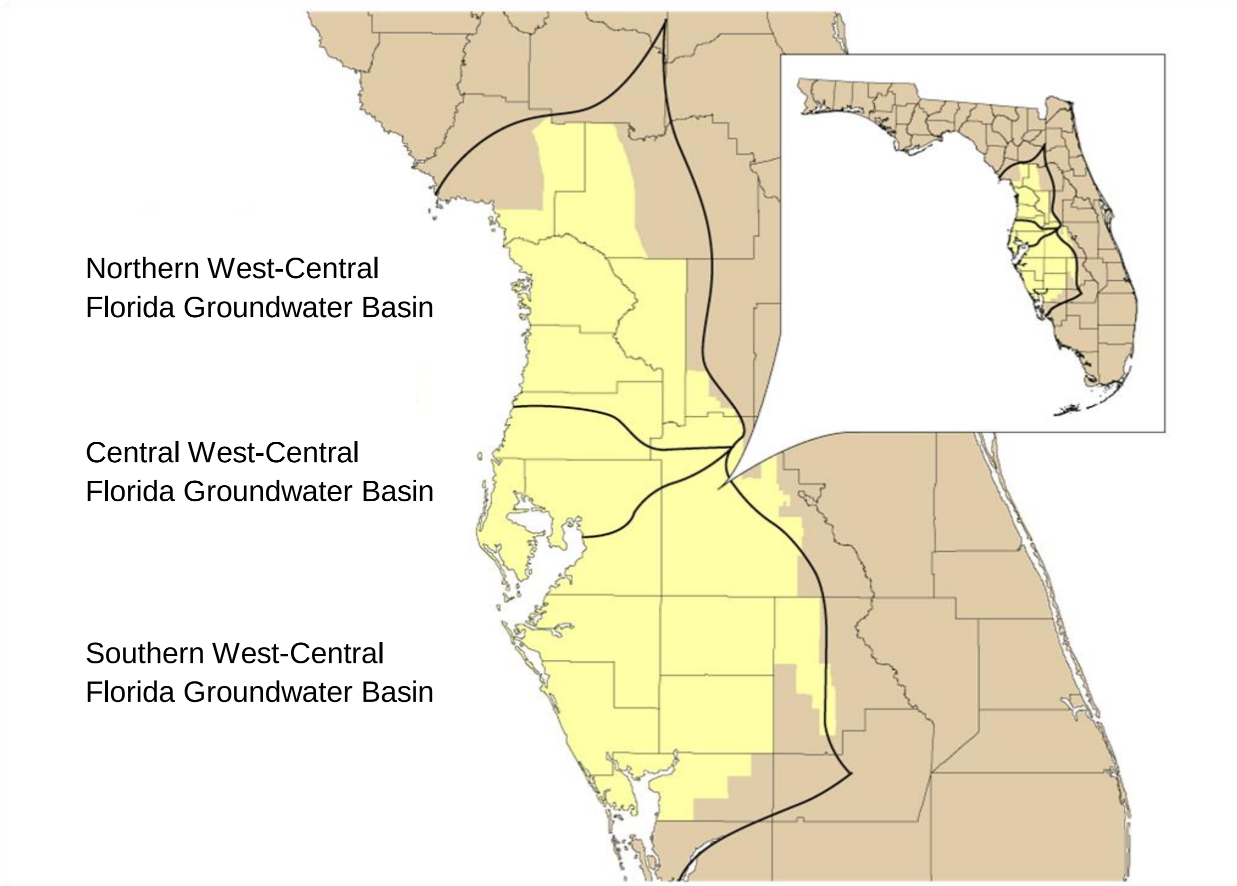


Figure 1-4. *The District and the West-Central Florida Groundwater Basins*

Part D. Previous Technical Investigations

The 2015 RWSP builds on a series of cornerstone technical investigations that were undertaken by the District and the USGS beginning in the 1970s. These investigations have provided the District with an understanding of the complex relationships between human activities (i.e., surface water and groundwater usage and large-scale land-use alterations), climate cycles, aquifer/surface water interactions, aquifer and surface hydrology, and water quality. Investigations conducted in the planning region and in areas adjacent to it are listed by categories and briefly outlined below.

Section 1. Water Resource Investigations

During the past 30 years, various water resource investigations were initiated by the District to collect critical information about the condition of water resources and the impacts of human activities on them. Following the Florida Water Resources Act of 1972, the District began to invest in enhancing its understanding of the effects of water use, drainage and development on the water resources and ecology of west-central Florida. A major result was the creation of the District's Regional Observation and Monitor-well Program (ROMP), which involved the construction of monitor wells and aquifer testing to better characterize groundwater resources and surface and groundwater interactions. Approximately a dozen wells were drilled annually, and in the 1980s, data collected from these wells began to be used in a number of hydrologic assessments that clearly identified regional resource concerns.

During the 1980s, hydrologic and biologic monitoring from the District's expanded data collection networks began to reveal water resource impacts in other areas of the District. In the late 1980s, the District initiated a detailed water resource assessment project (WRAP) in the Northern Tampa Bay (NTB) area to determine causes of water level declines and to address water supply availability. Resource concerns in this area included lowered lake and wetland levels.

Based on the findings of the WRAP study and continued concern about water resource impacts, the District established the NTBWUCA in 1989. The District implemented a strategy to address the resource concerns, which included comprehensive studies to determine long-term water supply availability. From May 1989 through March 1990, there were extensive public work group meetings to develop management plans for the NTBWUCA. These meetings are summarized in the Northern Tampa Bay Work Group Report (SWFWMD, 1990a) and Management Plan (SWFWMD, 1990b). These deliberations led to major revisions to the District's water use permitting rules, as special conditions were added that applied to the NTB and other WUCAs.

A WRAP is currently being conducted for the Northern Planning Region to gain a better understanding of the water resource issues from Pasco County north to Levy County. Exploratory drilling and testing data is being collected to enhance understanding of the groundwater system, characterize the saline water interface, identify areas of poor groundwater quality, determine the nature of flow to major springs and provide information for regional flow models. This effort will also assist in the evaluation of future water supply planning assessments and MFL establishment. The WRAP is expected to be completed in 2020.

The CFWI is a collaborative approach to study whether the Floridan aquifer system is reaching its sustainable limits of use and exploring the need to develop additional water supplies. The area includes southern Lake, Orange, Osceola, Seminole, and Polk Counties. It is a multi-district effort that includes the St. Johns River, South Florida, and Southwest Florida WMDs. Additionally, stakeholders, such as the DEP and FDACS, regional public water supply utilities, and others are participating in this collaborative effort that builds on work started for a prior effort called the Central Florida Coordination Area. A Draft CFWI RWSP has been developed and current work is focused on the solutions and regulatory components of the initiative.

Homosassa Springs is included in the District's Springs Management Plan

The District developed a Springs Management Plan (SWFWMD, 2013) that includes Rainbow Springs, Crystal River/Kings Bay, Homosassa Springs, Chassahowitzka Springs, and Weeki Wachee Springs. The plan addresses five priority issues that have a negative impact on the springs' ecological health. The priority issues are habitat loss, nutrient enrichment, flow declines, salinity increases, and water use. The plan is a roadmap describing the overall approach the District is taking to conserve and restore the ecology of all springs within its borders. Quantifiable objectives of the plan are aquatic habitat conservation and restoration; MFLs development; water quality standard compliance; and communications plan development. An adaptive management strategy to achieve the objectives is outlined in the plan and it includes planning, monitoring, and restoration components and a list of specific projects.

Section 2. USGS Hydrologic Investigations

The District has a long-term cooperative program with the USGS to conduct hydrogeologic investigations that are intended to supplement work conducted by District staff. The projects are focused on improving the understanding of cause-and-effect relationships and developing analytical tools for resource evaluations. Funding for this program is generally on a 50/50 cost-share basis with the USGS. However, this varies based on whether other cooperators are involved in the project and if requests for non-routine data collection or special project assignments are implemented. The District's cooperative investigations with the USGS have typically been focused on regional hydrogeology, water quality and data collection. Over the years, several groundwater and surface water cooperative projects have been completed in and around the planning region. In addition, a number of projects and data collection activities are in progress. Completed and ongoing cooperative District/USGS investigations and data collection activities are listed in Table 1-2.

Table 1-2. *District/USGS cooperative hydrologic investigations and data collection activities applicable to the Northern Planning Region*

Investigation Type	Description
Completed Investigations	
Groundwater	Regional Groundwater Flow System Models of the SWFWMD; Cypress Creek, Cross Bar and Morris Bridge Wellfields; and the St. Petersburg Aquifer Storage and Recovery (ASR) Site.
Surface Water	Statistical Characterization of Lake Level Fluctuations
	Lake Stage Statistics Assessment to Enhance Lake Minimum Level Establishment
	Lake Augmentation Impacts
	Primer on Hydrogeology and Ecology of Freshwater Wetlands in Central Florida
	Methods to Define Storm Flow and Base Flow Components of Total Stream Flow in Florida Watersheds
	Factors Influencing Water Levels in Selected Impaired Wetlands in the NTB Area
Groundwater and Surface Water	Interaction Between the Upper Floridan Aquifer and the Withlacoochee River
	Hydrology, Water Budget, and Water Chemistry of Lake Panasoffkee, West-Central Florida
	Occurrence and Distribution of Nitrate in the Silver Springs Basin
	Effects of Using Groundwater for Supplemental Hydration of Lakes and Wetlands
	Use of Groundwater Isotopes to Estimate Lake Seepage in the NTB and Highlands Ridge Lakes
	Effects of Recharge on Interaction Between Lakes and the Surficial Aquifer
	Surface and Groundwater Interaction in the Upper Hillsborough River Basin
	Relationship Between Groundwater Levels, Spring Flow, Tidal Stage and Water Quality for Selected Springs in Coastal Pasco, Hernando and Citrus Counties
	Surface and Groundwater Interaction in the Upper Hillsborough River Basin
Ongoing Investigations/Data Collection Activities	
Groundwater and Surface Water	Relative Importance of Surface-Water and Groundwater Flows to Tsala-Apopka Lake, West-Central Florida
Data Collection	Minimum Flows and Levels Data Collection
	Surface Water Flow, Level and Water Quality Data Collection

Section 3. Water Supply Investigations

Water Supply investigations for the planning region were initiated in the 1960s as part of the United States Army Corps of Engineers (USACE) Four River Basins project. The Four River Basins project began as a flood control project developed in response to severe coastal and inland flooding caused by Hurricane Donna in September 1960. The District was formed in 1961 to help implement this federal project, which led to development of several large control structures including the Tampa Bypass Canal (TBC), the Lake Tarpon and Tsala Apopka Outfalls, and the Masaryktown Canal.

Following a period of drought conditions in the mid-1960s that led to numerous dry well complaints, along with findings of project-related ecological studies, there was an apparent need for a broader-based approach to water management than just flood control. The scope of the Four River Basins project was expanded into a more comprehensive effort to assess water resources in the region and determine ways to utilize excess surface water and groundwater for regional water supply solutions. The revised approach led to changes for the TBC design to allow surface water transfers to the City of Tampa; the use of land preservations for water recharge and natural flood attenuation; and the cancellation of other structural projects that would have greatly altered environmental resources.

Control structure at Tsala-Apopka Outfall

Since the 1970s, the District conducted numerous hydrologic assessments designed to assess the effects of groundwater withdrawals and determine the availability of groundwater in the region. In the late 1980s, the Florida Legislature directed the WMDs to conduct a Groundwater Basin Resource Availability Inventory (Chapter 373.0395 F.S.) covering areas deemed appropriate by the WMD's Governing Boards. The District completed inventory reports for the 13 counties predominantly located within its jurisdiction. These reports described the groundwater resources of the individual counties and respective groundwater basins.

Based on the hydrologic assessments and the District's continuous hydrologic and biologic monitoring programs, the District established three WUCAs in the late 1980s in response to observed impacts of groundwater withdrawals. The District subsequently prepared the Water Supply Needs & Sources: 1990–2020 study (SWFWMD, 1992) to assess future water demands through the year 2020 and groundwater supply limitations in some areas. One objective of the study was to optimize resource management to provide for reasonable and beneficial uses without causing unacceptable impacts to water resources, natural systems, and existing legal users. Major recommendations of the study included reliance on local sources to the greatest extent practicable before pursuing more distant sources; requiring users to increase their water use efficiency; and pursuing a regional approach to water supply planning and future development.

In 1997, the Florida Legislature significantly amended Chapter 373, F.S., to include specific regional water supply planning requirements for the WMDs. The statutes were revised to require the preparation of a Districtwide Water Supply Assessment; the designation of one or more water supply planning regions within each district; and the preparation of a RWSP for any planning regions where sources of water were determined to be inadequate to meet future demands. The statute requires the reassessment of the need for a RWSP every 5 years, and that each RWSP shall be based on a minimum 20-year timeframe (Section 373.0361, F.S.). In response to the amended statutes, the District completed a Water Supply Assessment in 1998 that quantified water supply needs through the year 2020 and identified areas where future demand could not be met with traditional groundwater sources (SWFWMD, 1998). The District published its first RWSP in 2001 for the 10 counties located in the Southern Water Use Caution Area (SWUCA) and NTBWUCA (SWFWMD, 2001). The 2001 RWSP quantified water supply demands through the year 2020 within these counties and identified water supply options for developing sources other than fresh groundwater.

The RWSP was updated in 2006, and the planning period was extended to 2025. The 2006 RWSP concluded that fresh groundwater from the UFA would be available to meet future demands on a limited basis only and that sufficient alternative sources existed in the 10-county planning region to meet projected demands through 2025 (SWFWMD, 2006). It also concluded that a regional approach to meeting future water demands, including regional transmission systems, was required for some areas that had limited access to alternative water supplies.

The District's 2010 RWSP update extended the planning horizon to 2030 and was expanded into four regional volumes covering all counties of the District, based on four planning regions originally defined in previous assessments. It was concluded that the Northern Planning Region demand for water through 2030 could be met with fresh groundwater; however, the need for additional fresh groundwater supplies could be minimized through the use of available reclaimed water and implementation of comprehensive water conservation measures. This could result in averting impacts, such as those witnessed in other regions. The 2010 RWSP adopted several alternative water supply options that were developed by regional water supply authorities in the respective planning regions, and from the 2009 Polk County Comprehensive Water Supply Plan in the Heartland Planning Region.

Section 4. MFL Investigations

In addition to the actual measurement of water levels and flows, extensive field data collection and analysis is often required to support MFLs development. These data collection efforts and studies are both ecologic and hydrologic in nature and include basic biologic assessments, such as the determination of the frequency, abundance and distribution of plant and animal species and their habitats. Ultimately, this ecologic information is related to hydrology using some combination of conceptual, statistical and numerical models. In estuaries, for example, two or three-dimensional salinity models may be developed to assess how changes in flow affect the spatial and temporal distribution of salinity zones. In some instances, depending on the resources of concern, thermal or water quality models may also be developed. Elevation data is typically collected to support MFLs development for all resource types and may be used for generating bathymetric maps or data sets for modeling purposes, to determine when important features such as roads, floor slabs and docks become inundated, or when flows or levels drop sufficiently to affect recreation, aesthetics and other environmental values.

Section 5. Modeling Investigations

Since the 1970s, the District has developed numerous computer models to support resource evaluations and water supply investigations. These models have been subdivided into groundwater flow models for general resource assessments and solute transport models to assess saltwater intrusion. In recent years, the District has begun to support the use of integrated hydrologic models that simulate the entire hydrologic cycle and include information on both the surface water and groundwater flow systems. These models are used to address issues where the interaction between groundwater and surface water is significant. Many of the early groundwater flow models were developed by the USGS through the cooperative studies program with the District. Over time, as more data was collected and computers became more sophisticated, the models developed by the District have included more detail about the hydrologic system. The end result of the modeling process is a tool that can be used to assess effects of current and future withdrawals and better understand hydrologic relationships.

1.0 Groundwater Flow Models

Beginning in the late 1970s, the USGS, with cooperative funding from the District, created several models of the Hernando, Pasco, Pinellas and Hillsborough counties area that were generally used to evaluate effects of withdrawals for specific wellfield areas. Using information from these models, the District (Bengtsson, 1987) developed a transient groundwater model of this area with an active water table to assess effects of withdrawals on surficial aquifer water levels. In 1993, the District completed development of the NTB model, which covered approximately 1,500 square miles from Hernando to Pinellas counties (Hancock and Basso, 1993). Together with monitoring data, the NTB model was used to characterize and quantify the magnitude of groundwater withdrawal impacts occurring in the region. In addition to the models developed by the District and USGS, models have been developed by TBW to support requests for surface water and groundwater withdrawals.

The Northern Planning Region groundwater flow model (also known as the Northern District Model [NDM]) covers the northern half of the District, and portions of the St. Johns and Suwannee River WMDs (HydroGeoLogic, Inc., 2008, 2010, 2011, 2013). This model, first completed in 2008, has been updated in 2010, 2011, and most recently in 2013. It is unique for west-central Florida in that it is the first regional groundwater flow model that represents the aquifer system as fully three-dimensional. The model contains seven active layers, which include the surficial aquifer or unsaturated zone, the Intermediate Confining Unit (ICU), Suwannee Limestone, Ocala Limestone, Avon Park Formation, Middle Confining Unit (MCU) and the LFA. The model was recently expanded eastward to the St. Johns River to encompass all of Marion County through a cooperatively-funded agreement between the District, SJRWMD, WRWSA, and Marion County. The model was expanded at the request of Marion County so that one model could be used by both districts for Marion County water resource investigations. The Northern Planning Region model serves as an important tool to examine potential impacts to wetlands, lakes, springs and the Withlacoochee River from regional groundwater withdrawals. The results of these predictions have been used by the District to support water supply planning assessments and establishment of MFLs.

2.0 Saltwater Intrusion Models

Although regional saltwater intrusion in the NTB area is not a major resource concern as it is in the SWUCA, local and sub-regional saltwater intrusion has been observed. Saltwater intrusion models completed for the area include Dames and Moore, Inc. (1988), GeoTrans, Inc. (1991), HydroGeoLogic, Inc. (1992) and Tihansky (2005). These models have generally confirmed the localized nature of saltwater intrusion in the NTB area. HydroGeoLogic, Inc. completed a regional saltwater intrusion model in 2008 that covered the coastal region of Pasco, Hernando, Citrus and Levy counties. This work was completed in conjunction with the development of the Northern District groundwater flow model. Results of the saltwater intrusion model showed no significant regional movement of the saltwater interface over the next 50 years.

3.0 Integrated Groundwater/Surface Water Models

In 1997, SDI-Environmental developed the first fully integrated model of the area that covered an area larger than that of the NTB model. The District worked with TBW to develop a new generation of integrated model, the Integrated Northern Tampa Bay (INTB) model, which was first completed in 2007 with its most recent version finalized in 2013 (Geurink, and Basso, 2013). It covers a 4,000-square-mile area that extends from southern Citrus and Sumter counties to northern Manatee County. This advanced tool combines a traditional groundwater flow model with a surface water model and contains an interprocessor code that links both systems, which allows for simulation of the entire hydrologic system. It can be used to assess changes in rainfall, land use and groundwater withdrawals. The model has been used in MFL investigations of the Anclote, Hillsborough and Pithlachascootee rivers and Crystal and Weeki Wachee springs. In the future, the INTB model will be used in water supply planning to determine future groundwater availability, evaluate MFLs, and evaluate recovery in the NTB area resulting from the phased reductions in groundwater withdrawals from TBW's 11 central-system wellfields as required by the Partnership Agreement.

4.0 Districtwide Regulation Model

The development and implementation of a Districtwide regulation model (DWRM) was undertaken in an effort to produce a regulatory modeling platform that is technically sound, efficient, reliable, and has the capability to address cumulative impacts. The DWRM was initially developed in 2003 (Environmental Simulations, Inc., 2004). It is mainly used to evaluate whether requested groundwater quantities in water use permit (WUP) applications have the potential to cause unacceptable impacts to existing legal users, off-site land uses, and environmental systems on an individual and cumulative basis. This model simulates the surficial, intermediate, Upper Floridan and Lower Floridan aquifers. It covers the entire area of the District and an appropriate buffer area surrounding the boundaries of the District. The DWRM Versions 1, 2, 2.1, and 3 (Environmental Simulations, Inc., 2004, 2007, 2011, 2014) incorporate Focus Telescopic Mesh Refinement (FTMR), which was developed to enable the regional DWRM to be used as a base model for efficient development of smaller scale sub-models (FTMR models). The FTMR uses a fine grid around a well or group of wells and increasing grid spacing out to the edge of the model. It was specifically designed to enhance WUP analysis.

Chapter 2. Resource Protection Criteria

This chapter addresses the primary strategies the District employs to protect water resources, which include water use caution areas (WUCA), minimum flows and levels (MFLs), prevention and recovery strategies, reservations, climate change, and establishment of the Central Florida Water Initiative (CFWI).

Part A. Water Use Caution Areas

Section 1. Definitions and History

Water Use Caution Areas (WUCAs) are areas where the District's Governing Board has determined that regional action is necessary to address cumulative water withdrawals that are causing adverse impacts to the water and related natural resources or the public interest. The District has not declared a WUCA in the Northern Planning Region; however, the St. Johns River Water Management District (SJRWMD) has declared a priority water resource caution area adjacent to the District boundary in Lake and Marion counties.

District regional water supply planning is the primary tool in ensuring water resource sustainability in WUCAs. Florida law requires regional water supply planning in areas where it has been determined that existing sources of water are not adequate for all existing and projected reasonable-beneficial uses, while sustaining the water resources and related natural systems. Regional water supply planning quantifies the water needs for existing and projected reasonable-beneficial uses for at least 20 years, and identifies water supply options, including traditional and alternative sources. In addition, MFLs, established for priority water bodies pursuant to Chapter 373, Florida Statutes (F.S.), identify the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. If the existing flow or level of a water body is below, or is projected to fall below, the applicable minimum flow or level within 20 years, a recovery or prevention strategy must be implemented as part of the regional water supply plan (RWSP). Figure 2-1 depicts the location of the District's WUCAs. In order to determine whether an area should be declared a WUCA, the Governing Board must consider the following factors:

- Quantity of water available for use from groundwater sources, surface water sources, or both.
- Quality of water available for use from groundwater sources, surface water sources, or both, including impacts such as saline water intrusion, mineralized water upconing or pollution.
- Environmental systems, such as wetlands, lakes, streams, estuaries, fish and wildlife, or other natural resources.
- Lake stages or surface water rates of flow.
- Off-site land uses.
- Other resources as deemed appropriate.

In the late 1980s, the District determined that certain interim resource management initiatives could be implemented to help prevent existing problems in the water resource assessment project (WRAP) areas from getting worse prior to the completion of each WRAP. As a result, in 1989, the District established three WUCAs: Northern Tampa Bay (NTBWUCA), Eastern Tampa

Bay (ETBWUCA) and Highlands Ridge (HRWUCA). For each of the initial WUCAs, a three-phased approach to water resource management was implemented, including: (1) short-term actions that could be put into place immediately, (2) mid-term actions that could be implemented concurrent with the ongoing WRAPs and (3) long-term actions that would be based upon the results of the WRAPs. In addition to the development of conservation plans, cumulative impact analysis-based permitting and requiring withdrawals from stressed lakes to cease within three years, the District developed management plans for each WUCA to stabilize and restore the water resources in each area through a combination of regulatory and non-regulatory efforts. One significant change that occurred as a result of the implementation of the management plans was the designation of the most impacted area (MIA) in the ETBWUCA. The MIA consists of the coastal portion of the Southern Water Use Caution Area (SWUCA) in southern Hillsborough, Manatee and northern Sarasota counties. Within this area, no increases in permitted groundwater withdrawals from the Upper Floridan aquifer (UFA) were allowed and withdrawals from outside the area could not cause further lowering of UFA levels within the area. The ETBWUCA and HRWUCA were superseded in 1992 by the establishment of the SWUCA, which encompasses the entire southern portion of the District. The NTBWUCA was expanded in 2007 to include an additional portion of northeastern Hillsborough County and the remainder of Pasco County. In 2011, the District established the Dover/Plant City WUCA in eastern Hillsborough and western Polk counties following impacts from intense frost/freeze protection withdrawals.

Rural agricultural and pasture lands in the Northern Planning Region

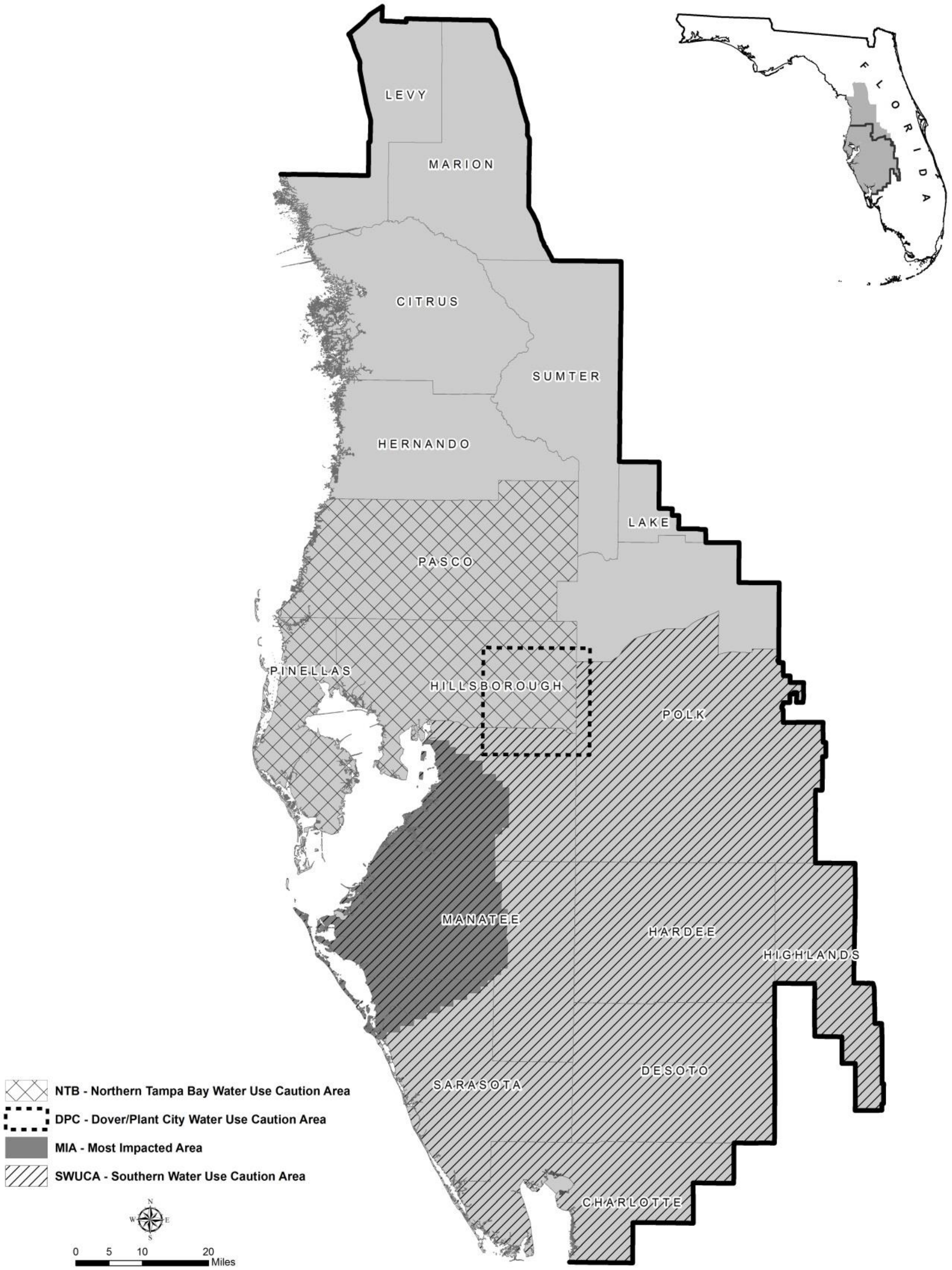


Figure 2-1. *Location of the District's water use caution areas and the MIA of the SWUCA*

Part B. Minimum Flows and Levels

Section 1. Definitions and History

Section 373.042, F.S., directs the Florida Department of Environmental Protection (DEP) or the water management districts (WMDs) to establish MFLs for lakes, wetlands, rivers and aquifers. Section 373.042(1)(a), F.S., states that "[t]he minimum flow for a given watercourse shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area." Section 373.042(1)(b), F.S., defines the minimum water level of an aquifer or surface waterbody as "...the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area." MFLs are established and used by the District for water resource planning; as one of the criteria used for evaluating water use permit (WUP) applications, and for the design, construction and use of surface water management systems.

Since the enactment of the Florida Water Resources Act of 1972 (Chapter 373, F.S.) in which the legislative directive to establish MFLs originated, and following subsequent modifications to this directive and adoption of relevant requirements in the Water Resource Implementation Rule, the District has actively pursued the adoption (i.e., establishment of MFLs) for priority water bodies. The District implements established MFLs primarily through water supply planning, water use permitting and environmental resource permitting programs, and funding of water resource and water supply development projects that are part of a recovery or prevention strategy. Beginning with legislative changes to the MFLs statute in 1996, the District enhanced its program of MFLs development. The District's MFLs program addresses all the requirements expressed in the Florida Water Resources Act and the Water Resource Implementation Rule.

1.0 Statutory and Regulatory Framework

The Florida Water Resources Act (Chapter 373, F.S.) and the Water Resource Implementation Rule (Chapter 62-40, Florida Administrative Code (F.A.C.)) provide the basis for establishing MFLs and explicitly include provisions for setting them. In 1996, the Florida Legislature mandated that the District submit a priority list and schedule for establishing MFLs by Oct. 1, 1997, for surface watercourses, aquifers and surface waters in Hillsborough, Pasco, and Pinellas counties in the NTBWUCA (Section 373.042[2], F.S.). Chapter 373 now requires all WMDs to update and submit for approval by the DEP a priority list and schedule for the establishment of MFLs throughout their respective jurisdictions. The priority list and schedule is published annually in the Consolidated Annual Report (CAR).

Section 2. Priority Setting Process

In accordance with the requirements of Sections 373.036(7) and 373.042(2), F.S., the District has established and annually updates its priority list and schedule for the establishment of MFLs, which also identifies water bodies scheduled for development of reservations. As part of determining the priority list and schedule, the following factors are considered:

- Importance of the water bodies to the state or region.
- Existence of or potential for significant harm to the water resources or ecology of the state or region.
- Required inclusion of all first-magnitude springs and all second-magnitude springs within state or federally owned lands purchased for conservation purposes.

- Availability of historic hydrologic records (flows and/or levels) sufficient to allow statistical analysis and calibration of computer models when selecting particular water bodies in areas with many water bodies.
- Proximity of MFLs already established for nearby water bodies.
- Possibility that the water body may be developed as a potential water supply in the foreseeable future.
- Value of developing an MFL for regulatory purposes or permit evaluation.
- Stakeholder input.

The District's current Priority List and Schedule for the Establishment of MFLs is posted in the District website and is included in the Chapter 2 Appendix.

Section 3. Technical Approach to the Establishment of MFLs

The District's technical approach for establishing MFLs addresses all relevant requirements expressed in the Florida Water Resources Act of 1972 (Chapter 373, F.S.) and the Water Resource Implementation Rule (Chapter 62-40, F.A.C.). The approach assumes that alternative hydrologic regimes may exist that differ from historic conditions, but are sufficient to protect water resource features from significant harm. For example, consider a historic condition for an unaltered river or lake system with no local groundwater or surface water withdrawal impacts. A new hydrologic regime for the system would be associated with each increase in water use, from small withdrawals that have no measurable effect on the historic regime to large withdrawals that could substantially alter the regime. A threshold hydrologic regime may exist that is lower or less than the historic regime, but which protects the water resources and ecology of the system from significant harm. This threshold regime could conceptually allow for water withdrawals, while protecting the water resources and ecology of the area. Thus MFLs may represent minimum acceptable, rather than historic or potentially optimal, hydrologic conditions.

1.0 Ongoing Work, Reassessment and Future Development

The District continues to conduct the necessary activities to support the establishment of MFLs according to the District's Priority List and Schedule. Refinement and development of new methodologies is also ongoing. In accordance with state law, MFLs are established based upon the best available information. The District plans to conduct periodic reassessment of the adopted MFLs, based on consideration of the significance of particular MFLs in water supply planning and the relevance of new data that may become available.

2.0 Scientific Peer Review

Chapter 373.042(4), F.S., permits affected parties to request independent scientific peer review of the scientific and technical data and methodologies used to determine MFLs. The District voluntarily seeks independent scientific peer review of MFL methodologies that are developed for all priority water resources, and has sought and obtained the review of methodologies for lakes, wetlands, rivers, springs and aquifers.

3.0 Methodology

The District's methodology for MFL establishment for wetlands, lakes, rivers, springs and aquifers is contained in the Chapter 2 Appendix.

Section 4. MFLs Established to Date

Figure 2-2 depicts priority MFLs water resources that are located within the planning region. A complete list of water resources with established MFLs in the District is provided in the Chapter 2 Appendix. Water resources with established MFLs in the planning region include:

- 22 lakes in Citrus, Hernando, Levy, Marion, and Sumter counties
- Chassahowitzka River System and Springs (Chassahowitzka Main, Chassahowitzka #1, Crab Creek, Potter, Ruth and Blind springs)
- Homosassa River System and Springs (includes Halls River, Southeast Fork Homosassa River, Homosassa Main, and Hidden River springs)
- Weeki Wachee River System and Springs (includes Weeki Wachee, Jenkins Creek, Salt, Little Weeki Wachee, and Mud River springs)

Priority water resources within the planning region for which MFLs have not yet been established or are being reevaluated include:

- Lower Withlacoochee River System
- Upper and Middle Withlacoochee River System (three segments)
- Rainbow River and Springs (Bubbling and Waterfall springs and springs in main spring bowl)
- Crystal River System and Kings Bay Springs
- Gum Springs Group
- Chassahowitzka River System and Springs for reevaluation (Chassahowitzka Main, Chassahowitzka #1, Crab Creek, Potter, Ruth and Blind springs)
- Homosassa River System and Springs for reevaluation (includes Halls River, Southeast Fork Homosassa River, Homosassa Main, and Hidden River springs)

Jenkins Creek

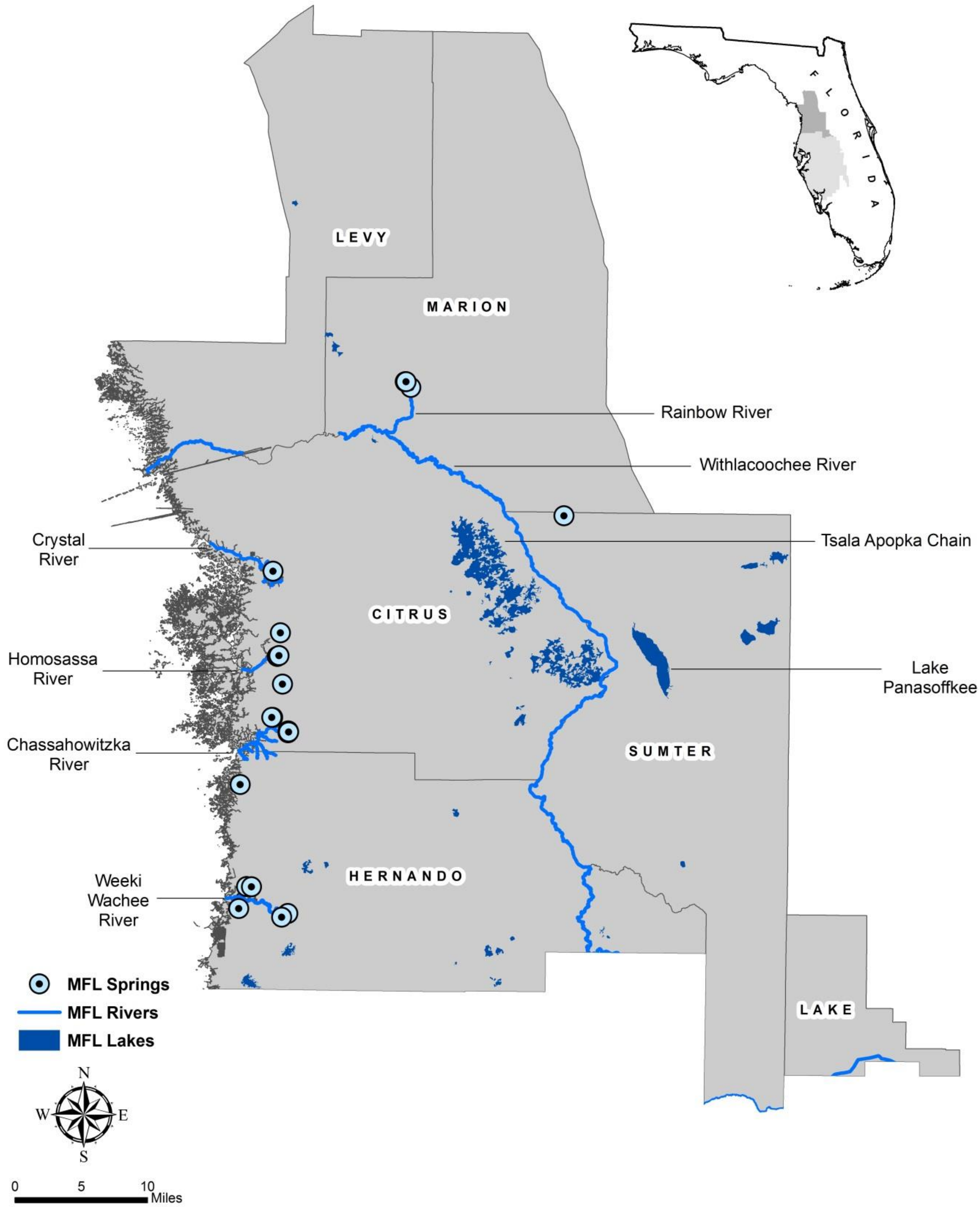


Figure 2-2. *MFL priority water resources in the Northern Planning Region*

Part C. Prevention and Recovery Strategies

Section 1. Prevention Activities

Section 373.0421(2), F.S., requires that a prevention strategy be developed if within 20 years the flow or level in a water body is projected to fall below an applicable MFL. A three-point prevention strategy has been developed to address MFLs: (1) monitoring water levels and flows for water resources/sites with established MFLs to evaluate the need for prevention strategies; (2) assessment of potential water supply/resource problems as part of the regional water supply planning process; and (3) implementation of the water use permitting program, which ensures that water use does not cause violation of established MFLs.

In addition to the development of a RWSP for the Northern Planning Region, the District and other entities in the region are involved in additional water resource assessments and planning efforts. The goal is to ensure that future water supply demands will be met without adversely impacting proposed or established MFLs. These activities are discussed below.

1.0 Northern Planning Region Strategy

In response to rapidly increasing development pressure in the planning region, the District developed a process in 2006 to evaluate options for long-term water resource management. The strategy focuses on minimizing current and future water use through best management and conservation practices so that use of groundwater as a source of supply can be extended as long as possible prior to introduction of alternative water sources. The strategy is being implemented to prevent significant water resource impacts, such as those that have occurred in the Tampa Bay, Heartland and Southern planning regions.

Principal goals of the strategy are to develop short-term measures that can be implemented to optimize the use of available groundwater to meet future demands while preventing unacceptable impacts to water resources. The Northern Planning Region strategy emphasizes three primary courses of action to address the issues of water demand and water supply in the planning region: resource monitoring, enhanced conservation and reuse, and collaborative regional water supply planning.

In 2014, the District adopted rules to expand the public supply permit holder per capita water use requirements that existed in the WUCAs to those areas of the District that were not subject to them. The requirements include the calculation of per capita water use according to adopted SWUCA rules and service area population estimation methodology, the submission of an annual per capita water use report and associated data via the annual public supply survey, refined service area delineation requirements and reporting, calculation of reclaimed and stormwater credits, and a phased-in utility per capita compliance of 150 gallons per person per day by December 31, 2019 (SWFWMD, 2014).

The District has also expanded water conservation rules that were in effect for the SWUCA and NTBWUCA to the entire District. Enhanced conservation standards for this planning region include requirements to submit a conservation plan, eliminate irrigation of golf course roughs, justify unused permitted quantities, submit reclaimed water feasibility evaluations, submit reclaimed water suppliers reports, submit alternative water supply receiver reports and, for water supply permit holders, implement water conserving rate structures. Finally, the District has conducted a public outreach campaign to engage stakeholders, decision-makers, residents, and regulated communities. Efforts have included a conservation summit for local governments and utilities, individual meetings with local government staff, and joint coordination meetings with the Withlacoochee Regional Water Supply Authority (WRWSA), the Withlacoochee Regional Planning Council (WRPC), editorial boards, and other agencies.

2.0 WRWSA Master Regional Water Supply Planning and Implementation Program

The District cooperated with the WRWSA to update the WRWSA Regional Water Supply Plan for 2014. The plan reviews potential water supply project options based on 2035 population projections and possible member partnerships. The update addresses how conservation and water reuse can prolong the availability of current water resources. A comprehensive assessment of public supply water conservation potential in the WRWSA four-county region was conducted for the planning period by the University of Florida’s Conserve Florida Water Clearinghouse. The analysis was completed using the EZGuide Online water conservation tool, which is a web-based model designed to estimate conservation potential for public supply utilities. The update includes recently studied Lower Floridan aquifer resources in its list of water supply project options, along with options for traditional groundwater, desalination, surface water, conservation, and reclaimed water availability based on updated population and MFLs criteria. The update incorporated numerous changes to regulatory and economic factors affecting demands and source availability. Cost estimates and supply quantities for project options were recalculated by the WRWSA and are incorporated within the District's 2015 RWSP.

The WRWSA first developed their Master Regional Water Supply Plan in 1995, and a 2005 Regional Water Supply Master Plan Update was completed in March 2007. A 2010 Feasibility Analysis was developed following Marion County’s inclusion into the WRWSA in 2008 and provided a revised list of proposed water supply, reclaimed water optimization, and water conservation options. Each update included population projections for Authority members, the associated water demands, and water supply options that could be developed to meet those demands. The 2014 update continues the WRWSA’s efforts to provide a regional approach to planning and developing cost-effective, sustainable water supplies for its member governments.

Northern Planning Region modeling and technical support for local communities is being conducted simultaneously with the WRWSA water supply planning efforts. The District entered into a cooperative agreement with the SJRWMD, Marion County, and the WRWSA to expand and recalibrate the Northern District groundwater model eastward to the St. Johns River in 2013. This project was completed in November 2013, and the final report and model files were submitted to all parties. The Northern District version 4.0 model has been run from predevelopment to 2035 pumping conditions to note regional changes in aquifer levels, springflow, and Withlacoochee River flow. This information was used by the WRWSA to update groundwater availability in their 2014 RWSP. In addition to joint groundwater modeling efforts, the WRWSA provides qualified expertise and technical support to local member communities to help them prepare and interpret technical modeling data.

3.0 Springs Management

There are more than 150 documented springs within the District. Most of these springs have experienced significant ecological changes over the past half century as a result of natural variability and human activities. The District developed a Springs Management Plan in 2013

(SWFWMD, 2013) that included a general restoration strategy, an overview of the goals and issues, and a list of proposed projects for the five-year period from 2013-2017. The plan recognizes the need to manage all springs within the District; however, it places a priority on the five first-magnitude spring groups: Rainbow, Crystal River/Kings Bay, Homosassa, Chassahowitzka, and Weeki Wachee. The vision for this effort is to conserve and restore the ecological balance of spring systems, thereby supporting regional economies and quality of life.

Weeki Wachee Springs, Hernando County, is a first-magnitude spring

The ecological integrity of springs may be based on four attributes: flow, water clarity, aquatic vegetation, and fish and wildlife. District management actions are intended to maintain these attributes for springs that are healthy and restore attributes that have been degraded. Five priority issues common in the five first-magnitude spring groups are habitat loss, nutrient enrichment, flow declines, salinity increase, and water use. These issues are addressed by the Springs Management Plan, which is designed to be an adaptive management strategy. An adaptive management strategy allows for the plan to be refined, as the considerable uncertainty about the causes of ecologic degradation is reduced through research and project implementation. Monitoring will be a key component of adaptive management, both for identifying the causes of ecological changes and evaluating the effects of restoration activities to optimize ecosystem management.

The adaptive management strategy is comprised of several components with associated projects or programs. Projects include natural systems restoration, water quality restoration, monitoring that includes data collection and mapping, research and development, and reclaimed water supply development. Looking into the future, the District will create specific management plans for each of the five first-magnitude spring groups. As management of these springs progresses, the second–magnitude and smaller springs will receive increased attention. The District will also continue to develop partnerships with other agencies and stakeholders, such as the Springs Coast Steering Committee, so the full range of issues and values associated with springs are considered.

Section 2. Recovery Strategies

Section 373.0421(2), F.S., requires that a recovery strategy be developed if the existing flow or level in a water body is below an applicable MFL. The District has established recovery strategies by rule in Chapter 40D-80, F.A.C. When an MFL for a water resource is not being met or, as part of a recovery strategy, is not expected to be met for some time in the future, the District will first evaluate the established MFL in light of any newly obtained scientific data or other relevant information to determine whether or not it should be revised. If no revision is necessary, management tools that may be considered include the following:

- Developing alternative water supplies.

- Implementing structural controls and/or augmentation systems to raise levels or increase flows in water bodies.
- Reducing water use permitting allocations (e.g., through water conservation).

District water resource assessments and MFL investigations have so far concluded that recovery strategies are not required in the Northern Planning Region.

Part D. Reservations

Subsection 373.223(4), F.S., authorizes reservations of water by providing as follows: “The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety…” The District will consider establishing a reservation of water when a District water resource development (WRD) project will produce water needed to achieve adopted MFLs. Reservations of water will be established by rule. The rule-making process allows for public input to the Governing Board in its deliberations about establishing a reservation including, among other matters, the amount of water to be reserved and the time of year the reservation would be effective. When a reservation is established and incorporated into Rule 40D-2.302, F.A.C., only those water use withdrawals that do not reduce the reserved quantity can be evaluated for permitting. There are currently no plans to establish a reservation in the Northern Planning Region.

Part E. Climate Change

Section 1. Overview

Climate change has been a growing global concern for several decades. According to the Intergovernmental Panel on Climate Change (IPCC), the global mean average land and ocean temperatures have increased approximately 1.2 to 1.9°F from 1880 to 2012 (IPCC, 2013). Such increases are driving a slow but persistent increase in sea levels and are altering precipitation regimes. These conditions will likely have local impacts including changes to natural habitats, encroachment of seawater into surface and groundwater resources, risk to public infrastructure, warmer temperatures that increase evaporation and impact agriculture, and changes to seasonal and annual rainfall patterns. Climate change is a global issue that requires international coordination and planning, although strategies for assessing vulnerabilities and developing adaptation plans are necessary on the local, regional, and statewide level.

In recent years, numerous agencies and organizations in Florida have developed initiatives to address climate change. Many of the state’s Regional Planning Councils (RPCs) have pooled agency resources for modeling and planning and are developing vulnerability assessments, climate adaptation plans, and post-disaster redevelopment plans for member communities. The Florida Department of Economic Opportunity’s (DEO’s) Community Resiliency Initiative provides planning tools and coordination among the RPCs. The WMDs and other agencies are actively participating in focus groups organized by RPCs and other governmental partnerships to consolidate climate information, develop consistent approaches to planning, and provide technical expertise when appropriate. Other participants in these initiatives include the National Weather Service, regional water supply authorities, state universities, and the following Florida state agencies: Fish and Wildlife Conservation Commission, Department of Transportation, Department of Health, Department of Environmental Protection, and the Division of Emergency Management (Butler, 2013).

Climate change is one water supply challenge among others such as droughts, water quality deterioration, and limitations on the availability of water resources. This section of the RWSP addresses the potential climate issues of concern for water supply planning, identifies current management strategies in place to address these concerns, and considers future strategies necessary to adaptively manage water supply resources.

Section 2. Possible Effects

The District's water supply planning efforts may be affected by climate change in three primary ways: sea level rise, air temperature rise and changes in precipitation regimes.

1.0 Sea Level Rise

The best available information is provided by the United States Army Corps of Engineers (USACE) for civil works projects, which estimates a sea level rise projection of 2.0 to 8.0 inches locally over the 20-year horizon of this report (2015-2035), with an intermediate-level projection of 3.5 inches. Over a 50-year horizon (2015-2065), a frequently used lifecycle for infrastructure design, the projected increase is 5.2 to 26 inches, with an intermediate-level projection of 10.3 inches. These estimates are consistent with National Oceanic and Atmospheric Administration and IPCC methodologies, and the given ranges are largely dependent on the continuing level of global emissions and the melting rate of land-locked ice (USACE, 2014). Sea level rise is likely to stress the District's water resources in a variety of ways. The inundation or upward migration of coastal wetlands may affect their ability to improve the quality of stormwater runoff and provide natural habitats. Estuarine water encroachment in coastal rivers may reduce the viable withdrawal periods at non-isolated freshwater intakes of water treatment facilities. Saltwater intrusion reduces water quality in aquifers that supply urban, agricultural, and industrial water users. Municipal sewer systems may experience infiltration that reduces the quality of reclaimed water.

One positive aspect is that sea level rise is projected to occur slowly, although persistently and with minor punctuations. This allows time to thoroughly evaluate the impacts to natural resources and public infrastructure, plan and implement adaptation strategies, and continue to use most existing coastal infrastructure for several decades. The cost of initiating sea level rise planning or incorporating it into other existing efforts is relatively low and can be performed without regret if inundation occurs at the slower estimated rates.

2.0 Air Temperature Rise

The IPCC predicts that global mean surface temperatures for the period covering 2016-2035 will likely be 0.5 to 1.3°F greater than in the 1986-2005 period, with larger near-term temperature increases in the subtropics than in the mid-latitudes. This would lead to longer and more frequent heat waves over land areas (IPCC, 2013). Evaporation is likely to increase with a warmer climate, which could result in lower surface water levels and increased irrigation demand. Increased evaporation is likely to impact stormwater runoff, soil moisture, groundwater recharge, and reservoir storage losses (Bates et al., 2008). Additionally, higher air temperatures may cause declines in water quality that could raise treatment costs for potable water supply.

3.0 Precipitation Regimes and Storm Frequency

Increasing global temperatures are expected to change water cycle patterns, although the changes will not be uniform along the earth's temperate zones. The IPCC models predict a slight precipitation increase over central Florida due to influencing global factors (IPCC, 2013). Local precipitation is also affected by regional factors such as El Niño/La Niña patterns, oscillations of temperature and pressure regimes in the northern Atlantic Ocean, and other conditions that complicate long-term predictions. Warming temperatures in the Atlantic and Gulf of Mexico can increase the likelihood of intense tropical storms and hurricanes that can generate storm surge, strong winds, and heavily concentrated rainfall. Higher summer temperatures and humidity may also increase the frequency of local convective weather events, resulting in thunderstorms, higher peak surface water flows, and increased flooding in some areas (Groisman et al., 2005).

Section 3. Current Management Strategies

The District has taken several steps to address the management of water resources that will also benefit efforts to plan and prepare for climate change impacts. First, the District's data collection and monitoring activities are likely to provide information critical to monitoring and responding to local climate change. Long-established networks of rainfall and streamflow gauge stations, many with real-time electronic reporting, provide continuous streams of data that will enable the District to monitor changes in local hydrology. In addition to monitoring rivers, lakes, springs, and wetlands to ensure adequate water for natural systems and human use, the District has an extensive network of coastal and inland surface and groundwater monitoring sites to collect and analyze water quality data, including information about saltwater intrusion. In those places where water quantity and quality issues become evident, the District implements programs, projects and regulations to address them. The District also participates in local, state and national discussions on these issues in order to accommodate timely and effective responses to climate changes as they become evident.

The Coastal Groundwater Quality Monitoring and Water-Use Permit networks are the largest and longest ongoing well sampling networks of their kind at the District. The networks currently have a combined total of over 350 wells that cover 13 counties, and new wells have been added to the networks at a rate of 5 to 10 wells per year. Having long-term water quality data will become increasingly important with continued demands for groundwater withdrawals in the District and statewide. Although the entire coastal region of the District is included in the monitoring effort, much emphasis is placed on the southern region of the District formally designated as the SWUCA. District staff is also determining how to use or modify existing groundwater models to predict density and water-level driven changes to aquifers utilized for water supply. Through cooperative funding, the District is assisting water utilities and regional water supply authorities with wellfield evaluations for improving withdrawal operations and planning for brackish treatment upgrades.

The District also encourages maximizing the use of diverse water supply sources and establishing system redundancies to ensure a resilient water supply. The District promotes water conservation across all use sectors, including agricultural and industrial uses, which not only saves supplies for the future but also reduces chemical and energy use. Through partnerships, the District continues to increase the availability and use of reclaimed water, the development of wet-weather storage facilities, and enhanced water efficiencies. Additionally, the District supports and co-funds projects to interconnect water supply systems, either potable or nonpotable, to ensure adequate supplies from dispersed sources and redundancy for emergencies. The District also helps to fund environmentally sustainable and drought-resistant water supply options such as reclaimed water, stormwater reuse, brackish groundwater treatment, surface water reservoirs, aquifer storage and recovery, aquifer recharge, and seawater desalination.

Section 4. Future Adaptive Management Strategies

While ongoing District efforts can provide critical information and allow flexibility to accommodate future changes in water supply, local governments and industries are principally tasked with developing and communicating the appropriate risk assessment and adaptation strategy for each municipality or other significant water user. The commonly evaluated community adaptation strategies can be grouped into three generalized approaches: armament, accommodation, or organized retreat. The District is able to provide a supporting role during the planning and implementation for each of these approaches.

- Armament. An armament strategy involves the erection of defensive barriers such as dykes and pumping systems to protect existing infrastructure from storm surges and sea level rise. Armament may be a preferred approach for dense urban and commercial areas, although they may limit transitional natural habits and create an effective tipping point for inundation. The community's existing water supply infrastructure and demand centers would be maintained.
- Accommodation. An accommodation strategy utilizes improved infrastructure such as elevated roads and buildings and canal systems that allow coastal inundation to occur. Accommodation strategies may suit growing municipalities that can apply innovative community planning to assure longevity. The District's water supply planning efforts may involve the technological development of alternative water supplies including aquifer recharge systems, direct and indirect reuse, and reverse osmosis treatment options for these communities. The District would also have a role in assuring the transitional health of water bodies.
- Organized Retreat. An organized retreat strategy may involve the rezoning of property threatened by inundation, or transfer to public ownership, potentially through rolling easements or post-disaster development plans. Retreat strategies typically include ecological engineering projects to assist the transition of natural habitats that will also provide shelter to upland infrastructure.

The District would account for these strategies through the five-year update schedule of the RWSP. The schedule allows sufficient time to anticipate transitional changes to population centers in the water demand projections, and to develop appropriate water supply options. Continued development of regionally interconnected water systems also allows large-scale water treatment facilities to adjust distribution to new demand locations.

Climate change may have a significant potential to affect water supply sources and should be factored into evaluations of the adequacy of supplies to meet future demand. It also has the potential to dramatically change patterns of demand and could, therefore, be an important consideration in demand projections. Changes in the nature of supply and demand would necessitate infrastructure adaptation. High cost and relative uncertainty can make these adaptations problematic; however, as related information is generated, existing and proposed water sources and projects will be evaluated to determine their feasibility and desirability. For these reasons, the District is maintaining a "monitor and adapt" approach toward the protection of natural resources from climate change. The District will actively monitor research projects, both locally and nationally, interpret the results, and initiate appropriate actions necessary to protect the water resources in our region as the effects of climate change become more evident.

Part F. Central Florida Water Initiative (CFWI)

Section 1. Formation

The CFWI focuses on the CFWI Planning Area, which includes southern Lake, Orange, Osceola, Seminole and Polk counties (see Figure 2-3). The CFWI is being undertaken to provide a coordinated approach for water management in a region where the boundaries of three water management districts intersect and where water withdrawals in one district may impact water resources and water users throughout the area. The District, along with the SJRWMD, SFWMD, DEP, Florida Department of Agriculture and Consumer Services (FDACS), regional public water supply utilities and other stakeholders are collaborating on the initiative to develop a unified process to address current and long-term water supply needs in central Florida. The guiding principles of the CFWI are to:

- Identify the sustainable quantities of traditional groundwater sources available for water supplies that can be used without causing unacceptable harm to the water resources and associated natural systems.
- Develop strategies to meet water demands that are in excess of the sustainable yield of existing traditional groundwater sources.
- Establish consistent rules and regulations for the three WMDs that meet their collective goals, and implement the results of the CFWI.

Section 2. CFWI RWSP

The first ever multi-District RWSP was developed for the CFWI Planning Area as a draft collaborative work product in 2014. The plan focuses on water demand estimates and projections, water resource assessments (based in part on groundwater modeling), and developing feasible water supply and water resource development options that will meet future water supply needs in a manner that sustains the water resources and related natural systems. Modeling results and groundwater availability assessments concluded that fresh groundwater resources alone cannot meet future water demands in the CFWI Planning Area without resulting in unacceptable impacts to water resources and related natural systems. The assessments showed the primary areas that appear to be more susceptible to the effects of groundwater withdrawals, including the Wekiva Springs/River System, western Seminole and Orange counties, southern Lake County, the Lake Wales Ridge, and the portion of the SWUCA in Polk County. The evaluations also indicated that expansion of withdrawals associated with projected demands through 2035 could increase the existing areas of water resource stress within the CFWI Planning Area. The CFWI RWSP identified 142 potential water supply development project options that could potentially provide up to 411 mgd of additional water supply, including maximized use of reclaimed water, increased water storage capacity, limited use of fresh and brackish groundwater, use of surface water, and use of desalinated seawater.

The CFWI Solutions Planning Team, consisting of representatives from the WMDs, DEP, FDACS, public supply utilities, the agricultural industry, environmental groups, business representatives, and regional leaders used the CFWI RWSP to further develop specific water supply projects through partnerships with water users. The final work product of the Solutions Planning Team will be a CFWI 2035 Water Resources Protection and Water Supply Strategies document, which will be incorporated into the CFWI RWSP. The document also includes the necessary financing, cost estimates, potential sources, feasibility and permitting analysis, identification of governance structure options, and any potential recovery needs. This document is scheduled for approval in late 2015.

Consistency was maintained between the CFWI documents and the District's update of the RWSP. Because Polk County is part of the CFWI Planning Area, the demands and many of the projects listed in this RWSP are also in the CFWI RWSP.

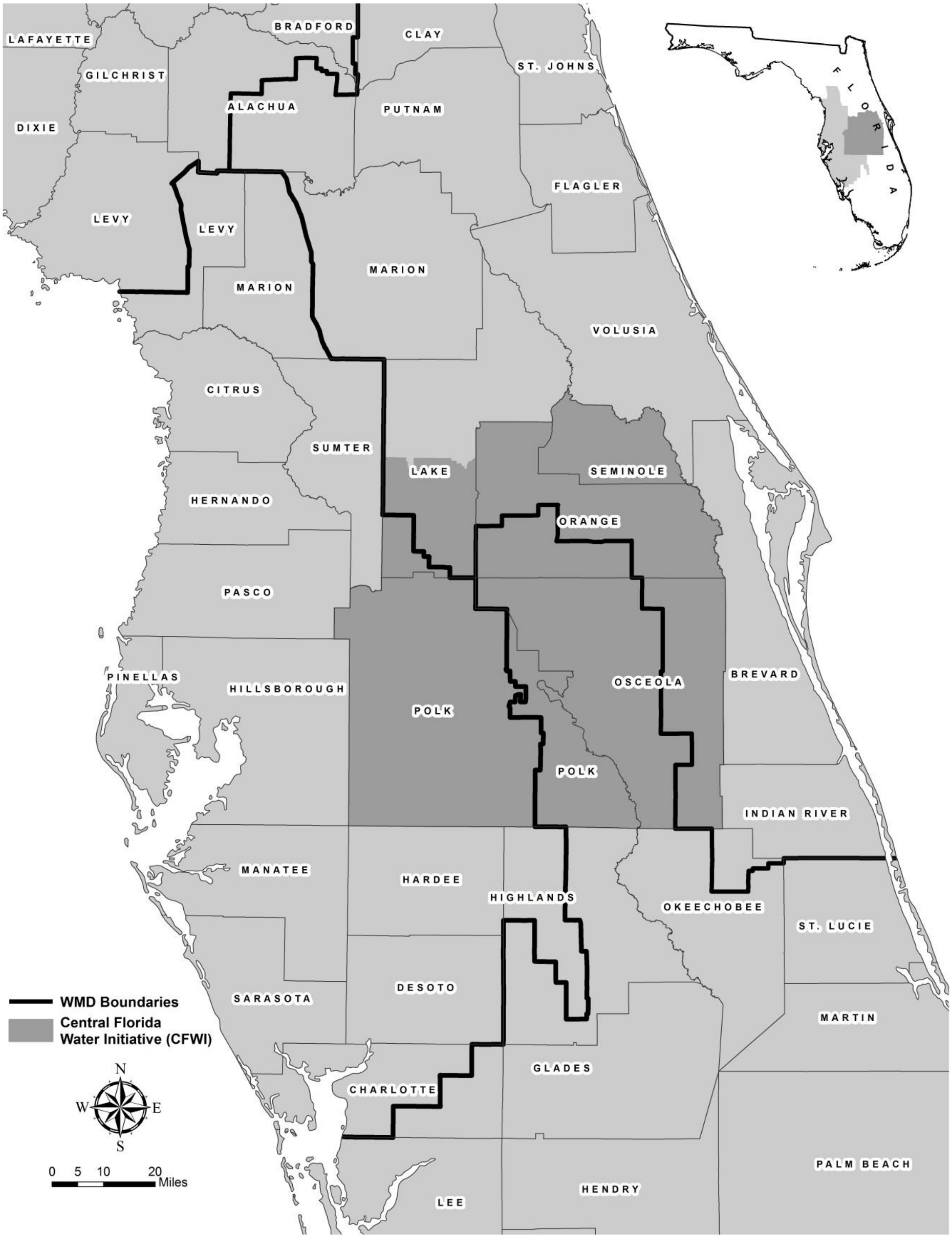


Figure 2-3. *Location of the Central Florida Watershed Initiative Area*

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Chapter 3. Demand Estimates and Projections

This chapter is a comprehensive analysis of the demand for water for all use categories in the Northern Planning Region for the 2010 to 2035 planning period. The chapter includes methods and assumptions used in projecting water demand for each county, the demand projections in five-year increments and an analysis and discussion of important trends in the data. The Southwest Florida Water Management District (District) projected water demand for the public supply, agricultural, industrial/commercial, mining/dewatering, power generation and landscape/recreation sector for each county in the planning region. An additional water use sector, environmental restoration, comprises quantities of water that need to be developed and/or retired to meet established minimum flows and levels (MFLs). The environmental restoration demand could increase during the planning period based on the recovery requirements of MFLs established in future years. The methodologies used to project demand for each category are briefly summarized in this chapter and presented in greater detail in the Chapter 3 Appendix.

The demand projections represent those reasonable and beneficial uses of water that are anticipated to occur through the year 2035. The District determined 5-in-10 (average condition) and 1-in-10 (drought condition) demands for each five-year increment from 2010 to 2035 for each sector. The demand projections for counties located partially in other water management districts (WMDs) (Lake, Levy and Marion) reflect only the anticipated demands in those portions located within the District's boundaries.

General reporting conventions for the Regional Water Supply Plan (RWSP) were guided by the document developed by the Water Planning Coordination Group: Final Report: Development and Reporting of Water Demand Projections in Florida's Water Supply Planning Process (WPCG, 2005). This document was produced by the Water Demand Projection Subcommittee of the Water Planning Coordination Group, a subcommittee consisting of representatives from the WMDs and the Florida Department of Environmental Protection (DEP), formed in 1997 as a means to reach consensus on the methods and parameters used in developing RWSPs. Some of the key guidance parameters include:

- <u>Establishment of a base year</u>: The year 2010 was agreed upon as a base year to develop and report water demand projections. This is consistent with the methodology agreed upon by the Water Planning Coordination Group. The data for the base year consists of reported and estimated usage for 2010; whereas, data for the years 2015 through 2035 are projected demands.
- <u>Water use reporting thresholds</u>: Minimum thresholds of water use within each water use category were agreed upon as the basis for projection.
- <u>5-in-10 versus 1-in-10</u>: For reporting demand in average versus drought conditions, specific parameters were prescribed for at least a portion of the demand related to all water supply categories except industrial/commercial, mining/dewatering and power generation. In general, demand is reported for a 5-in-10 average annual effective rainfall condition and a 1-in-10 drought year condition (an increase in water demand having a 10 percent probability of occurring during any given year).

The projected demand represents the total amount of water required to meet reasonable and beneficial water needs through 2035. Total demand does not account for reductions that could be achieved by additional demand management measures. Water conservation and other sources are accounted for separately in Chapter 4, as a means by which demand can be met.

Part A. Water Demand Projections

Demand projections were developed for five sectors: (1) public supply, (2) agriculture, (3) industrial/commercial, mining/dewatering and power generation, (4) landscape/recreation and (5) environmental restoration (also referred to as PS, AG, I/C, M/D, PG, L/R, and ER). The categorization provides for the projection of demand for similar water uses under similar assumptions, methods and reporting conditions.

Section 1. Public Supply

1.0 Definition of the Public Supply Water Use Sector

The public supply sector consists of four subcategories: (1) large utilities (permitted for 0.1 mgd or greater), (2) small utilities (permitted for less than 0.1 mgd), (3) domestic self-supply (individual private homes or businesses that are not utility customers that receive their water from small wells that do not require a water use permit (WUP)) and (4) additional irrigation demand (water from domestic wells that do not require a WUP and used for irrigation by residences that rely on a utility for indoor and other non-irrigation water needs).

2.0 Population Projections

2.1 Base Year Population

All WMDs agreed that 2010 would be the base year from which projections would be determined. The District calculated the 2010 population by extrapolating back from GIS Associates, Inc.'s 2012 population estimate. Utilities with permitted quantities less than 100,000 gallons per day (gpd) are not required to report population or submit service area information. Consequently, population was obtained from the previously issued permit.

2.2 Methodology for Projecting Population

The population projections developed by the Bureau of Economic and Business Research (BEBR) are generally accepted as the standard throughout Florida. However, these projections are made at the county level only and accurate projections of future water demand require more spatially precise data. Subsequently, the District’s projections are BEBR projections disaggregated to land parcel level, which is the smallest area of geography possible for population studies. In turn, these parcel-level projections are normalized to the BEBR medium projection for the counties. Using this methodology, the District contracted with GIS Associates, Inc. to provide small-area population projections for the 16 counties entirely or partly within the District.

3.0 2010 Base Year Water Use and Per Capita Rate

3.1 Base Year Water Use

The 2010 public supply base year water use for each large utility is derived by multiplying the average 2008–2012 unadjusted gross per capita rate by the 2010 estimated population for each individual utility. For small utilities, per capita information is found in the last issued permit. If no per capita information is available, the per capita is assumed to equal the average county per capita. Base year water use for small utilities is obtained by multiplying the per capita from the current permit by the 2010 estimated population from the last issued permit. Domestic self-supply base year is calculated by multiplying the 2010 domestic self-supply population for each county by the average 2008-2012 residential countywide per capita water use.

4.0 Water Demand Projection Methodology

4.1 Public Supply

Water demand is projected in five-year increments from 2015 to 2035. To develop the projections, the District used the 2008–2012 average per capita rate multiplied by the projected population for that increment. An additional component of public water supply demand is water derived from domestic wells for irrigation. These wells have a diameter of less than 6 inches, do not require a WUP and are used for irrigation at residences that receive potable water for indoor use from a utility. These wells are addressed in a separate report entitled Southwest Florida Water Management District Irrigation Well Inventory (D.L. Smith and Associates, 2004). This report provides the estimated number of domestic irrigation wells within the District and their associated water demand. The District estimates that approximately 300 gpd are used for each well.

4.2 Domestic Self-Supply (DSS)

DSS is any portion of the county population not served by a utility. County DSS population estimates and projections were calculated as the difference between the total county population estimate or projection and the total population served by the utilities. For counties that are in multiple districts, only that portion of the population within the District was included.

5.0 Water Demand Projections

Table 3-1 shows the projected public supply demand for the planning period. The table shows that demand will increase by 58.41 percent or 51.36 mgd for the 5-in-10 condition.

The projections are inconsistent with those in the District's 2010 RWSP. The differences can be attributed to slower than anticipated population immigration, the economic downturn and more accurate utility level population projections using a GIS model which accounts for growth and build-out at the parcel level.

Table 3-1. *Projected public supply demand including public supply utilities, domestic self-supply and private irrigation wells in the Northern Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2010 Base		2015		2020		2025		2030		2035		Change 2010-2035		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Citrus	21.12	22.38	22.42	23.76	24.11	25.56	25.66	27.20	27.03	28.66	28.25	29.95	7.14	7.57	33.8%	33.8%
Hernando	25.36	26.88	27.55	29.21	30.20	32.01	32.67	34.63	34.91	37.00	36.88	39.09	11.52	12.21	45.4%	45.4%
Lake	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.19	0.20	0.21	0.22	0.11	0.12	110.0%	110.0%
Levy	1.88	1.99	1.98	2.10	2.10	2.23	2.23	2.36	2.35	2.49	2.48	2.63	0.60	0.64	32.0%	32.0%
Marion	16.41	17.39	18.65	19.77	21.39	22.68	24.05	25.49	26.48	28.07	28.94	30.68	12.53	13.29	76.4%	76.4%
Sumter	23.07	24.45	28.06	29.74	32.56	34.51	36.15	38.32	39.47	41.84	42.52	45.07	19.45	20.62	84.3%	84.3%
Total	**87.93**	**93.20**	**98.78**	**104.71**	**110.51**	**117.14**	**120.92**	**128.17**	**130.44**	**138.26**	**139.28**	**147.64**	**51.36**	**54.44**	**58.4%**	**58.4%**

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-3 for source values.

6.0 Stakeholder Review

Population and water demand projection methodologies, results and analyses were provided to the District's water use regulation staff and public water use stakeholders for review. Changes suggested by stakeholders were incorporated only if they were based on historical regression data and long-term trends and supported by complete documentation.

Section 2. Agriculture

1.0 Description of the Agricultural Water Use Sector

Agriculture represents the second largest sector of water use in the District after public supply. Included in this category are irrigated crops and other miscellaneous water uses associated with agricultural commodity production within the District. Irrigation demand was determined and reported in the RWSP for each of the following commodities: (1) blueberries, (2) citrus, (3) cucumbers, (4) field crops, (5) melons, (6) nurseries, (7) other farm uses, (8) other fruit trees, (9) other vegetable and row crops, (10) pasture, (11) potatoes, (12) sod, (13) strawberries and (14) tomatoes. Water demands associated with non-irrigated agriculture such as aquaculture, dairy, cattle and poultry, were also estimated and projected.

2.0 Water Demand Projection Methodology

Demand projections for irrigated commodities were determined by multiplying projected irrigated acreage by the irrigation requirements of each commodity. For citrus, acreage projections were formulated based on trends in historic Florida Agricultural Statistics Service (FASS) data. As published historic acreage for non-citrus crops are no longer available at the county level, historic non-citrus crop acreage was estimated from permit, pumpage and other data sources and projected through the use of trend analysis at the county level. Non-irrigation demand (e.g., aquaculture and livestock) was based on analysis of trends in historic used and permitted quantities. The methodologies are described and data provided in more detail in Appendix 3-1. It is important to note that the agricultural demand projections for Lake County are taken from the Draft CFWI RWSP (May 2015).

The Florida Department of Agriculture and Consumer Services (FDACS) has also prepared Florida Statewide Agricultural Irrigation Demand (FSAID2) projections through 2035. The District did not use the FSAID2 projections for several reasons. Foremost, they were not completed in a time frame consistent with the District's schedule for completion of the RWSP. Second, the District used CFWI projections for Polk and Lake Counties, whereas the FSAID2 did not. Third, the FSAID2 methodology allows the acre-inch application rate for citrus to exceed what would likely be permitted. The District did, however, cooperate fully with the consulting firm hired by FDACS to prepare the FSAID2 projections. This level of cooperation and exchange of data and information is evident in the small differences between the projections once certain adjustments are made.

For irrigated crops, the FSAID2 process uses autoregressive techniques to forecast acreage based on the historic share of agricultural land that is irrigated at the county level. An econometric model was utilized to estimate crop water demand per acre and the coefficients of the model are based on fitting results to historic metered or reported pumpage data. The District provided pumpage data to FDACS' consultant for use in the modeling process.

For livestock and aquaculture (non-irrigation) water demands, the FSAID2 projections were based primarily on livestock count data and permitted quantities per head. Similar to the District's methodology, demands were held steady throughout the planning period, based on steady, if not declining, demands and lack of data upon which to make better projections.

3.0 Water Demand Projections

Agriculture in the planning region has historically been practiced at a considerably smaller scale than in the District's planning regions to the south. However, trends indicate that although irrigated acreage in the planning region is expected to decline by 0.45 percent during the planning period, agricultural irrigation water demand is expected to increase by approximately 7.66 percent, likely due to an increasing percentage of acreage in more water intensive cropping patterns. As citrus has not been a major crop in the planning region for some time, the region is not experiencing the declines in total acreage that have occurred in other regions due to significant declines in citrus acreage.

In 2015, the District projects 24.27 mgd will be used to irrigate 15,870 acres of agricultural commodities. Table 3-2 displays the projected change in total agricultural water demand[1] (both irrigation and non-irrigation) for the 5-in-10 and 2-in-10 conditions for the planning period. For the 5-in-10 condition, total regional agricultural water demand (both irrigation and non-irrigation) is projected to increase from 26.71 mgd in 2010 to 28.55 mgd in 2035, an increase of 1.85 mgd or 6.91 percent. The majority of the increase will be for field crops, other vegetables, row crops and nurseries. Increases in agricultural demand may be met with alternative sources and/or conservation.

The District did not develop 1-in-10 drought condition projections for agriculture per the RWSP Format and Guidelines (DEP et al., June 2009) due to limitations of the District's agricultural permitting demand model (AGMOD). Therefore, projections for 2-in-10 drought demands are provided as best available information. Additional information on the differences between average and drought conditions and drought projections development can be found in Appendix 3-1.

Except for the year 2035, neither 1-in-10 or 2-in-10 agricultural demands were projected in the Draft CFWI RWSP (May 2015). Therefore, total drought quantities for Lake County and the region are not reflected in Table 3-2, except for 2035. To include total drought quantities for the region without data for Lake County would produce misleading totals so they are addressed as "NA" except for 2035. Changes in 2-in-10 quantities for other counties in the planning region are fully reflected in Table 3-2.

As noted above in Section 2.0 (Water Demand Projection Methodology), FDACS produced agricultural water demand projections for the years 2015 through 2035. Once some reasonable adjustments are made to the FSAID2 projections based on the two significant differences in data and methodology addressed above, there is only about 1.85 percent difference Districtwide between the District's 2035 average condition irrigation demand projections and the FSAID2 average condition projections. Those adjustments include changing the FSAID2 projections for Polk and Lake Counties to the CFWI demand projections and holding FSAID2 citrus acre-inch application rates to 2015 rates throughout the planning period. Without the adjustments, the

[1] CFWI projected water demands associated with aquaculture, livestock watering, dairy, poultry, swine, etc., are reported as "miscellaneous" in the Draft CFWI RWSP, and are included as non-irrigation demand in total water demands in Table 3-2 and in Appendix 3-1.

FSAID2 2035 Districtwide irrigation projections are about 32.07 percent higher than the District's and FSAID2 Districtwide drought year irrigation projections are 21.51 percent higher than the District's.

The FSAID2 2035 livestock and aquaculture Districtwide demand projections are 27.13 percent higher than the District's projections. However this only represents a difference of 2.72 mgd Districtwide.

For greater detail on the comparison of FSAID2 and District projections at the Districtwide and county levels and how adjustments were made to the FSAID2 projections for comparison purposes, please see Appendix 3-1.

4.0 Stakeholder Review

The agricultural water demand projection methodology, results and analyses were provided to the District's water use regulation staff and to a limited number of agricultural experts for review in 2014.

District staff began presenting draft agricultural demand projections to our Agricultural Advisory Committee, permit evaluation staff, and other stakeholders in September 2014. As a result of their input, several revisions were made to the projection methodologies to better reflect actual trends. The District's technical memorandum outlining the projection methodologies and resulting demand projections have been posted on the District's website since January 21, 2015. These demand projections have been unchanged since February 25, 2015.

The District completed the first full draft of the RWSP and presented it to the Governing Board in April 2015 for approval to publish the results and initiate public workshops. Subsequent to Governing Board approval in April 2015, public workshops on the District's projections (including agricultural demand) were held on May 28, June 30, July 21, and July 23, 2015.

The District's projections were well-received by the agricultural community and no significant issues were raised concerning the projected agricultural demand.

Non-irrigation agricultural demand includes livestock watering

Table 3-2. *Projected agricultural demand in the Northern Planning Region (5-in-10 and 2-in-10) (mgd)*

County	2010 Base		2015		2020		2025		2030		2035		Change 2010-2035		% Change	
	5-10	2-10	5-10	2-10	5-10	2-10	5-10	2-10	5-10	2-10	5-10	2-10	5-10	2-10	5-10	2-10
Citrus	1.82	2.01	1.77	1.98	1.76	1.98	1.80	2.02	1.86	2.09	1.94	2.18	0.12	0.18	6.8%	8.7%
Hernando	2.74	3.22	2.67	3.18	2.61	3.11	2.58	3.08	2.56	3.06	2.56	3.07	-0.18	-0.16	-6.5%	-4.8%
Lake[1]	1.69	NA	1.56	NA	1.43	NA	1.30	NA	1.17	NA	1.10	1.60	-0.59	NA	-34.9%	NA
Levy	6.66	7.52	7.53	8.50	7.79	8.76	8.10	9.09	8.44	9.45	8.79	9.82	2.13	2.30	31.9%	30.6%
Marion	4.68	5.18	4.44	4.96	4.63	5.20	4.89	5.51	5.20	5.87	5.55	6.28	0.87	1.10	18.6%	21.2%
Sumter	9.12	9.72	8.92	9.48	8.59	9.10	8.47	8.94	8.49	8.93	8.61	9.04	-0.51	-0.68	-5.6%	-7.0%
Total	**26.71**	**NA**	**26.89**	**NA**	**26.82**	**NA**	**27.14**	**NA**	**27.72**	**NA**	**28.55**	**31.99**	**1.85**	**NA**	**6.9%**	**NA**

[1] Lake County projections derived from the Draft CFWI RWSP (May 2015).

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-1 for source values.

Section 3. Industrial/Commercial (I/C) and Mining/Dewatering (M/D)

1.0 Description of the I/C and M/D Water Use Sectors

I/C and M/D uses within the District include chemical manufacturing, food processing and miscellaneous industrial and commercial uses. Much of the water used in food processing is for citrus and other agricultural commodities. Chemical manufacturing is associated with phosphate mining and consists mainly of phosphate processing. M/D water use is associated with a number of products mined in the planning region, including limestone and sand.

2.0 Demand Projection Methodology

Demand projections for the 2015 RWSP were developed by multiplying the 2010 amount of water used for each I/C and M/D facility by growth factors based on Woods & Poole Economics' gross regional product (GRP) forecasts by county in five-year increments. For example, if an IC facility used 0.30 mgd in 2010 and the county calculated growth factor from 2010 to 2015 was 3 percent, the 2015 projection for that facility would be 1.03 x 0.30 = 0.31 mgd. If the 2015 to 2020 growth factor was 4 percent, the 2020 projection would be 0.32 mgd. Water use for 2010 is derived from the District's 2010 Water Use Well Package Database (WUWPD). Based on the well package, in 2010 there were 38 I/C and 11 M/D water use permittees in the planning region.

3.0 Water Demand Projections

Table 3-3 shows the projected I/C and M/D regional water demand for the planning period. The table shows an increase in demand from 9.18 mgd in 2010 to 10.72 mgd in 2035, an increase of 1.54 mgd, or 16.7 percent. The projections for the District's portion of Lake County is zero for this water demand category based on the projections from the CFWI RWSP. The projection is quite reasonable given that the portion of Lake County that is within the District is very small and rural.

For several years, the permitted quantity in the I/C and M/D sectors has been declining. Much of this reduction is due to revisions in the way permitted quantities for M/D are allocated by the District. Non-consumptive dewatering uses are no longer included in permitted quantities. Starting with the 2010 RWSP, demand projections were included for all 16 counties; whereas, earlier RWSPs included demand projections for only the 10 southern counties. Additionally, quantities permitted for product entrainment were not included in the 2010 or 2015 projections, because the District no longer considers them part of actual water demand (i.e., quantities necessary to conduct mining operations).

In accordance with the 2009 Format and Guidelines, the 5-in-10 and 1-in-10 demands are the same. The uses "are assumed to be reasonably the same in a 1-in-10-year drought event as in an average year (i.e., no significant demand variation)" (DEP et al., June 2009).

Table 3-3. *Projected industrial/commercial and mining/dewatering demand in the Northern Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2010 Base	2015	2020	2025	2030	2035	Change 2010-2035	% Change
Citrus	0.75	0.76	0.79	0.81	0.83	0.85	0.10	13.2%
Hernando	7.85	8.18	8.43	8.68	8.93	9.19	1.33	16.9%
Lake	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Levy[1]	0.07	0.07	0.07	0.07	0.07	0.07	0.01	11.3%
Marion	0.13	0.13	0.13	0.13	0.14	0.14	0.01	10.4%
Sumter	0.39	0.41	0.42	0.44	0.45	0.47	0.09	22.1%
Total	**9.18**	**9.55**	**9.83**	**10.13**	**10.42**	**10.72**	**1.54**	**16.7%**

[1] Lake County projections derived from the Draft CFWI RWSP (May 2015).

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-2 for source values. Changes in small demand numbers across time can represent a large percent change in demand over time that is not readily seen from the rounded values in the table.

4.0 Stakeholder Review

The demand projection methodology, results and analyses were provided to the District's water use permitting staff and I/C and M/D sector stakeholders for review and comment. The projections were reviewed by the District's Industrial Advisory Committee, which concurred with the projection methodologies and outcome. Upon receiving additional stakeholder comments, the District reviewed suggested changes and, when appropriate, included updates.

Section 4. Power Generation (PG)

1.0 Description of the PG Water Use Sector

The PG uses within the District include water for thermo-electric power generation used for cooling, boiler make-up, or other purposes associated with the generation of electricity. The PG quantities have previously been grouped with IC and MD quantities, but are provided separately in this section per the 2009 Format and Guidelines (DEP et al., June 2009).

2.0 Demand Projection Methodology

Demand projections for the 2015 RWSP were developed by multiplying the 2010 amount of water used for each PG facility by growth factors based on Woods & Poole Economics' gross regional product (GRP) forecasts by county in five-year increments. For example, if a PG facility used 0.30 mgd in 2010 and the county calculated growth factor from 2010 to 2015 was 3 percent, the 2015 projection for the facility would be 1.03 x .030 =0.31 mgd. If the 2015 to 2020 growth factor was 4 percent, the 2020 projection would be 0.32 mgd. Water use for 2010 is derived from the WUWPD. Based on the WUWPD data, in 2010 there was one PG water use permittee in the planning region, located in Citrus County.

3.0 Water Demand Projections

Table 3-4 shows the projected PG water demand for the planning period. The table shows an increase in demand from 2.33 mgd in 2010 to 2.64 mgd in 2035, an increase of 0.31 mgd, or 13.24 percent. The demand projections do not include reclaimed, seawater or non-consumptive use of freshwater. In accordance with the 2009 Format and Guidelines, the 5-in-10 and 1-in-10 demands are the same. Power generation uses "are assumed to be reasonably the same in a 1-in-10-year drought event as in an average year (i.e., no significant demand variation)" (DEP et al., June 2009).

Table 3-4. *Projected power generation demand in the Northern Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2010 Base	2015	2020	2025	2030	2035	Change 2010-2035	% Change
Citrus	2.33	2.36	2.43	2.50	2.56	2.64	0.31	13.2%
Hernando	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Lake[1]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Levy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Marion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Sumter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Total	**2.33**	**2.36**	**2.43**	**2.50**	**2.56**	**2.64**	**0.31**	**13.2%**

[1] Lake County projections derived from the Draft CFWI RWSP (May 2015).

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-2 for source values. Changes in small demand numbers across time can represent a large percent change in demand over time that is not readily seen from the rounded values in the table.

4.0 Stakeholder Review

The demand projection methodology, results, and analyses were provided to the District's water use permitting staff and PG sector stakeholders for review and comment. The projections were reviewed by the District's Industrial Advisory Committee, which concurred with the projection methodologies and outcome. Upon receiving additional stakeholder comments, the District reviewed suggested changes and, when appropriate, included updates.

Section 5. Landscape/Recreation (L/R)

1.0 Description of the L/R Water Use Sector

The L/R sector includes the self-supplied water use associated with the irrigation of golf courses, cemeteries, parks, medians, attractions and other large self-supplied green areas. Golf courses are major users within this category.

2.0 Demand Projection Methodology

Landscape/Recreation baseline use data is from the WUWPD (SWFWMD, 2014). This database includes metered use for active individual/general permits and estimated use for

General Permits by Rule. The projection methodologies are divided into those for golf and those for other landscape and recreation. A more detailed description of the methodologies used is contained in Appendix 3-5.

Based on comments from knowledgeable stakeholders that initial demand projections for golf may be too high, the District engaged the services of a respected golf industry consulting firm to develop county-level percent changes in demand for 18-hole equivalent golf courses for each five-year period of the planning period. The percent changes were then applied to the previous five-year period's pumpage beginning with the 2010 baseline pumpage. The projected percentage changes were based on projected socioeconomic factors such as, household income and ethnicity, and golf play rates associated with those socioeconomic factors.

Other (non-golf) L/R demands are based on population growth within each county. Water use for this sector is assumed to grow at the projected county-level percent change in population. The five-year population percent changes for each five-year period were calculated and then applied to the previous five-year period's pumpage, beginning with the baseline pumpage.

3.0 Water Demand Projections

Table 3-5 provides total L/R demand for the planning period (both golf and other L/R demand). An increase in demand of 7.78 mgd for the 5-in-10 condition is projected between 2010 and 2035, an increase of 52.1 percent.

In 2010, golf water demand made up over 80 percent of total L/R water use in this planning region. Furthermore, this planning region has the highest projected percentage increase in demand for 18-hole equivalent golf courses (56 percent between 2010 and 2035). This is in large part due to the demographics of the region. Those 55 years of age and older tend to play more golf. In Sumter County, the county with the largest percentage increase in golf demand in the District, those 55 and over are projected to make up 74 percent of the population in 2035. In Hillsborough County, those 55 years of age and older will make up only 28 percent of the county population. Hillsborough County is in the planning region with the lowest projected increase in golf demand (Tampa Bay).

4.0 Stakeholder Review

The demand projection methodology, results and analyses were provided to the District's water use permitting staff and L/R use sector stakeholders for review and comment. The most significant comments were from the District's Green Industry Advisory Committee indicating that the golf portion of the projections were likely too high based on trends in the golf industry, The District reviewed relevant industry literature and consulted industry professionals. Based on this review, changes were made to the methodology for projecting L/R demands. DEP reviewers also questioned the initial large increase in L/R demand. The revised projections indicate a significantly smaller percentage increase in demand from 2010 to 2035 in the Northern Planning Region.

Table 3-5. *Projected L/R demand in the Northern Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2010 Base		2015		2020		2025		2030		2035		Change 2010-2035		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Citrus	4.55	5.91	4.56	5.92	5.11	6.63	5.66	7.34	6.21	8.06	6.76	8.77	2.20	2.86	48.3%	48.3%
Hernando	5.10	6.58	4.95	6.38	5.58	7.20	6.23	8.03	6.88	8.87	7.53	9.71	2.43	3.13	47.5%	47.6%
Lake[1]	0.00	NA	0.00	NA	0.00	NA	0.00	NA	0.00	NA	0.00	0.00	0.00	NA	0.0%	NA
Levy	0.28	0.36	0.28	0.36	0.28	0.36	0.28	0.36	0.28	0.37	0.29	0.37	0.01	0.01	3.0%	3.0%
Marion	3.53	4.56	3.56	4.60	3.98	5.14	4.40	5.68	4.82	6.23	5.25	6.78	1.72	2.23	48.8%	48.8%
Sumter	1.47	1.89	1.64	2.10	1.92	2.46	2.22	2.85	2.54	3.26	2.89	3.71	1.42	1.83	96.9%	96.9%
Total	**14.93**	**NA**	**14.99**	**NA**	**16.86**	**NA**	**18.78**	**NA**	**20.73**	**NA**	**22.71**	**29.35**	**7.78**	**NA**	**52.1%**	**NA**

[1] Lake County projections derived from the Draft CFWI RWSP (May 2015).

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-4 for source values.

Section 6. Environmental Restoration (ER)

1.0 Description of the ER Water Use Sector

ER comprises quantities of water that may need to be developed and/or existing quantities that need to be retired to facilitate recovery of natural systems to meet their MFLs. Unlike the District's other three planning regions, there are no water resources in recovery in the Northern Planning Region. As a result, there is no need to project demand for ER. However, this could change if water resources are identified as impacted, as the District continues to establish MFLs in the region.

The effect of future demands on springs was evaluated in the Withlacoochee Regional Water Supply Authority (WRWSA) RWSP Update (WRWSA, 2014). For the portion of the WRWSA area within District boundaries, it was determined that adjusted demands for 2035 could be met with groundwater, with no exceedances to springs and rivers for which MFLs were proposed or adopted. Demands were adjusted by reducing water demand through water conservation and mitigating aquifer drawdowns to some degree by reclaimed water recharge. However, unadjusted demands would likely cause MFL exceedances for Homosassa and Chassahowitzka springs. This suggests that groundwater from the Upper Floridan aquifer may be limited in certain areas by 2035. The plan notes that additional quantities of groundwater will be available from the Upper and Lower Floridan aquifers in certain areas; however, an accurate estimate is not available at this time.

Chassahowitzka River

Section 7. Summary of Projected Change in Demand

Table 3-6 summarizes the increases and decreases in demand respectively for the 5-in-10 and 1-in-10 conditions for all use categories. Previously, increases and decreases in demand were tracked separately, now they are totaled by demand for the labeled year. Decreases in demand represent a reduction in the use of groundwater, which can be available for mitigation of new groundwater permits and/or permanently retired to help meet future environmental restoration requirements.

Table 3-6 shows that 62.83 mgd of additional water supply is needed from existing sources or will need to be developed to meet demand in the planning region through 2035. Public supply water use will increase by 51.36 mgd over the planning period. Agricultural and I/C, M/D, and PG water use will increase by a combined 3.69 mgd. L/R water use will increase by 7.78 mgd.

Table 3-7 summarizes the projected demand for each county in the planning region for the 5-in-10 condition.

Table 3-6. *Summary of the projected demand in the Northern Planning Region (5-in-10 and 1-in-10)[1] (mgd)*

Water Use Category	2010 Base		2015		2020		2025		2030		2035		Change 2010-2035		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Public Supply	87.93	93.20	98.78	104.71	110.51	117.14	120.92	128.17	130.44	138.26	139.28	147.64	51.36	54.44	58.4%	58.4%
Agriculture	26.71	NA	26.89	NA	26.82	NA	27.14	NA	27.72	NA	28.55	31.99	1.85	NA	6.9%	NA
I/C & M/D	9.18	9.18	9.55	9.55	9.83	9.83	10.13	10.13	10.42	10.42	10.72	10.72	1.54	1.54	16.7%	16.7%
Power Gen.	2.33	2.33	2.36	2.36	2.43	2.43	2.50	2.50	2.56	2.56	2.64	2.64	0.31	0.31	13.2%	13.2%
Landscape/Rec.	14.93	NA	14.99	NA	16.86	NA	18.78	NA	20.73	NA	22.71	29.35	7.78	NA	0.52	NA
Total	**141.08**	**NA**	**152.57**	**NA**	**166.45**	**NA**	**179.47**	**NA**	**191.87**	**NA**	**203.91**	**222.35**	**62.83**	**NA**	**44.5%**	**NA**

[1] Agriculture quantities in the 1-in-10 column are actually 2-in-10.
Note: Summation and/or percentage calculation differences occur due to rounding.

Table 3-7. *Summary of the projected demand for counties in the Northern Planning Region (5-in-10) (mgd)*

Water Use Category	Planning Period						Change 2010-2035	
	2010	2015	2020	2025	2030	2035	mgd	%
Citrus								
Public Supply	21.12	22.42	24.11	25.66	27.03	28.25	7.14	33.8%
Agriculture	1.82	1.77	1.76	1.80	1.86	1.94	0.12	6.8%
I/C & M/D	0.75	0.76	0.79	0.81	0.83	0.85	0.10	13.2%
Power Gen.	2.33	2.36	2.43	2.50	2.56	2.64	0.31	13.2%
Landscape/Rec.	4.55	4.56	5.11	5.66	6.21	6.76	2.20	48.3%
Cumulative Total	**30.57**	**31.88**	**34.20**	**36.42**	**38.50**	**40.44**	**9.87**	**32.3%**
Hernando								
Public Supply	25.36	27.55	30.20	32.67	34.91	36.88	11.52	45.4%
Agriculture	2.74	2.67	2.61	2.58	2.56	2.56	-0.18	-6.5%
I/C & M/D	7.85	8.18	8.43	8.68	8.93	9.19	1.33	16.9%
Power Gen.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Landscape/Rec.	5.10	4.95	5.58	6.23	6.88	7.53	2.43	47.5%
Cumulative Total	**41.06**	**43.36**	**46.83**	**50.16**	**53.28**	**56.16**	**15.10**	**36.8%**
Lake								
Public Supply	0.10	0.12	0.14	0.16	0.19	0.21	0.11	110.0%
Agriculture	1.69	1.56	1.43	1.30	1.17	1.10	-0.59	-34.9%
I/C & M/D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Power Gen.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Landscape/Rec.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Cumulative Total	**1.79**	**1.68**	**1.57**	**1.46**	**1.36**	**1.31**	**-0.48**	**-26.8%**
Levy								
Public Supply	1.88	1.98	2.10	2.23	2.35	2.48	0.60	32.0%
Agriculture	6.66	7.53	7.79	8.10	8.44	8.79	2.13	31.9%
I/C & M/D	0.07	0.07	0.07	0.07	0.07	0.07	0.01	11.3%
Power Gen.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Landscape/Rec.	0.28	0.28	0.28	0.28	0.28	0.29	0.01	3.0%
Cumulative Total	**8.88**	**9.86**	**10.24**	**10.68**	**11.15**	**11.62**	**2.74**	**30.9%**
Marion								
Public Supply	16.41	18.65	21.39	24.05	26.48	28.94	12.53	76.4%
Agriculture	4.68	4.44	4.63	4.89	5.20	5.55	0.87	18.6%
I/C & M/D	0.13	0.13	0.13	0.13	0.14	0.14	0.01	10.4%
Power Gen.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Landscape/Rec.	3.53	3.56	3.98	4.40	4.82	5.25	1.72	48.8%
Cumulative Total	**24.73**	**26.78**	**30.13**	**33.47**	**36.64**	**39.87**	**15.14**	**61.2%**
Sumter								
Public Supply	23.07	28.06	32.56	36.15	39.47	42.52	19.45	84.3%
Agriculture	9.12	8.92	8.59	8.47	8.49	8.61	-0.51	-5.6%
I/C & M/D	0.39	0.41	0.42	0.44	0.45	0.47	0.09	22.1%
Power Gen.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Landscape/Rec.	1.47	1.64	1.92	2.22	2.54	2.89	1.42	96.9%
Cumulative Total	**34.04**	**39.02**	**43.49**	**47.28**	**50.96**	**54.49**	**20.45**	**60.1%**
Region Total	**141.08**	**152.57**	**166.45**	**179.47**	**191.87**	**203.91**	**62.83**	**44.5%**

Note: Summation and/or percentage calculation differences occur due to rounding. Changes in small demand numbers across time can represent a large percent change in demand over time that is not readily apparent from the rounded values in the table.

Section 7. Comparison of Demands between the 2010 RWSP and the 2015 RWSP

There are significant differences between the 2010 and 2015 RWSP demand projections in the agricultural, public supply and I/C, M/D and PG water use sectors. The 2010 base numbers are reduced in all sectors from the 2010 projected numbers used in the 2010 RWSP due to methodology changes and over-projections. The projection differences can also be attributed to slower than anticipated population growth and the economic downturn. Regarding the agricultural projections, the 2010 RWSP projected a decline of nearly 0.8 mgd for the 2005–2030 planning period, while the 2015 RWSP projects an increase of 1.85 mgd for the planning period. Regarding the public supply category, the 2010 RWSP projected an increase of 72.1 mgd for the 2005–2030 planning period, while the 2015 RWSP projects an increase of 51.36 mgd for 2010–2035 planning period. There is also a significant difference between the 2010 and 2015 I/C, M/D and PG demand projections. The 2010 RWSP projected a decline of 9.8 mgd for this category, while the 2015 RWSP projects a net 1.85 mgd increase. For L/R demand, the 2010 RWSP projected an increase of 11.3 mgd, while the 2015 RWSP projects just a 7.78 mgd increase.

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Chapter 4. Evaluation of Water Sources

This chapter presents the results investigations by the Southwest Florida Water Management District (District) to quantify the amount of water that is potentially available from all sources of water within the planning region to meet demands through 2035. Sources of water that were evaluated include surface water, stormwater, reclaimed water, seawater desalination, brackish groundwater desalination, fresh groundwater and conservation. The amount of water that is potentially available from these sources is compared to the demand projections for the planning region presented in Chapter 3 and a determination is made as to the sufficiency of the sources to meet demand through 2035.

Part A. Evaluation of Water Sources

Fresh groundwater from the Upper Floridan aquifer (UFA) currently is by far the major source of supply for all use categories in the planning region. In addition, the principal source of water to meet the projected 2035 demand is likely to be new quantities of fresh groundwater. However, impacts resulting from groundwater withdrawals in southwest Hernando and northern Sumter counties may limit future availability of groundwater in these areas. Establishment of minimum flows for the coastal springs may also limit the availability of groundwater in certain areas. To ensure that low-cost groundwater supplies are available in the future, water users throughout the region are increasingly developing reclaimed water systems and implementing conservation measures. These measures will enable water supply systems to support more users with the same quantity of water and hydrologic stress. Although it may be beyond the 2035 planning period, the region’s continued growth will eventually require the development of alternative sources such as brackish groundwater, seawater and surface water with off-stream storage reservoirs. The following discussion summarizes the evaluation of all water supply sources and the potential for those sources to be used to produce new water supplies in the planning region.

Section 1. Fresh Groundwater

Fresh groundwater from the UFA is the principal source of water supply for all use categories in the planning region. Although there is a surficial aquifer in the planning region, the lack of a confinement between the Upper Floridan and surficial aquifers in most places causes the aquifers to function as a single unit. In 2013, approximately 95 percent (122 mgd) of 129 mgd of water (including domestic self-supply) used in the planning region was from groundwater sources. Approximately 64 percent (78 mgd) of the fresh groundwater was used for public supply (permitted and domestic self-supply). The following is an assessment of the availability of fresh groundwater in the UFA and Lower Floridan aquifer (LFA) in the planning region.

1.0 Upper Floridan Aquifer

The UFA consists of a thick sequence of marine carbonate deposits and is the main source for water supply within the planning region. A relatively thin sequence of sands, silts and clays overlies the carbonate deposits. The upper several hundred feet of limestone and dolomite comprise the most productive and utilized portion of the aquifer. The UFA is mostly unconfined over most of the planning region (SWFWMD, 1987; Hydrogeologic, 2013).

The bottom boundary of the freshwater flow system occurs in the middle and lower portion of the Avon Park Formation where gypsum beds are present over most of the Northern Planning

Region. This unit forms the bottom confining bed of the freshwater flow system and is named middle confining unit 2 (MCU II) (Miller, 1986). The LFA is found below MCU II, but groundwater is highly mineralized throughout much of the region and is not used.

Minimum flows and levels (MFLs) have been established for Weeki Wachee, Chassahowitzka, and Homosassa springs, as well as several lakes in the planning region. The formal adoption of MFLs for Chassahowitzka and Homosassa springs has been delayed pending the outcome of an administrative challenge. Currently, all established or proposed MFLs are being met. For 2035, there is the possibility that MFLs for Chassahowitzka, Homosassa, and Weeki Wachee springs, Lake Theresa (Weeki Wachee Prairie), and Hunters Lake in southwest Hernando County could be exceeded if the projected demand is met with groundwater from existing facilities. In addition, minimum levels for lakes Miona, Okahumpka and Deaton in northeast Sumter County may be exceeded by 2035 if public supply demand is met with groundwater from this area. In both counties, reductions in demand through the use of reclaimed water, the implementation of strict demand management measures (conservation) and the development of groundwater sources outside of these areas, or development of LFA groundwater, can prevent these MFLs from being exceeded. Over the next five years, MFLs are proposed for Rainbow, Gum, and Crystal River springs and the Withlacoochee River. Future groundwater availability will be governed by compliance with these MFLs when they are established.

Computer flow modeling using the Northern District model has shown that groundwater from the UFA is available to meet demand to 2035 by utilizing conservation and reuse initiatives (Cardno-Entrix, 2014). The conservation initiatives include demand reductions of 10 percent for both public supply and agriculture use, and 20 percent for recreational use. Reuse projects include those planned through 2035. The simulations analyzed the change in surficial and UFA water levels from pre-pumping conditions to 2035 using projections of future demand. In this model scenario, changes to spring flow and Withlacoochee River base flow, due to groundwater withdrawals from pre-pumping conditions to 2035, were 10 percent or less (see Tables 4-1 and 4-2). All springs with established minimum flows were also projected to be met. In most of the planning region, predicted drawdown within the surficial aquifer or UFA (where it is unconfined) is less than one foot, except in localized areas where concentrated groundwater withdrawals for public supply occur in northeast Sumter and western Hernando counties. In these areas, management strategies such as increased monitoring, conservation, and use of reclaimed water are being promoted to offset potential impacts due to withdrawals.

Table 4-1. *Predicted flow changes for springs from non-pumping to 2035 conditions based on the Northern District Groundwater Flow Model (Cardno-Entrix, 2014)*

Spring Name	No Pumping Flow (cfs)	Predicted 2035 Flows (cfs)	2035 Percent Change	MFL Allowable Percent Flow
Weeki Wachee Spring Group	206.1	192.8	6.5	10.0
Chassahowitzka Spring Group	157.0	154.0	1.9	3.0
Homosassa Spring Group	258.4	250.9	2.9	3.0
Gum Slough Springs[1]	95.3	89.3	6.3	9.0
Kings Bay Springs	465.5	455.4	2.2	Under Development
Rainbow Springs and River	649.3	632.6	2.6	Under Development

[1] The minimum flow for Gum Slough Springs is a staff recommendation and is not yet adopted.

Table 4-2. *Predicted changes in baseflow contribution to rivers from non-pumping to 2035 conditions based on the Northern District Groundwater Flow Model (Cardno-Entrix, 2014)*

River Segment	No Pumping Flow (cfs)	Predicted 2035 Flow (cfs)	2035 Percent Flow Change
Withlacoochee River at Croom	77.6	74.1	4.5
Withlacoochee River near Holder	315.2	282.7	10.3

1.1 Upper Floridan Aquifer Permitted/Unused Quantities

A number of public supply utilities in the planning region currently are not using their entire permitted allocation of groundwater. The District anticipates that these utilities will eventually grow into these unused quantities to meet future demand. Based on a review of the unused quantities of water associated with public supply water use permits, approximately 23.4 mgd of additional groundwater quantities are available to public supply utilities from the UFA. However, to ensure that environmental impacts from groundwater withdrawals are minimized, it is the District's intent that the 2035 demand that will be met by groundwater will be significantly reduced by maximizing the efficient use of reclaimed water and implementing conservation measures.

2.0 Lower Floridan Aquifer

In northeast Sumter County and portions of Marion County, the MCU II unit is absent and another confining unit is present in the Upper Avon Park Formation. This unit consists of a tight, dense, limestone and is referred to as middle confining unit 1 (MCU I) (Miller, 1986). The Avon Park Formation below MCU I contains fresh groundwater and is also referred to as the LFA. The base of the LFA lies over 2,000 feet below land surface near the top of the Cedar Keys Formation where gypsum mixes with dolomite and forms the bottom boundary of the Floridan aquifer system. MCU I and the LFA extend eastward from Sumter County into the St. Johns River Water Management District (SJRWMD).

The City of Wildwood and The Villages development in northeast Sumter County have explored the LFA below MCU I and found good quality groundwater that is highly productive. The Villages development utilizes nearly 10 mgd of water from the LFA for irrigation. The City of Wildwood is planning to use the LFA to meet some of their future demand. The City of Ocala and Marion County utilities have also completed exploratory drilling and testing of the LFA below MCU I. The degree of confinement of MCU I is variable, but recent testing at Wildwood has shown it to be relatively tight with little observed impact to the overlying UFA. If this verifies across the region, then LFA withdrawals could reduce a portion of future impact from the UFA, since they would have less effect on lakes, wetlands, rivers, and springs.

The recently completed water supply plan update for the Withlacoochee River Water Supply Authority anticipates additional quantities of 4.1 mgd from the LFA for the City of Wildwood and 8.2 mgd from the LFA available for Marion County by 2035 (WRWSA, 2014). Additional data collection from exploratory drilling and testing that is planned over the next five years along with refinement of regional groundwater flow models will further understanding of withdrawal impacts and ultimate quantities available from the LFA. In those areas where it is demonstrated that development of groundwater quantities from the LFA can be done without exceeding any established MFLs, and will otherwise avoid harm caused by withdrawals, such LFA quantities are designated as nontraditional sources. Demonstration of meeting these requirements must be done on a case-by-case basis.

Section 2. Water Conservation

1.0 Non-Agricultural Water Conservation

Non-Agricultural water conservation is defined as the beneficial reduction of loss, waste or other inefficient uses of water accomplished through the implementation of mandatory or voluntary best management practices (BMPs) that enhance the efficiency of both the production and distribution of potable water (supply-side measures) and indoor or outdoor water use (demand-side measures). The implementation of a comprehensive portfolio of conservation measures creates the benefits listed below.

- Infrastructure and Operating Costs. The conservation of water allows utilities to defer expensive expansions of potable water and wastewater systems while limiting operation and maintenance (O&M) costs at existing treatment plants, such as the use of electricity for pumping and treatment or expensive water treatment chemicals.
- Fiscal Responsibility. Most water conservation measures have a cost-effectiveness that is more affordable than that of other alternative water supply sources such as reclaimed water or desalination. Cost-effectiveness is defined as the cost of each measure compared to the amount of water expected to be conserved over the lifetime of the measure.
- Environmental Stewardship. Proper irrigation designs and practices, including the promotion of Florida-Friendly Landscaping™ (FFL), can provide natural habitat for native wildlife as well as reduce unnecessary runoff from properties into water bodies. This, in-turn, can reduce nonpoint-source pollution, particularly from operations that use fertilizers, pesticides or fungicides which, in turn, may hamper a local government's

overall strategy of dealing with total maximum daily load (TMDL) restrictions within their local water bodies or maintain spring water quality health.

Since the 1990s, the District provided financial and technical assistance to water users and suppliers in the planning region for the implementation of local and regional water conservation efforts. The District has a long history of successful water use reduction projects, which encourages water users to seek assistance by working with District staff when implementing water-saving and water conservation education programs.

Water savings have been achieved in the Northern Planning Region through a combination of regulatory, economic, incentive-based outreach, and technical assistance for the development and promotion of the most recent technologies and BMPs. Regulatory measures include water use permit conditions, year-round water restrictions and municipal codes and ordinances that require water-efficiency standards for new development and existing areas. For example, the National Energy Policy Act of 1992 requires that all new construction built after 1994 be equipped with low-flow plumbing fixtures. In Florida, Senate Bill 494, which took effect in July 2009, requires all automatic irrigation systems to use an automatic shutoff device. Senate Bill 2080 prohibits contractual and/or local government ordinance restrictions on the implementation of FFL. Periodically, water management districts (WMDs) in Florida issue water shortage orders that require short-term mandatory water conservation through situational BMPs and other practices.

Economic measures, such as inclining block rate structures, are designed to promote conservation and provide price signals to customers of public water supply systems to reduce inefficient use. Incentive programs include rebates, utility bill credits or giveaways of devices and fixtures that will replace older, less water-efficient models. Such equipment includes, but is not limited to, high-efficiency toilets, low-flow faucet aerators, low-flow showerheads and irrigation controllers such as rain sensors, soil moisture sensors, evapotranspiration controllers or tensiometers. Recognition programs, such as the District's Water CHAMP℠ and Florida Water Star℠ (FWS), are also incentive programs that recognize homeowners and businesses for their environmental stewardship.

The District performs leak detection surveys in an effort to reduce water loss.

The District's water loss reduction program provides guidance and technical expertise to public supply water utilities and helps identify and reduce water loss. The non-regulatory assistance and educational components of the program maximize water conservation throughout the public supply water use sector and improve both local utility system efficiency and regional water resource benefits. Among the services provided upon request are comprehensive leak detection surveys, meter accuracy testing and water audit guidance and evaluation. Since the program's inception, the leak detection team has conducted 104 comprehensive leak detection surveys throughout the District, locating 1,219 leaks of various sizes. This has resulted in an estimated 6.1 mgd of water savings. In the Northern Planning Region, the leak detection team has conducted 35 comprehensive leak detection surveys throughout the District, locating 453 leaks of various sizes. This has resulted in an estimated 2.6 mgd of water savings within the Region.

For the past five years, the District has administered the statewide FWS voluntary water conservation certification program for new and existing homes and commercial developments. Residences, businesses and communities can earn FWS certification through meeting efficiency standards in appliances, plumbing fixtures, irrigation systems and landscapes.

A single family home built to meet FWS criteria may use at least 40 percent less water outdoors and approximately 20 percent less water indoors than a home built to the current Florida Building Code. Local governments that adopt FWS criteria as their standard for new construction can expect greater long-term savings to occur than for similar structures build to conventional standards. In addition, FWS offers installation and best management practices training for landscapers and irrigation contractors, providing an opportunity for them to become FWS accredited professionals.

Education is an important element of a successful conservation program. While the actual quantity of water saved as a result of customer education is not measurable, the effort greatly increases the success of all other facets of a conservation program by raising customer awareness and changing attitudes regarding water use. Educating the public is a necessary facet of every water conservation program, and conservation education programs accompanied with other effective conservation measures can be an effective supplement of a long-term water conservation strategy. On a Districtwide scale, water conservation efforts have contributed to unadjusted gross per capita use rates declining since 2000 from 139 gpd per person to 98 gpd per person in 2010. The per capita use rate for the District is now the lowest of all five WMDs. The per capita trend for this planning region is shown in Figure 4-1.

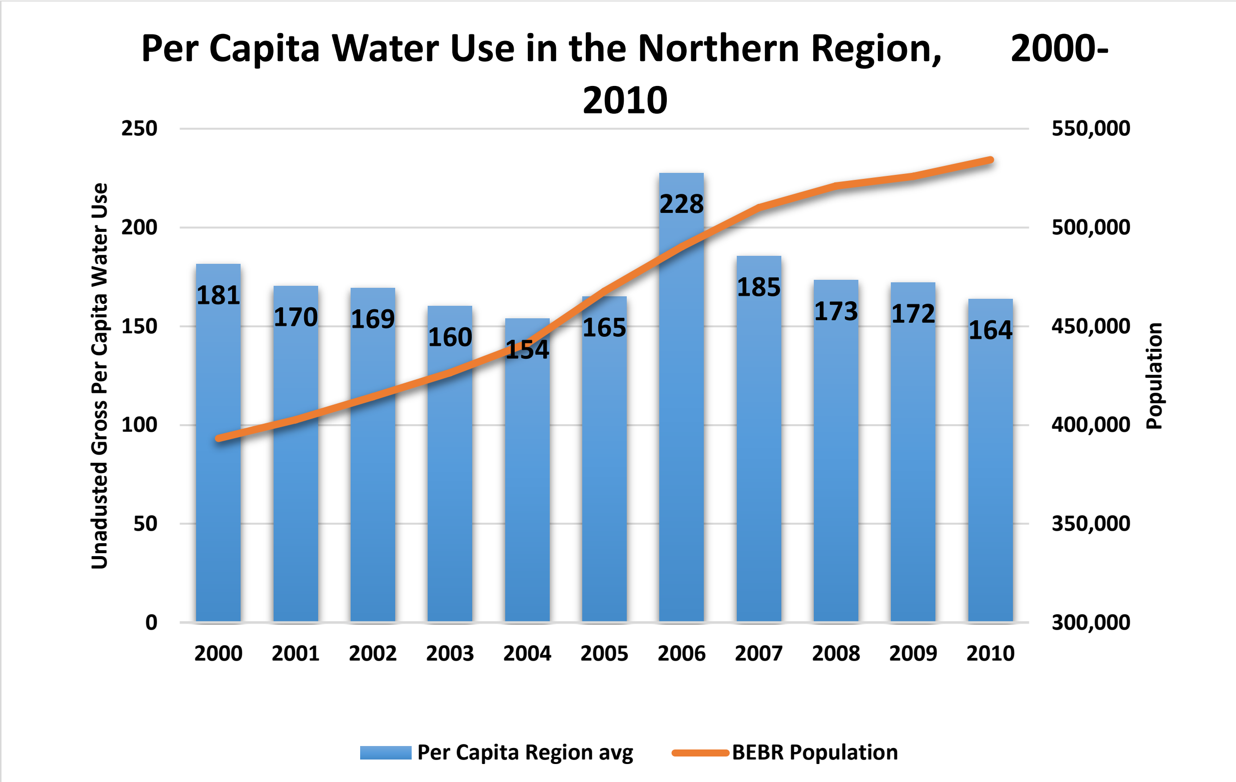


Figure 4-1. *Unadjusted per capita water use in the Northern Planning Region, 2000-2010*

1.1 Public Supply

The public supply category includes all water users that receive water from public water systems and private water utilities. The public supply category may include non-residential customers such as hospitals and restaurants that are connected to a utility potable distribution system. Water conservation in the public supply sector will continue to be the primary source of water savings in the District. Public supply systems lend themselves most easily to the administration of conservation programs, since they measure each water customer's water use and can focus, evaluate and adjust the program to maximize savings potential. The success of the District's water conservation programs for public supply systems to date is demonstrated by the 14.70 mgd in savings that has been achieved within the District since programs began in 1991. Within the Region, it is estimated that savings for the public supply category could be an additional 11.29 mgd by 2035, if all water conservation programs presented below are implemented (see Table 4-3).

1.1.1 Water Conservation Potential in the Northern Planning Region

A comprehensive assessment of public supply water conservation potential in the Withlacoochee Regional Water Supply Authority (WRWSA) four-county region was conducted for the planning period by the University of Florida's Conserve Florida Water Clearinghouse (CFWC). The CFWC completed the analysis using the EZGuide Online water conservation tool, which is a web-based model designed to estimate conservation potential for public supply utilities.

1.1.2 Assessment Methodology

The EZGuide water conservation model uses a variety of inputs to determine water savings, costs, and per capita use rates that could be achieved as a result of implementing water conservation BMPs and other measures at the utility-level. The model produces a customized output that is specific to the customer profile of the utility. Additional details on the EZGuide Online tool, including a full description of the input data used in the model, are available at the Conserve Florida website (www.conservefloridawater.org), and are also described in Appendix 4, Water Conservation Analysis for WRWSA.

Input parameters for 12 of the larger public utilities (benchmark utilities) in the WRWSA region were entered into the EZGuide model to perform a detailed assessment of their water conservation potential. The group of benchmark utilities included the cities of Belleview, Brooksville, Bushnell, Crystal River, Dunnellon, Inverness, Ocala, and Wildwood, Citrus, Hernando, and Marion county utilities, and The Villages. The benchmark utilities represented approximately 82 percent of the total public supply population within the WRWSA region in the year 2010. The model results for these twelve utilities were extrapolated to the remaining 33 utilities within the WRWSA region that used in excess of 0.1 mgd. The extrapolation was accomplished by matching the water-use profiles of customers of the benchmark utilities to the group of 33 utilities with similar customer bases. Each utility has a different water use profile with a slightly different breakout of single family residential, commercial, multi-family residential, and other water uses.

Since the WRWSA region includes all of Marion County, a significant portion of that demand is in the SJRWMD. In order to identify the conservation potential associated with the District's portion of Marion County, the potential was reduced proportionately to the difference in demands.

Levy and Lake Counties are part of the Northern Planning Region, but are not within the WRWSA region. In order to estimate conservation for Levy County, the benchmark water conservation potential documented in WRWSA Regional Water Supply Plan (RWSP) was applied, as a percentage, to the demands for Levy County. This provided a reasonable estimate of potential demand reduction for Levy County. For Lake County, the results of the Draft 2015 CFWI RWSP were incorporated.

1.1.3 Results

Three tiers of water conservation savings targets to achieve 5, 10 and 15 percent savings were developed as part of this effort. To achieve these levels of conservation, a series of BMPs, retrofit programs and other water savings measures was developed for each tier. Conservation measures to address each facet of residential and commercial water use were included in each of the three tiers of conservation targets. For example, in the single-family residential category, measures were included to address outdoor water use, showers, sinks, clothes washers and toilets. For each tier of conservation savings, the cost associated with each individual BMP or conservation measure generally increased commensurate with the water savings target.

If the proposed measures associated with each of the three tiers of water conservation savings were implemented, significant reductions in public water supply per capita water use would be realized in the WRWSA region. If the 5, 10 and 15 percent conservation targets were achieved by the year 2035, approximately 6.3, 13.0, and 20.2 mgd (respectively) of water could be saved in the public supply category in the WRWSA region. Achieving this level of conservation will entail large-scale deployment of the specific water conservation measures identified by the EZGuide model associated with each tier of conservation targets.

Based on the results of the Draft 2015 CFWI RWSP for Lake County (District), and by achieving a 10 percent conservation target in Citrus, Hernando, Marion (District), Sumter and Levy counties, approximately 11.29 mgd of water could be saved in the public supply sector of the Northern Planning Region.

1.1.4 Additional Considerations

Additional opportunities for public supply water conservation, beyond those estimated by the CFWC EZGuide Model discussed in the preceding section, exist within the WRWSA region. The most significant conservation opportunity is in the single-family residential outdoor water use sector, which currently accounts for an average of 33 percent of total public supply water use (approximately 33 mgd in the year 2010) in the WRWSA region. According to estimates developed by the CFWC, in some of the larger utility service areas in the WRWSA region, between 35 percent and 60 percent of water use is for lawn and landscape irrigation. The CFWC estimates that the average irrigable square footage of a single-family residential parcel in the WRWSA region is approximately 10,000 square feet, or slightly less than 0.25 acre. Converting to drought tolerant landscaping, practicing onsite rainwater harvesting and partially or fully replacing highly maintained lawns with more natural landscapes could greatly reduce or eliminate the need for irrigation at single family residences. These reductions could potentially save a significant percentage of the 33 mgd of potable water used for outdoor purposes in the WRWSA region.

1.2 Domestic Self-Supply (DSS)

The DSS sector includes individual private homes and businesses that are not utility customers and receive their domestic water supply from a well or from a surface supply for uses such as irrigation. DSS wells do not require a District water use permit, as the well diameters do not meet the District's requirement for a permit. DSS systems are not metered and, therefore, changes in water use patterns are less measurable than those that occur in the public supply sector. Conservation programs for DSS users can still be very successful, especially when outreach for the program is done in parallel with local public supply programs. Within the region, it is estimated that savings for the DSS sector could be 4.20 mgd by 2035, if all water conservation programs are implemented (see Table 4-3).

1.2.1 DSS Assessment Methodology

The water conservation potential for the DSS sector is assumed to be directly proportional to that of the residential part of public supply and its estimate is dependent on the calculation of public supply residential indoor and outdoor water conservation potential. This potential was derived from the WRWSA RWSP Update and the Draft 2015 CFWI RWSP for Lake County. After the aggregate estimate of residential indoor and outdoor water conservation was completed, the total amount of potential public supply residential water conservation was divided by the aggregate service area population to yield a residential per capita water conservation potential of 14.65 gallons per day. Lake County utilized the CFWI conservation per capita of 5.57. This public supply per capita water conservation estimate was then multiplied by the projected DSS population of 287,865 to get the DSS water conservation estimate of 4.20 mgd. This method was used in the Draft 2015 CFWI RWSP and has been publicly vetted on a regional scale.

1.3 Industrial/Commercial (I/C)

The I/C water use sector includes factories and other industrial enterprises that obtain water directly from surface water and/or groundwater sources through a water use permit. According to a survey sent to I/C permittees, water use efficiency improvements related to industrial processes have been implemented to a limited extent since 1999. Businesses try to minimize water use to reduce pumping, purchasing, treatment process and disposal costs. To date, the District has focused efforts on education, indoor and outdoor surveys and commercial applications, such as spray valves and low-flow toilets. The industrial processes being used in this category are unique, so opportunities for water savings are best identified through a site-specific assessment of water use at each (or a similar) facility. It is estimated that the savings for the I/C sector could be 0.92 mgd by 2035 (see Table 4-3).

1.3.1 I/C Assessment Methodology

The water conservation potential for Industrial/Commercial (I/C) supply is considered to be directly proportional to that of I/C customers served by public supply systems. It was not feasible for this analysis to evaluate the conservation potential of the many varied commercial and industrial processes. It is assumed that the consumptive use permitting process and business economics already drive commercial and industrial establishments to minimize their use of process water. This estimate is dependent on the calculation of public supply I/C water conservation potential, which was derived from the WRWSA RWSP Update and the Draft 2015 CFWI RWSP for Lake County. The aggregate estimate of publicly supplied I/C water conservation potential was obtained from these plans and the percentage of savings for that use type was applied to the 2035 projected demand for the I/C category (6.4 mgd X 14.4% = 0.92 mgd). Lake County did not have a projected 2035 demand for this use type, therefore, did not have a projected savings potential. This methodology focuses on the domestic indoor uses associated with I/C facilities and does not account for potential savings of commercial and industrial process water. This method was used in the Draft 2015 CFWI RWSP and has been publicly vetted on a regional scale.

1.4 Landscape/Recreation (L/R)

The L/R water use sector includes golf courses and large landscapes (e.g., cemeteries, parks and playgrounds) that obtain water directly from groundwater and surface water sources rather than from a public supply system. It is acknowledged that some amount of water savings has been achieved in this sector through the use of efficient irrigation practices and technology. Within the regin, it is estimated that the savings for the L/R water use sector could be 1.83 mgd by 2035 (see Table 4-3).

1.4.1 L/R Assessment Methodology

The estimate of water conservation potential of this sector was derived from the percentage of water conservation estimated by the WRWSA RWSP Update and the Draft 2015 CFWI RWSP for Lake County for publically supplied outdoors water use. Savings were based on the soil moisture sensor and irrigation audit BMPs. The percentage of savings for that use type (outdoor use) was applied to the 2035 projected demand for the L/R sector (22.71 mgd X 8.1% = 1.83 mgd). Lake County did not have a projected 2035 demand for this use type, therefore, it did not have a projected savings potential. This method was used in the Draft 2015 CFWI RWSP and has been publicly vetted on a regional scale.

1.5 Summary of the Potential Water Savings from Non-Agricultural Water Conservation

Through the implementation of all conservation measures listed above for the public supply, DSS, I/C and L/R water use sectors, it is anticipated that approximately 18.24 mgd could be saved in the planning region by 2035, at a total projected cost of $50.94 million.

Table 4-3. *Potential non-agricultural water conservation savings in the Northern Planning Region*

Use Sector	2035 Demand	Water Conserved in 2035 (mgd)	Percent Reduction	Average Cost-Effectiveness ($/1,000 gal.)
Public Supply*	103.9	11.29	10.9%	$0.67
DSS	36.28	4.20	11.6%	$0.68
I/C	6.40	0.92	14.4%	$0.68
L/R	22.71	1.83	8.1%	$1.57
Total	**169.29**	**18.24**	**10.7%**	**$0.78**

*Public Supply 2035 demands based on WRWSA plan

2.0 Agricultural Water Conservation

To estimate the quantity of water that could potentially be saved through agricultural water conservation, the District used the “model” farms concept. The model farms concept is a quantification tool to determine the potential for water savings for various scenarios of irrigation system conversions and/or BMPs that are specific to a number of different agricultural commodities and associated water use factors such as soil type, climate conditions, crop type, etc. The District also achieves agricultural water savings through the Facilitating Agricultural Resource Management Systems (FARMS) Program. The FARMS Program is categorized as water resource development (WRD) and, therefore, water savings achieved through the program are assigned to WRD quantities, rather than to water conservation. Additional information on the FARMS Program is provided in Chapter 7.

There are 20 model farm options available with different best management/irrigation system modifications applied to the existing farms. It is recognized that the model design parameters and case study results may not be directly transferable to all operations within a given commodity category. The model farm case studies should be viewed as a standard basis for comparison of cost analyses and for estimation of water savings. An additional benefit of the model farms data is that it is used to determine whether specific elements of projects implemented as part of the FARMS Program are cost-effective. The District reviewed 20 model farm options and selected three as being the most applicable in the planning region. The three model farm options selected represent BMPs for irrigation of citrus, nurseries and other vegetables/row crops (HSW, 2004).

Sprinkler-type systems are typically used for container nurseries, field crops and sod farms. Drip systems are steadily increasing in popularity, particularly for row crops grown using plastic film mulch. Drip systems are also used in conjunction with a seepage system used for bed preparation and crop establishment. Microjet systems are the most common system used for citrus. Since supplemental irrigation for citrus exceeds all other agricultural quantities combined, more water is delivered by microjet systems than from all other systems. Surface irrigation, which includes semi-closed systems, is the most common type of irrigation for non-citrus crops in Florida.

For the three model farm options selected for the planning region, the costs per acre required to convert to a more efficient irrigation system and the cost to implement BMPs were estimated based on publicly available data and information and interviews with local irrigation system and farm management providers. The potential savings associated with each of the model farm scenarios is included in Tables 4-4 and 4-5. The data in these tables represent the maximum potential savings, if all growers were to install the most efficient irrigation systems and implement appropriate BMPs for their respective commodities.

Table 4-4. *Model farm potential water savings (5-in-10)*

Description of Model Farm/ Irrigation System/BMPs Scenario				Water Savings (mgd)						
Model Farm Scenario ID	Crop	Existing Irrigation System	Irrigation System Conversion	2005	2010	2015	2020	2025	2030	Assumptions
1	Citrus – flatwoods[1]	Microjet	No, other BMPs only	0.32	0.29	0.23	0.23	0.23	0.23	100 percent implementation, maximum improvement
8	Nurseries – container	Sprinkler	Line source emitter and other BMPs	0.6	2.1	2.2	2.3	2.3	2.4	100 percent implementation, maximum improvement
12	Other vegetables and row crops	Semi-closed seepage	Fully-enclosed seepage and other BMPs	1.8	2.3	2.4	2.4	2.4	2.5	100 percent implementation, 50 percent maximum improvement

[1] Citrus model farm potential water savings were adjusted to be consistent with latest demand projections.
– Model Farm Scenario 1 (Citrus flatwoods): Existing microjet irrigation system is sufficient and no irrigation system conversion is required. Implement other BMPs only to achieve water savings. Model Farm Scenario 8 (Container nurseries): Replace existing sprinkler irrigation with line source emitters (also commonly known as “spaghetti tubing”) irrigation system and implement other BMPs to achieve water savings.
– Model Farm Scenario 11 (Other vegetables and row crops): Existing, semi-closed seepage systems are sufficient and no irrigation system conversion is required. Implement other BMPs only to achieve savings. The data in this table can be viewed as the maximum potential savings if all growers were to install the most efficient irrigation systems and implement appropriate BMPs. Source: SWFWMD (2008a), Hazen and Sawyer (2009).

Table 4-5. *Model farm potential water savings (1-in-10)*

Description of Model Farm/ Irrigation System/BMPs Scenario				Water Savings (mgd)						
Model Farm Scenario ID	Crop	Existing Irrigation System	Irrigation System Conversion	2005	2010	2015	2020	2025	2030	Assumptions
1	Citrus – flatwoods[1]	Microjet	No, other BMPs only	0.68	0.61	0.52	0.52	0.52	0.52	100 percent implementation, maximum improvement
8	Nurseries - Container	Sprinkler	Line source emitter and other BMPs	0.67	0.81	0.96	1.12	1.27	1.36	100 percent implementation, maximum improvement
12	Other vegetables and row crops	Semi-closed seepage	Fully-enclosed seepage and other BMPs	0.41	0.40	0.40	0.40	0.40	0.40	100 percent implementation, 50 percent maximum improvement

[1] Citrus model farm potential water savings were adjusted to be consistent with latest demand projections.
– Model Farm Scenario 1 (Citrus flatwoods): Existing microjet irrigation system is sufficient and no irrigation system conversion is required. Implement other BMPs only to achieve water savings. Model Farm Scenario 8 (Container nurseries): Replace existing sprinkler irrigation with line source emitters (also commonly known as “spaghetti tubing”) irrigation system and implement other BMPs to achieve water savings.
- Model Farm Scenario 11 (Other vegetables and row crops): Existing, semi-closed seepage systems are sufficient and no irrigation system conversion is required. Implement other BMPs only to achieve savings. The data in this table can be viewed as the maximum potential savings if all growers were to install the most efficient irrigation systems and implement appropriate BMPs. Source: SWFWMD (2008a), Hazen and Sawyer (2009).

2.1 Potential Agricultural Water Conservation Savings

Table 4-6 shows that the potential for agricultural water savings for all commodities is 5.3 mgd through 2035 for the 5-in-10 condition. Citrus, field crops and nurseries are shown individually and the remaining commodities are summarized together.

Table 4-6. *Summary of potential agricultural water conservation savings by commodity (5-in-10) for the Northern Planning Region through 2030*

Commodity	Total Estimated Savings (mgd)[1]	Total Cost ($/acre)[2]
Citrus	0.33	$105
Field Crops	2.41	$1,800
Nursery	0.72	$486
Other	1.85	$100
Total	5.30	

[1] Based on 100 percent participation.
[2] Capital plus O&M cost, per planted acre for the first year of irrigation conversion. The total cost/acre for conversion to a more efficient system assumes the main and sub-main line installations are not included in cost estimation because it is assumed that the line would already exist in the previous system.

Section 3. Reclaimed Water

Reclaimed water is defined by the Florida Department of Environmental Protection (DEP) as water that is beneficially reused after being treated to at least secondary wastewater treatment standards by a domestic wastewater treatment plant (WWTP). Reclaimed water can be used to accomplish a number of goals, including decreasing reliance on potable water supplies, increasing groundwater recharge and restoring natural systems. Figure 4-2 illustrates the reclaimed water infrastructure, utilization and availability of reclaimed water within the District in 2010, as well as planned utilization that is anticipated to occur by 2020 as a result of funded projects.

The Villages development in Sumter County has one of the largest reclaimed water systems in the planning region. In 2010, customers within The Villages utilized an average daily flow of more than 4 mgd of reclaimed water for golf course and other public access irrigation use. Existing and funded projects are expected to result in reclaimed water increases of 4.9 mgd, bringing utilization within the planning region to approximately 14 mgd by 2020. Appendix 4-1 contains anticipated 2020 reclaimed water utilization.

The benefit that can be obtained from the use of reclaimed water is governed by the concepts of utilization and water resource benefit. Utilization is the percent of treated wastewater from a WWTP that is utilized in a reclaimed water system. The utilization rate of a reclaimed water system varies by utility. Typically, only 50 to 70 percent of treated wastewater flows go to reclaimed water customers. The highest utilization rates occur in utilities in urban areas where large industries and numerous residential customers can be supplied. Utilization is also limited by seasonal supply and storage. A utility cannot expand its reuse system beyond peak flow demand, which occurs during dry periods when demand is highest, without experiencing shortages. For example, a reclaimed water system with a 1 mgd flow normally is limited to supplying 0.5 mgd (50 percent utilization) on a yearly basis. This is because during the dry season, demand for reclaimed water for irrigation can more than double.

The six main options to increase utilization beyond 50 percent include seasonal storage, system interconnects, an interruptible customer base, environmental enhancement/recharge, potable reuse, and supplementing reclaimed water supplies with other sources.

Seasonal storage is the storage of excess reclaimed water in surface reservoirs or aquifer storage and recovery (ASR) systems during the wet season when demand is low. This stored reclaimed water can be used to augment daily reclaimed water flows to meet peak demand in the dry season.

System interconnects involve the transfer of reclaimed water from areas of excess supply to areas of high demand. This transferred reclaimed water can be used to augment daily reclaimed water flows to meet peak demand in the dry season.

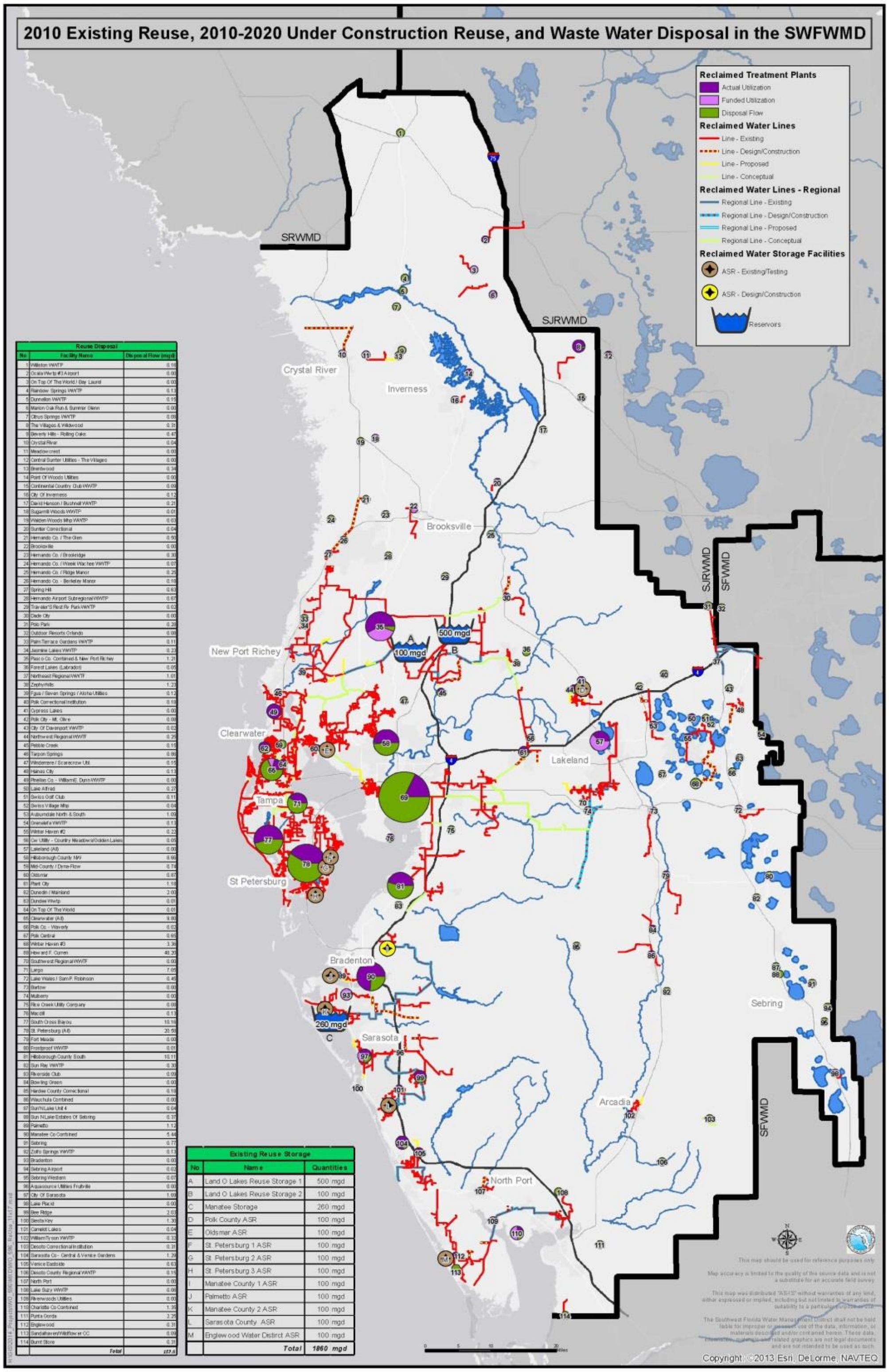
An interruptible customer base is where a utility has golf course, recreational, commercial, agricultural, industrial, and other bulk customers that have multiple sources of irrigation or process water. Reclaimed water is supplied to these customers during certain times of the day and during certain seasons, but they may be requested to go "off line" and switch to backup sources during peak demand times or seasons. This enables a utility to develop a much larger customer base and maximize the utilization of reclaimed water, while avoiding the negative consequences of running out of reclaimed water during peak irrigation times/seasons.

Environmental enhancement and recharge involves using excess reclaimed water to enhance wetland habitat, meet minimum flows and levels or recharge the UFA to achieve water resource benefits. Potable reuse involves purifying reclaimed water to a quality for it to be used as a raw water source for potable supplies.

Supplementing reclaimed water supplies with other water sources, such as stormwater and groundwater for short periods to meet peak demand, enables systems to serve a larger customer base.

Water resource benefit is the amount of potable-quality groundwater or surface water that is replaced by reclaimed water usage or the amount of reclaimed water used for environmental enhancement. Customers tend to use more reclaimed water than potable water because reclaimed water is generally less expensive and not as restricted as potable water. For example, a single-family residence with an inground irrigation system connected to potable water uses approximately 300 gpd for irrigation. However, if the same single-family residence converts to an unmetered, flat-rate, reclaimed water irrigation supply without day-of-week restrictions, it will use approximately two and one-half times this amount (804 gpd). In this example, the benefit rate would be 37 percent (300 gpd offset for 804 gpd reclaimed water utilization). Different types of reclaimed water uses have different benefit potentials. For example, a power station or industry using one mgd of potable water for cooling or process water will, after converting to reclaimed water, normally use approximately the same quantity. In this example, the benefit rate would be 100 percent. Most reclaimed water utilities provide service to a wide variety of customers and, as a result, the average reclaimed water benefit rate is estimated to be 65 percent. The District is actively cooperating with utilities to help identify ways to increase reclaimed water utilization and benefit. For example, efficiency can be further enhanced with practices such as individual metering coupled with water-conserving rates, efficient irrigation design and irrigation restrictions.

The District's goal is to achieve 70 percent utilization of all wastewater treatment plant flows and 70 percent benefit efficiency of all reclaimed water used by 2035. This goal is intended to reduce the overuse of reclaimed water and increase potable and groundwater benefits. Opportunities may exist for utilization and benefits to be even greater in some cases by utilizing methods such as customer base selection (i.e., large industrial), project type selection (i.e., recharge) and implementation of developing technologies.



Reuse Disposal		
No	Facility Name	Disposal Flow (mgd)
1	Williston WWTP	0.16
2	Ocala Wwtp #3 Airport	0.00
3	On Top Of The World / Bay Laurel	0.00
4	Rainbow Springs WWTP	0.13
5	Dunnellon WWTP	0.15
6	Marion Oak Run & Summer Glenn	0.00
7	Citrus Springs WWTP	0.08
8	The Villages & Wildwood	0.31
9	Beverly Hills - Rolling Oaks	0.47
10	Crystal River	0.04
11	Meadowcrest	0.00
12	Central Sumter Utilities - The Villages	0.00
13	Brentwood	0.34
14	Point Of Woods Utilities	0.00
15	Continental Country Club WWTP	0.09
16	City Of Inverness	0.12
17	David Hanson / Bushnell WWTP	0.21
18	Sugarmill Woods WWTP	0.01
19	Walden Woods Mhp WWTP	0.03
20	Sumter Correctional	0.04
21	Hernando Co. / The Glen	0.50
22	Brooksville	0.00
23	Hernando Co. / Brookridge	0.30
24	Hernando Co. / Weeki Wachee WWTP	0.07
25	Hernando Co. / Ridge Manor	0.25
26	Hernando Co. - Berkeley Manor	0.18
27	Spring Hill	0.63
28	Hernando Airport Subregional WWTP	0.67
29	Traveler'S Rest Rv Park WWTP	0.02
30	Dade City	0.00
31	Polo Park	0.28
32	Outdoor Resorts Orlando	0.08
33	Palm Terrace Gardens WWTP	0.11
34	Jasmine Lakes WWTP	0.23
35	Pasco Co. Combined & New Port Richey	1.21
36	Forest Lakes (Labrador)	0.05
37	Northeast Regional WWTF	1.01
38	Zephyrhills	1.23
39	Fgua / Seven Springs / Aloha Utilities	0.12
40	Polk Correctional Institution	0.19
41	Cypress Lakes	0.00
42	Polk City - Mt. Olive	0.08
43	City Of Davenport WWTP	0.02
44	Northwest Regional WWTF	0.25
45	Pebble Creek	0.15
46	Tarpon Springs	0.86
47	Windemere / Scarecrow Utl.	0.15
48	Haines City	0.13
49	Pinellas Co. - William E. Dunn WWTP	0.00
50	Lake Alfred	0.27
51	Swiss Golf Club	0.11
52	Swiss Village Mhp	0.04
53	Auburndale North & South	1.09
54	Grenelefe WWTP	0.13
55	Winter Haven #2	0.22
56	Cw Utility - Country Meadows/Golden Lakes	0.05
57	Lakeland (All)	0.00
58	Hillsborough County NW	8.66
59	Mid-County / Dyna-Flow	0.74
60	Oldsmar	0.87
61	Plant City	1.18
62	Dunedin / Mainland	2.00
63	Dundee Wwtp	0.01
64	On Top Of The World	0.01
65	Clearwater (All)	9.80
66	Polk Co. - Waverly	0.02
67	Polk Central	0.65
68	Winter Haven #3	3.38
69	Howard F. Curren	48.20
70	Southwest Regional WWTF	0.00
71	Largo	7.05
72	Lake Wales / Sam P. Robinson	0.45
73	Bartow	0.00
74	Mulberry	0.00
75	Rice Creek Utility Company	0.08
76	Macdill	0.13
77	South Cross Bayou	10.16
78	St. Petersburg (All)	20.58
79	Fort Meade	0.00
80	Frostproof WWTP	0.01
81	Hillsborough County South	10.11
82	Sun Ray WWTP	0.30
83	Riverside Club	0.09
84	Bowling Green	0.00
85	Hardee County Correctional	0.18
86	Wauchula Combined	0.00
87	Sun'N Lake Unit 4	0.04
88	Sun N Lake Estates Of Sebring	0.37
89	Palmetto	1.12
90	Manatee Co Combined	5.44
91	Sebring	0.77
92	Zolfo Springs WWTP	0.13
93	Bradenton	0.00
94	Sebring Airport	0.02
95	Sebring Western	0.07
96	Aquasource Utilities Fruitville	0.00
97	City Of Sarasota	1.69
98	Lake Placid	0.00
99	Bee Ridge	2.03
100	Siesta Key	1.30
101	Camelot Lakes	0.04
102	William Tyson WWTP	0.32
103	Desoto Correctional Institution	0.31
104	Sarasota Co - Central & Venice Gardens	1.29
105	Venice Eastside	0.63
106	Desoto County Regional WWTP	0.15
107	North Port	0.00
108	Lake Suzy WWTP	0.08
109	Riverwoods Utilities	0.00
110	Charlotte Co Combined	1.35
111	Punta Gorda	2.25
112	Englewood	0.31
113	Sandalhaven/Wildflower CC	0.09
114	Burnt Store	0.31
	Total	157.6

Existing Reuse Storage		
No	Name	Quantities
A	Land O Lakes Reuse Storage 1	500 mgd
B	Land O Lakes Reuse Storage 2	100 mgd
C	Manatee Storage	260 mgd
D	Polk County ASR	100 mgd
E	Oldsmar ASR	100 mgd
F	St. Petersburg 1 ASR	100 mgd
G	St. Petersburg 2 ASR	100 mgd
H	St. Petersburg 3 ASR	100 mgd
I	Manatee County 1 ASR	100 mgd
J	Palmetto ASR	100 mgd
K	Manatee County 2 ASR	100 mgd
L	Sarasota County ASR	100 mgd
M	Englewood Water District ASR	100 mgd
	Total	1860 mgd

Figure 4-2. *Districtwide reclaimed water map*
To download this map, visit http://www.swfwmd.state.fl.us/conservation/reclaimed/

1.0 Potential for Water Supply from Reclaimed Water

Table 4-7 provides information on the current and future availability of reclaimed water in the planning region and the potential to achieve potable-quality water benefits through 2035. In 2010, there were 32 WWTPs in Levy, Citrus, Sumter, Marion, Hernando and Lake counties, collectively producing 16.84 mgd of wastewater. Of that quantity, 9 mgd was used resulting in 6.7 mgd of benefits to traditional water supplies. Therefore, only approximately 54 percent of the available reclaimed waste water produced in the region was provided to customers for irrigation, industrial cooling or other beneficial purposes. By 2035, it is expected that more than 70 percent of reclaimed water available in the planning region will be used. It is further expected that efficiency of use will be close to 70 percent through a combination of measures such as customer selection metering, volume-based rates and education. As a result, by 2035, it is estimated that 23.78 mgd (more than 70 percent) of the 30.17 mgd of wastewater treated will be beneficially used. This will result in approximately 16.8 mgd of benefits, of which 10.6 mgd is post-2010 benefits (70 percent efficiency).

Table 4-7. *2010 actual versus 2035 potential reclaimed water availability, utilization and benefit (mgd) in the Northern Planning Region*

County	2010 Availability, Utilization and Benefit[1]				2035 Potential Availability, Utilization and Benefit[2]			
	Number of WWTPs in 2010	WWTP Flow in 2010	Utilization in 2010	Potable-Quality Water Benefit in 2010 (74%)	2035 Total WWTP Flow	2035 Utilization (70%)[3]	2035 Potable-Quality Water Benefit(70 %)[3]	2010 – 2035 Benefit
Levy	1	0.16	0.00	0.00	0.19	0.13	0.09	0.09
Citrus	9	3.21	0.02	0.01	5.60	4.19	3.17	3.17
Sumter	7	4.91	4.26	3.15	9.38	7.12	4.89	2.00
Marion	7	3.83	2.63	1.95	7.30	6.54	4.58	2.81
Hernando	8	4.73	2.13	1.57	7.70	5.80	4.06	2.57
Lake	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**32**	**16.84**	**9.04**	**6.69**	**30.17**	**23.78**	**16.79**	**10.64**

[1] Estimated at 74 percent Regionwide average.
[2] See Table 4-1 in Appendix 4.
[3] Unless otherwise noted.

Section 4. Surface Water

The Withlacoochee River is the only major river system in the planning region. When established, MFLs will ultimately constrain the potential yield of the Withlacoochee River for water supply.

1.0 Criteria for Determining Potential Water Availability

Since the MFL for the Withlacoochee River has not yet been established, the available yield was calculated using a planning-level minimum flow criteria. The five-step process used to estimate potential surface water availability includes: (1) estimation of unimpacted flow, (2) selection of the analysis period, (3) application of minimum flow or planning level criteria, (4) consideration of existing legal users and (5) application of engineering limitations. The amount of water that can be developed in the future will depend on adopted minimum flows and the permitting process. A complete description of this process is included in the Chapter 4 Appendix 4-2.

2.0 Overview of the Withlacoochee River System

The Withlacoochee River watershed covers approximately 2,100 square miles. The river originates in the Green Swamp in Polk County and flows northward for 157 miles where it discharges into the Gulf of Mexico near Yankeetown, Florida. In 1989, the river and its connected lakes and tributaries were designated an Outstanding Florida Water (OFW). Within the Green Swamp near Highway 98, where the Withlacoochee River is close to the headwaters of the Hillsborough River, a low, natural saddle separates the two watersheds. The Withlacoochee River can discharge to the Hillsborough River during high flows, but overflow seldom occurs.

The upper reaches of the Withlacoochee River in the Green Swamp consist mostly of agricultural lands and wetlands. The river corridor is more developed near Dade City in Pasco County but, for the most part, it remains relatively rural in character. From the Lake Tsala Apopka area downstream to Dunnellon, isolated areas of development are present, but much of the landscape is wilderness or rural. The main tributaries to the Withlacoochee River are Pony, Grass and Jumper creeks, Gator Hole and Gum sloughs, and the Little Withlacoochee, Panasoffkee Outlet, and Rainbow rivers. Several springs flow into the river, including Dobes Hole, Riverdale, Nichols, Gum Slough, Wilson Head, Blue, and Rainbow. There are several control structures that affect flow in the Withlacoochee River, including the Inglis Dam at Lake Rousseau, structures between Lake Tsala Apopka and the river, and the Wysong-Coogler Dam located two miles downstream from the mouth of the Panasoffkee Outlet River.

Panasoffkee Outlet River

West of Lake Rousseau, the Withlacoochee River flows to the Gulf of Mexico where it discharges into the Withlacoochee Bay estuary. From Inglis to the Gulf, the river has been greatly altered by the construction of a lock, dam and bypass canal. Construction of the Cross Florida Barge Canal changed the hydrologic regime of the lower portion of the Withlacoochee River. The barge canal limits the high flow conditions historically experienced by the estuary, with an overall reduction to long-term average flows.

The Withlacoochee River is generally a gaining stream with increasing groundwater discharge in the downstream direction (Trommer et al., 2009). It was estimated that, during the period from October 2003 to March 2007, approximately 40 percent of the total river flow at Holder was from groundwater seepage, 30 percent was from tributary flow and 30 percent was from spring flow.

The WRWSA, in cooperation with the District, completed an update to their RWSP estimating the availability of surface water from the Withlacoochee River by applying a “proposed minimum flow” (Cardno Entrix, 2014). The WRWSA used a proposed minimum flow because the District had not yet established a minimum flow for the river. The proposed minimum flow was developed using data from the Croom and Holder USGS gaging stations where the available flow record is most comprehensive. This study did not include development of a threshold for the lower Withlacoochee River, since it has been significantly altered by construction of the Inglis Dam and the Cross Florida Barge Canal. The most downstream point included in the WRWSA study was Holder, which excludes flow from the Rainbow River located further downstream. Because the Rainbow River was not included in the WRWSA study, it was not used to calculate surface water availability in this RWSP.

The District applied planning level minimum flow criteria to flow data obtained from the USGS gage near Holder to make the calculation. Flows from the Rainbow River at Dunnellon were added to the flows near Holder to account for the Rainbow River’s contribution to the Withlacoochee River. Once minimum flows are established for the Withlacoochee River, water supply availability estimates will be refined. The average annual discharge at the gage near Holder plus the discharge from the Rainbow River at the Dunnellon gage is 948 mgd (1,466 cfs) for the period 1965–2013. Permitted annual average withdrawals from the Withlacoochee and Rainbow rivers are 0.535 mgd and 0.003 mgd, respectively. Actual average annual diversions from the Withlacoochee and Rainbow rivers were not included in the surface water availability estimate, because they are negligible. Based on the planning level minimum flow criteria, an additional 88 mgd of water supply is potentially available from the Withlacoochee River.

3.0 Potential for Water Supply from Surface Water

Table 4-8 summarizes potential surface water availability from the Withlacoochee River. The estimated additional surface water that could potentially be obtained from the Withlacoochee River in the planning region ranges from approximately 0.54 mgd to 88.5 mgd. The lower end of the range is the amount of surface water that has been permitted, but is currently unused, and the upper end includes permitted but unused quantities plus the estimated remaining available surface water (88 mgd). Additional factors that could affect the quantities of water that are ultimately developed for water supply include the future establishment of minimum flows, variation in discharges to the river from outside sources, changes in groundwater pumping as more permits are issued, and the ability to develop sufficient storage capacity.

Withlacoochee River

Table 4-8. *Summary of current withdrawals and potential availability of water from the Withlacoochee River in the Northern Planning Region (mgd) based on planning-level minimum flow criteria*

Water Body	In-stream Impoundment	Adjusted Annual Average Flow[1]	Potentially Available Flow Prior to Withdrawal[2]	Permitted Average Withdrawal Limits[3]	Current Withdrawal[4]	Unpermitted Potentially Available Withdrawals[6]	Days/Year New Water Available[5]		
							Avg	Min	Max
Withlacoochee River near Holder plus Rainbow River at Dunnellon	Yes	948	94.8	0.54	Negligible	88	310	17	366
Total			**94.8**	**0.54**		**88**			

[1] Mean flow based on recorded USGS flow. Period of record used is 1965–2013.
[2] Based on 10 percent of mean flow.
[3] Based on individual WUP permit conditions, which may or may not follow current 10 percent diversion limitation guidelines.
[4] Equal to remainder of 10 percent of total flow after permitted uses allocated, with minimum flow cutoff for new withdrawals of P85 and maximum system diversion capacity of twice median flow (P50).
[5] Based on estimated number of days that any additional withdrawal is available considering current permitted quantities and withdrawal restrictions. The minimum and maximum are the estimated range of days that additional withdrawals would have been available in any particular year.
[6] Unpermitted potentially available withdrawals from the Withlacoochee Regional Water Supply Authority study (Cardno-Entrix., 2014) were not used because the analysis did not include flows available from the Rainbow River tributary.

Section 5. Brackish Groundwater Desalination

Brackish groundwater is found in the District along coastal areas in the UFA as a depth-variable transition between fresh and saline waters. Figure 4-3 depicts the generalized location of the freshwater/saltwater interface (as defined by the 1,000 mg/L isochlor) in the Avon Park high production zone of the UFA in the southern and central portions of the District. Brackish groundwater is also found in the LFA below MCU II. Data collected by the District's exploratory well drilling program indicates that brackish groundwater from the LFA could be a viable water supply for areas outside the immediate coastal zone. Additional data collection is planned by the District to assess the water supply potential of the LFA in greater detail.

Brackish groundwater is defined as having impurity concentrations greater than drinking water standards (i.e., total dissolved solids (TDS) concentration greater than 500 mg/L), but less than seawater (SWFWMD 2001). Seawater has a TDS concentration of 35,000 mg/L. Water supply facilities that utilize brackish groundwater typically use source water that slightly or moderately exceeds potable water standards. Water with TDS values less than 6,000 mg/L is preferable for treatment due to recovery efficiency and energy costs. Brackish groundwater desalination is a more expensive source of water than traditional sources, and utilities and industries have used brackish groundwater only when less expensive sources are unavailable. However, improvements in technology have substantially reduced operating costs for newer systems.

The predominant treatment technology for brackish groundwater is medium or low-pressure reverse osmosis (RO) membranes. TDS concentrations greater than approximately 10,000 mg/L typically require high-pressure RO membranes that are more costly to operate. This water quality threshold generally distinguishes the upper limit of brackish groundwater source feasibility. Most treatment facilities reduce operating costs by blending RO permeate with lower quality raw water. Some utilities supplement their surface water treatment with a portion of high quality RO treated groundwater to reduce the TDS levels of finished water. Having the option to blend RO permeate with other existing sources improves the overall quality and reliability of the facility.

Depending on the TDS concentration of raw water, 15 to 50 percent of the water used in the RO process becomes concentrate that must be disposed of through methods that may include surface water discharge, deep-well injection or dilution at a WWTP. Surface water discharges require a National Pollutant Discharge Elimination System (NPDES) permit and may be restrained by TMDL limitations. In some cases, RO facilities have been required to run below their potential efficiencies to reduce the strength of the concentrate. Because of these environmental considerations, deep-well injection is becoming more prevalent. The use of deep-well injection may not be permittable in some areas, due to unsuitable geologic conditions. An additional disposal option that may be viable in the future is zero liquid discharge (ZLD). ZLD is the treatment of concentrate for a second round of high-recovery desalination, then crystallization or dehydration of the remaining brine. The resulting solids may have economic value since there is potential to use it in various industrial processes. This technology provides a concentrate disposal option for situations where other methods are not environmentally feasible, although the costs of ZLD disposal can be prohibitively high.

The Florida Legislature declared brackish groundwater an alternative water source in 2005 (Senate Bill 444). However, it remains a groundwater withdrawal and must occur in a manner that is consistent with applicable rules, regulations, and water use management strategies of the District. Factors affecting the development of supplies include the hydraulic properties and water quality of the aquifer, rates of groundwater withdrawal, and well configurations. The District revised its Cooperative Funding Initiative Policy in December 2007, which previously restricted any funding for the construction of projects that develop groundwater. Since then, the District has assisted with the construction of four brackish groundwater treatment projects. The funding is intended to incentivize the development of integrated, robust, multi-jurisdictional water supply systems that are reliable, sustainable, and utilize diverse water sources. A phased approach to brackish groundwater project development is recommended that includes hydrogeologic evaluations to determine project viability, design phases that help refine the economic and permitting feasibility, and construction procured through a competitive bidding process.

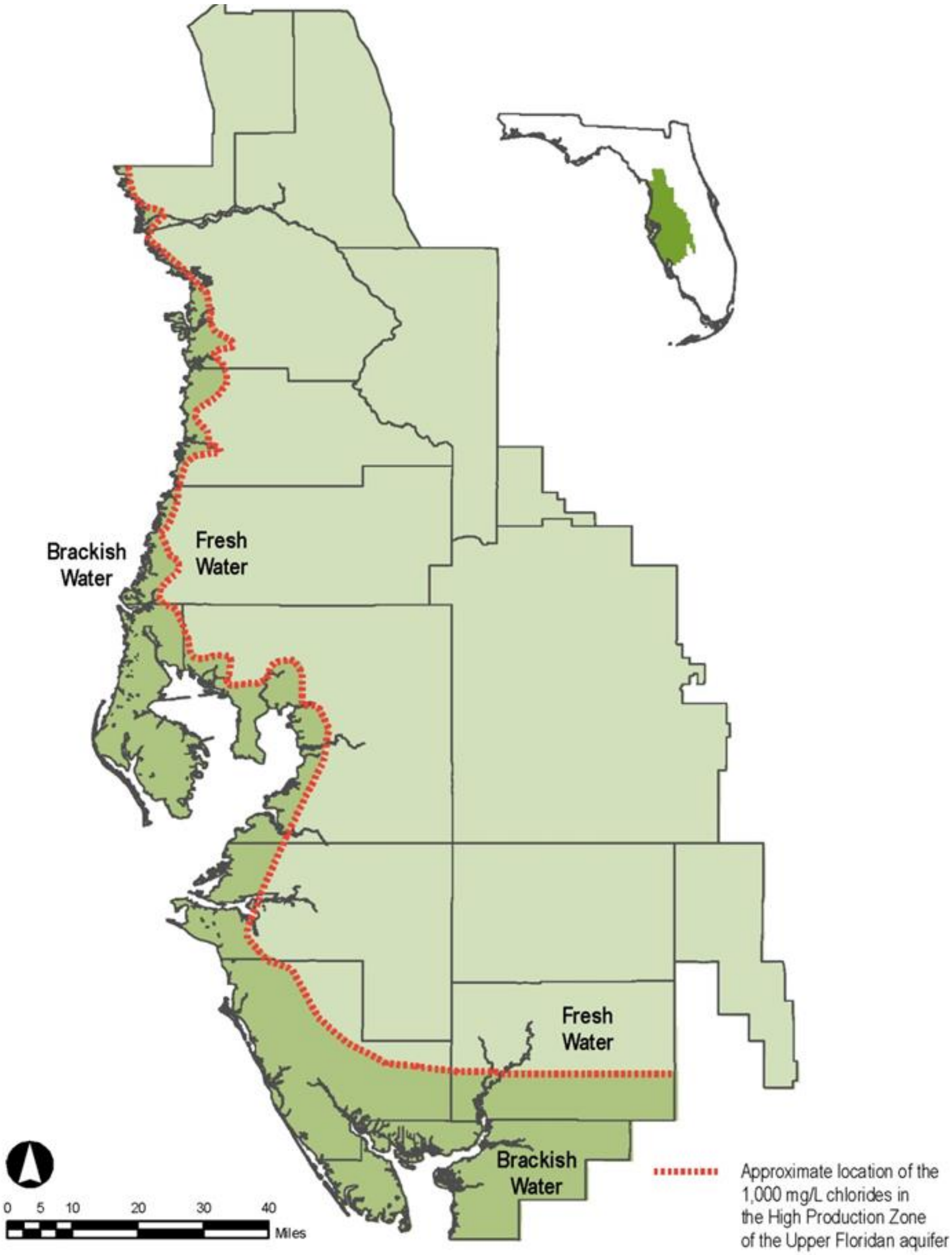


Figure 4-3. *Generalized location of the freshwater/saltwater interface in the District*

1.0 Potential for Water Supply from Brackish Groundwater

In the coastal portions of the planning region, salt water is close to the surface and exists as a wedge beneath a relatively thin freshwater lens in the UFA. This, combined with the fact that the UFA in these areas is unconfined and highly transmissive, results in a very significant potential for induced saltwater intrusion from brackish groundwater withdrawals. Extensive analysis and modeling will be required to determine the permittability of sustainable brackish groundwater withdrawals in coastal areas. In some inland areas, the freshwater zone in the UFA may only be a few hundred feet thick. Below this level, water becomes increasingly more mineralized, mainly due to the presence of sulfate. The variability of sulfate concentrations with depth across the planning region is significant. For example, sulfate concentrations in groundwater pumped from depths of 600 to 1,000 feet at The Villages development in northeast Sumter County varied from 10 to 50 mg/L, which is well within potable water standards. The Villages uses higher-sulfate water for landscape irrigation, without advanced treatment, to offset demand for potable-quality groundwater in the upper portions of the aquifer.

The District is conducting tests through exploratory drilling to determine and map water quality within the LFA in northern Sumter and western Marion counties. The water quality has been generally fresh below MCU I in areas tested, but degrades where water is near contact with evaporitic minerals contained in the deeper MCU II.

Because fresh groundwater continues to be available in much of the planning region, specific project options for brackish groundwater supply have not been thoroughly evaluated. As a result, it is not possible to determine the availability of brackish groundwater from the UFA and LFA. In the near term, the availability of brackish groundwater in the planning region for water supply must be determined on a case-by-case basis through the permitting process.

The District's ROMP program exploring the Lower Floridan aquifer in Sumter County

Section 6. Aquifer Recharge

Natural recharge of rainfall infiltration to the surficial aquifer and underlying aquifers is the primary source maintaining aquifer levels. Aquifer recharge (AR) is the process of beneficially using excess water to directly or indirectly recharge aquifers. AR may be accomplished by using wells or rapid infiltration basins (RIBs). In order to maximize environmental and water supply benefits, AR projects will generally target the fresher portions of the aquifer.

Successful AR projects will improve groundwater levels. This water level improvement may provide for (1) improving local groundwater quality, (2) mitigate or offset existing drawdown impacts due to withdrawals, (3) providing storage of seasonally available waters and thereby augmenting water supplies, and (4) potentially providing for additional new permitted groundwater withdrawals in areas of limited water supply. AR project success criteria can include demonstration of the level to which aquifers have been restored, demonstrated improvements to aquifer water quality and/or increases in available water supply for existing and future users.

Sources of water for use in AR projects are often available seasonally and may include high quality reclaimed water, surface water and stormwater. Of the 719.49 mgd of reclaimed water used Statewide in 2013 (DEP, 2013), 100.96 mgd was used for groundwater recharge, which constitutes approximately 14 percent of the total volume.

Each individual AR project will have distinctively different construction specifications, regulatory requirements and operational maintenance considerations. The hydrogeologic setting of an area often determines which AR approach can be used.

1.0 Direct Aquifer Recharge

Direct AR uses wells to inject water meeting applicable DEP water quality standards into an aquifer. Direct AR water recovery may occur through other wells constructed in the area. However, direct AR projects are often designed to improve aquifer conditions.

Characterization of the targeted aquifer for direct AR is fundamental in the design, operation, and maintenance of a direct AR system. Understanding the permeability and the degree of aquifer confinement above and below the injection interval, along with a characterization of the difference in water quality between the injection source water and the ambient groundwater in the injection interval and existing aquifers above and below, is critical to direct AR project success. Direct AR system designs must address the potential for mobilization of naturally occurring arsenic on a site specific basis. If not addressed in the design of a direct AR project, the related and undesirable geochemical reactions may occur when the injection water reacts with the aquifer. Properly designed projects can avoid or manage these reactions through the adjustment of injection water chemistry, such as the removal of dissolved oxygen. In certain circumstances, the DEP may allow these chemical reactions to occur if an adequate property area is controlled by ownership and it a can be demonstrated the reaction is limited to the controlled area and will not require any other users of the aquifer to implement additional treatment to continue their use.

Recent experience with operational ASR projects incorporating oxygen degasification systems and post treatment stabilization have proven that metals mobilization can be minimized and controlled by reducing the dissolved oxygen content in the injection source water in addition to maintaining a negative oxygen-reduction potential (ORP). AR projects will need to function in the same manner. Groundwater flow resulting from injection and the natural groundwater flow gradient will have the potential to move dissolved metals down gradient. For this reason, it will be important to establish necessary aquifer monitoring and institutional controls to guard against public access to potentially contaminated groundwater if metals are mobilized.

2.0 Indirect Aquifer Recharge

Indirect AR is when water is applied to land surface where it can infiltrate and recharge the aquifer. Indirect AR can be accomplished by using a variety of techniques, including spray fields, recharge wetlands, large-scale drain fields, and RIBs. This recharge approach is used in areas where there is a good connection between the surface and source aquifer for water supply. Water applied to the surface must meet minimum water quality standards approved by the DEP. Infiltration capacity and permeability of the soil, presence of drainage features, depth to the water table, local hydrogeology, locations of nearby drinking water wells, as well as locations of nearby wetlands and lakes are all important to identify, test and characterize to determine feasibility of indirect AR. In favorable regions, indirect AR can provide additional natural water quality treatment to the water as it percolates through sediments during infiltration, in addition to subsequently increasing aquifers levels. It is estimated by the District that 22.22 mgd of available reclaimed water (Districtwide) was being applied through RIBs for indirect AR as of 2010 (DEP Reuse Inventory of 2010).

Section 7. Seawater Desalination

Seawater is defined as water in any sea, gulf, bay or ocean having a TDS concentration of 35,000 mg/L or more (SWFWMD, 2001). Seawater can provide a stable, drought proof water supply that may be increasingly attractive as the availability of traditional supplies diminish and advances in technology and efficiency continue to reduce costs. There are five principal elements to a seawater desalination system that require extensive design considerations: an intake structure to acquire the source water, pretreatment to remove organic matter and suspended solids, RO desalination to remove dissolved minerals and microscopic constituents, post-treatment to stabilize and buffer product water and prepare it for transmission, and concentrate disposal management (National Research Council, 2008). Each of these elements is briefly discussed below.

The intake structure is utilized to withdraw large amounts of source water for the treatment process. The volume of water withdrawn may significantly exceed the amount treated if concentrate dilution is necessary. The intake design and operation must address environmental impacts because much of the District’s near-shore areas have been designated as either OFW or aquatic preserves. Ecological concerns include the risk of impingement and entrainment of aquatic life at the intake, entrainment of sediments and oils, and perturbation to seagrasses and hard-bottom communities.

The pretreatment of source water is imperative to protect the sensitive RO membranes from fouling prematurely from organic carbon and particulates, and this may be the most critical design element. A pretreatment system may require coagulation and/or microfiltration technology similar to the treatment of fresh surface water. A robust pretreatment may seem duplicative, but lessons learned from Tampa Bay Water and other facilities have demonstrated the importance of pretreatment to the long-tern viability of the facility.

High-pressure RO membrane treatment is the most widely accepted seawater desalination technology. The RO system pressurizes saline water above the osmotic pressure of the solutes and passes the water through a network of semi-permeable membranes. Fresh water passes through the membranes, while a constant flow of raw water prevents the dissolved minerals from fouling the membrane's surface. The membranes are susceptible to fouling or damage from dissolved organic matter and fine suspended particles, which is why an effective pretreatment method is necessary. The pressurization step can be energy-intensive. Seawater treatment requires pressures from 600 to 1,000 psi, compared to brackish groundwater systems (with <10,000 mg/l TDS) operating at 30 to 250 psi (DEP, 2010). Most large-capacity seawater facilities have energy recovery systems that use turbines driven by high-pressure flow exiting the RO membranes to boost pressure to the pumps feeding the source water. Energy recovery systems reduce electrical demands, alleviate redundant pumping capacities, lower operational costs, and reduce the facility's carbon footprint.

The post-treatment element is necessary to protect the facility's infrastructure and distribution piping. The RO product water has a very low hardness and alkalinity, which can corrode piping and add unwanted metals into the finished water. Chemical post-treatment such as lime or caustic soda addition is often used for buffering and pH adjustment. A settling system may be necessary to reduce turbidity generated by chemical treatment. A degassing system may also be necessary, as dissolved gasses such as hydrogen sulfide can pass through RO membranes and create a noticeable odor in the finished water.

Nearly all seawater desalination facilities worldwide dispose of RO concentrate by surface water discharge, which entails significant environmental considerations. The salinity of the concentrate can be 50 percent higher than that of the source water, and the increased density of the concentrate may cause it to sink and impact benthic communities (National Research Council, 2008). A NPDES permit from the Environmental Protection Agency (EPA) and other local permits may be required to discharge the concentrate into surface waters. To obtain the NPDES permit, a variety of factors must be demonstrated to not impose harm to aquatic organisms. There are several technological approaches to alleviating these issues, including diffusion of the discharge using widely dispersed multiple outlets and pumping large volumes of additional water to dilute the concentrate to safe levels prior to discharge.

The co-location of desalination facilities with coastal electric power stations can significantly enhance their financial feasibility. Co-location produces cost and environmental compliance benefits by utilizing existing intake structures and blending concentrate with the power station's high-volume cooling water discharge. The complex infrastructure for the intake and outflow is already in place, and source water heated by the power station's boilers can be more efficiently desalinated.

Additional information on seawater desalination can be found in the DEP report entitled *Desalination in Florida: Technology, Implementation, and Environmental Issues* (www.dep.state.fl.us/water/default.htm).

1.0 Potential for Water Supply from Seawater Desalination (NPR)

The District's 2010 RWSP identified an option for a 15 mgd seawater desalination facility in the planning region co-located at the Crystal River power station near the Gulf of Mexico in Citrus County. This option was reevaluated for the WRWSA's 2014 RWSP Update, in cooperation with the District. Conceptual details and estimated costs of this project option have been modified due to operational changes at the Crystal River power station.

Lake Rousseau Dam

The Crystal River power station contains a once-through seawater cooling water system capable of withdrawing over 1,800 mgd of seawater, and a canal discharge system that transports the cooling water flows over 2 miles from the shoreline. The once-through cooling system was historically used for a nuclear power unit and two coal burning power units. Since the prior RWSP update, the nuclear unit has been permanently retired, and the two coal units are scheduled for decommission in 2020 or sooner. The Crystal River power station will continue operations, but is utilizing power units equipped with more efficient closed-cycle cooling systems. This impacts the seawater desalination project option in two ways: the ability to bypass some of the power station's cooling water flow towards a water treatment facility is diminished, and the high-volume outflows for the dilution and disposal of RO concentrate will not be available. The WRWSA investigated an alternate intake design that would withdraw water from the Cross Florida Barge Canal, located north of the power station. The salinity range in the Barge Canal is approximately 15,000 to 20,000 mg/l TDS on average and would require less mechanical pressure to treat osmotically than pure seawater, although tides and discharges from the Lake Rousseau dam may cause fluctuations in water quality that could complicate treatment operations and limit productivity. The WRWSA reevaluation also found that deep well injection would be the next most feasible and cost-efficient RO concentrate disposal option. The updated project option costs are presented in Chapter 5. The proposed location, along with other existing and proposed seawater and brackish groundwater desalination facilities in the District, is shown in Figure 4-4.

The WRWSA also evaluated the siting of a seawater desalination facility at other coastal locations in Hernando and Citrus counties. No other locations appeared feasible due to the extensive alterations that would be required on protected wetlands, coastal seagrasses, and other sensitive environmental areas.

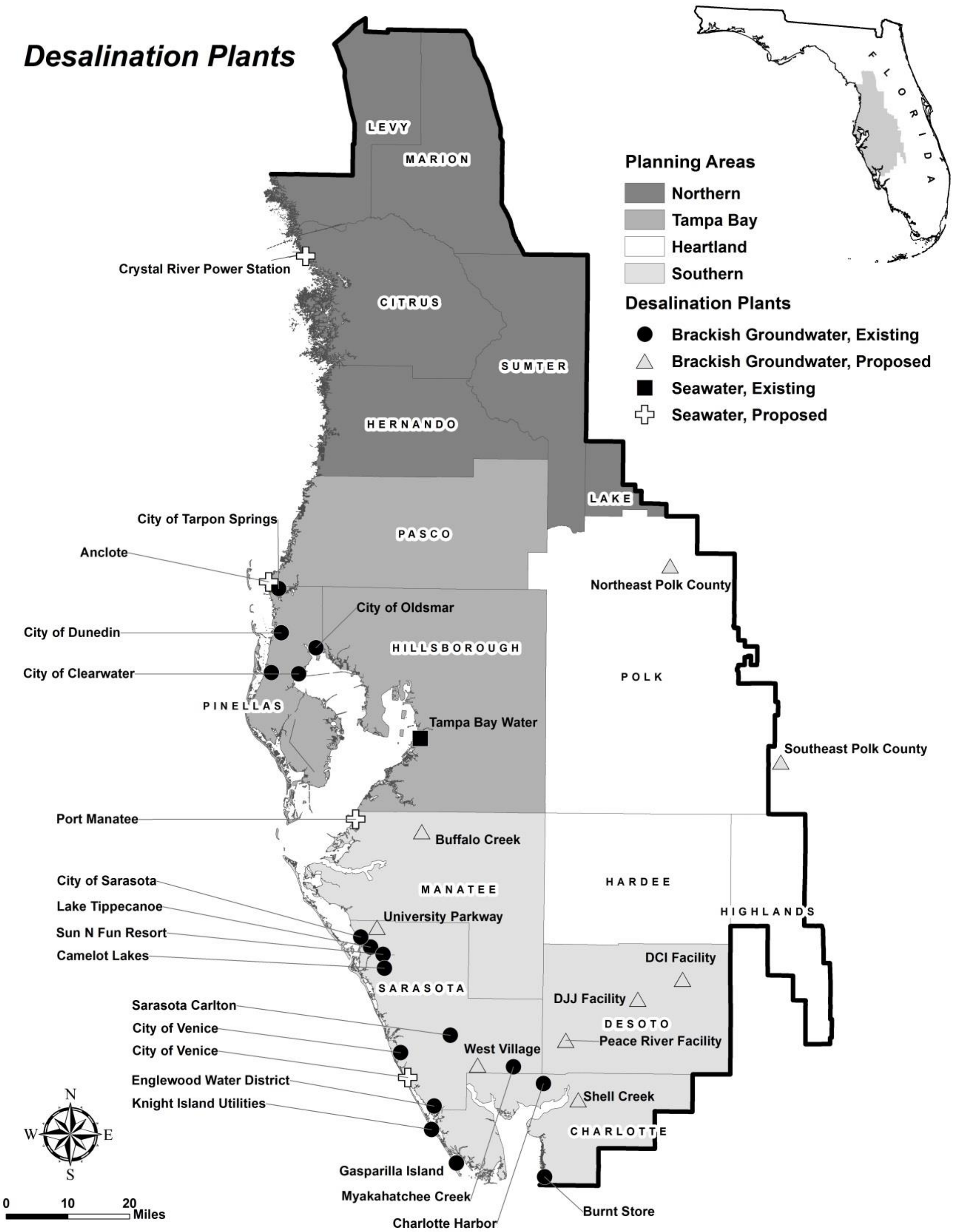


Figure 4-4. *Location of existing and potential seawater and brackish groundwater desalination facilities in the District*

Section 8. Stormwater

In the coming years, additional efforts may be focused towards the investigation and advancement of stormwater capture and reuse, which is otherwise known as "Stormwater Harvesting". The intent of this Stormwater Harvesting Program (SHP) is to expand upon existing stormwater reuse efforts, to facilitate innovation in this underdeveloped arena, and to take advantage of programs that have been successfully implemented by other Districts. There are additional opportunities to capture and reuse surplus stormwater. A guiding principle for SHP is to support the pre-development behavior of hydrologic systems; to retain and naturally percolate rainwater. It's also very important to try to recapture surface water discharges that would otherwise result in a tidal discharge. There are understandably numerous considerations and impediments to the successful implementation of an SHP. Below is a list of impediments and critical considerations for stormwater harvesting:

- Weather systems and rainfall availability
- Cost of infrastructure development
- Geographical challenges (available water volumes near areas of need)
- Stormwater quality and quantity
- Regulatory framework and incentives
- Suitability of soils
- Stakeholder buy-in

A defined "need" may be the most significant element in a stormwater harvesting program. There are scenarios where water is available, and the solutions may be cost effective, but would the alternatives be the highest and best use of available resources. A stormwater harvesting program must therefore balance stormwater availability against a defined need, so it must identify areas in the District where traditional water supply sources are limited. For this reason, a need-based approach may target areas such as the Most Impacted Area (MIA), as well as water use caution areas (WUCAs).

Having defined many of the SHP impediments and considerations, following is a list of areas of opportunity for stormwater harvesting now and in the future:

- Dispersed water management and dispersed water storage
- Agricultural conservation and reuse systems
- Commercial irrigation
- Residential irrigation
- Retrofit urban runoff areas
- Augmentation of reclaimed water systems
- Waterbody (natural systems) base flow augmentation and/or restoration
- Regionalization of stormwater ponds
- Surficial aquifer recharge

Section 9. Summary of Potentially Available Water Supply

Table 4-9 is a summary of the additional quantity of water that will potentially be available from all sources of water in each county in the planning region from 2015 through 2035. The table shows that the total additional quantity available is 161.13 mgd.

Table 4-9. *Potential additional water availability in the Northern Planning Region through 2035 (mgd)*

County	Surface Water[1]		Reclaimed Water	Desalination		Fresh Groundwater[3]		Water Conservation		Total
	Permitted Unused	Available Unpermitted	Benefits	Seawater	Brackish Groundwater	Surficial and Intermediate	Upper Floridan Permitted Unused	Non-Agricultural	Agricultural	
Hernando	-	-	2.57	-	-	-	9.76	7.12	0.41	19.86
Citrus	-	44	3.17	15	-	-	3.88	4.46	0.14	70.65
Sumter	-	-	2.00	-	-	-	5.97	3.51	1.62	13.10
Levy	-	-	0.09	-	-	-	0.40	0.47	1.82	2.78
Lake	-	-	0.00	-	-	-	0.00	0.01	0.54	0.55
Marion	0.54	44	2.81	-	-	-	3.39	2.66	0.77	54.17
Total	**0.54**	**88**	**10.64**	**15**	**TBD**	**NA**	**23.40[2]**	**18.25**	**5.30**	**161.13**

[1] Available surface water from the Withlacoochee River is split between Citrus and Marion counties because the calculation was based on flows at a location between these two counties; however, future withdrawals from other counties may be available.
[2] Groundwater that is permitted but unused for public supply. Based on 2013 Estimated Water Use (SWFWMD, 2014). It is anticipated that regional future demand can be met with groundwater, provided existing and anticipated local impacts are mitigated or avoided with conservation and reclaimed water use. The quantity of groundwater available in each county is equivalent to each county's projected 2035 demand.
[3] Fresh Groundwater does not include quantities potentially available from the LFA in portions of the planning region. These quantities will be further evaluated in future updates of this RWSP for the Northern Planning Region.

Part B. Determination of Water Supply Deficits/Surpluses

Future water supply deficits/surpluses in the planning region were calculated as the difference between projected demands for 2035 and demands calculated for the 2010 base year (Table 3-6). The projected additional water demand in the planning region for the 2010–2035 planning period is approximately 62.83 mgd. As shown in Table 4-9, up to 161.13 mgd is potentially available from water sources in the planning region to meet this demand. Based on a comparison of projected demands and available supplies, it is concluded that sufficient sources of water are available within the planning region to meet projected demands through 2035.

Chapter 5. Overview of Water Supply Development Options

The water supply development (WSD) component of the Regional Water Supply Plan (RWSP) requires the Southwest Florida Water Management District (District) to identify water supply options from which water users can choose to meet their individual needs. In addition, the District is to determine the associated costs of developing these options. As discussed in Chapter 4, sources of water potentially available to meet projected demand in the planning region include fresh groundwater, water conservation, reclaimed water, surface and stormwater, Aquifer Storage and Recovery (ASR) and Aquifer Recharge, and seawater desalination. Investigations were conducted to identify reasonable options for developing each of the sources, to provide planning level technical and environmental feasibility analyses, and to determine costs to develop the options.

The RWSP Executive Summary presents statutory guidance on how water supply entities are to incorporate WSD options from the RWSP into their water supply planning and development of their comprehensive plans.

Part A. Water Supply Development Options

The District developed the reclaimed water options in this chapter. Surface water/stormwater, fresh groundwater, and seawater desalination options were developed by the Withlacoochee Regional Water Supply Authority (WRWSA) as part of their RWSP 2014 Update, which was co-funded by the District. The water conservation options were developed as a collaborative effort among the District, the WRWSA, and the Conserve Florida Water Clearinghouse.

The options presented in this chapter are not necessarily the District’s preferred options, but are reasonable concepts that water users in the region could pursue in their water supply planning. A number of the options are of such a scale that they would likely be implemented by the WRWSA. Other options, such as those involving reclaimed water and conservation, could be implemented by individual utilities. The District anticipates that users will choose an option or combine elements of different options that best fit their needs for WSD. Following a decision to pursue an option identified in the RWSP, it will be necessary for the parties involved to conduct more detailed engineering, hydrologic and biologic assessments to provide the necessary technical support for developing the option and to obtain all applicable permits.

The WRWSA’s RWSP 2014 Update provided unit production cost estimates for the surface water, groundwater and desalination options. Currency is based on 2013 U.S. dollars. Water production costs in $/1,000 gallons provided by the WRWSA are a function of the capital cost debt service based on a 30-year life cycle at 3.75 percent interest (2013 federal discount rate for water projects), annual O&M costs, and amount of water produced.

Section 1. Fresh Groundwater Options

Fresh groundwater project options for the planning region were reevaluated during development of the WRWSA's RWSP 2014 Update. The former groundwater supply options published in the 2010 RWSP were developed principally by siting wellfields in areas furthest from minimum flows and levels (MFL) water bodies and other environmentally sensitive areas. This approach helped to quantify a maximum amount of groundwater available to the region, but necessitated the planning of extensive, costly transmission systems to deliver water to demand centers. The WRWSA's 2014 Update used a more practical approach of siting potential wellfield options based on spatial distribution of water supply demands. The project options are cited within reasonable proximity to utility service areas where additional supplies may be needed, based on projected deficits over the currently permitted quantities during the planning period. The wellfield production quantities were subsequently evaluated using the Northern District Model to determine whether or not exceedances to MFL water bodies would occur.

Fresh groundwater may also be potentially available from the LFA in portions of the Northern Planning Region, particularly in parts of Marion and northern Sumter counties. This source was not quantified in the WRWSA's 2014 update, but was mentioned as a potential future source requiring further investigation. Freshwater from the LFA has also not been quantified for purposes of this RWSP and no LFA water supply development options have been included; however, it is recognized that this source exists and this source may potentially be developed as an alternative water supply source in certain areas. This would need to be determined on a case-by-case basis.

Fresh Groundwater Option #1. WRWSA Charles A. Black Wellfield Expansion

- Entity Responsible for Implementation: WRWSA, Citrus County Utilities

The Charles A. Black (CAB) wellfield in central Citrus County includes seven groundwater production wells and two water treatment facilities, each consisting of disinfection equipment, storage tanks, and distribution piping equipment. The total design capacity of the wells is 17.06 mgd and the rated capacity (largest well out of service) is 11.88 mgd. The combined capacity of the water treatment facilities is 14.5 mgd. The CAB's current water use permit allocation is for 4.6 mgd annual average and 6.6 mgd peak day.

This project option would expand the production of the system by 2.34 mgd to 6.94 mgd annual average and 9.9 mgd peak capacity. The current wells and treatment facilities have the capacity to supply the increased quantities without construction upgrades to infrastructure. The only associated costs would be for the permit modification and the increased groundwater production. The cost estimates shown in Table 5-1, below, are based on the WRWSA's quoted estimate for consulting modeling and permitting services, and the ratio increase of current O&M costs.

Table 5-1. *WRWSA Charles A. Black Wellfield Expansion option costs*

Quantity Produced (mgd)	Capital Cost	Capital Cost/mgd	Total Cost/1,000 Gallons	O&M Annual Costs
2.34	$65,000	$27,800	$0.04	$217,000

Fresh Groundwater Option #2. City Of Wildwood Lower Floridan Aquifer Wellfield Near CR-501

- Entity Responsible for Implementation: City of Wildwood, WRWSA

The City of Wildwood has proposed developing a Lower Floridan aquifer (LFA) well and water treatment plant near the existing CR-501 (Coleman) water treatment plant. A study completed in 2010 found the LFA was situated approximately 600 feet below surface and provided a productive fresh water source. (BFA, 2010) The wellfield option would have a capacity of 6.0 mgd to meet the peak day demands of the city. The project would consist of two LFA wells, 18-inches in diameter drilled to a depth of approximately 1,100 feet below surface. It is assumed that the two high-capacity wells would require approximately 1.25 miles of separation; therefore, raw water transmission pipelines between the wells and treatment facility are included in the capital cost estimate. The treatment facility would require storage and sulfide removal. The acquisition of approximately five acres of land was calculated in the capital costs. See Table 5-2 for a summary of this option's potential costs.

Table 5-2. *City of Wildwood LFA Wellfield Near CR-501 option costs*

Quantity Produced (mgd)	Capital Cost	Capital Cost/mgd	Total Cost/1,000 Gallons	O&M Annual Costs
6.0	$6,668,000	$1,600,000	$0.52	$758,000

Fresh Groundwater Option #3. Marion County Utilities Marion Oaks Wellfield

- Entity Responsible for Implementation: WRWSA, Marion County Utilities

The Marion Oaks Wellfield option would provide additional potable water supply to southwest-central Marion County. The wellfield would consist of two 18-inch diameter Upper Floridan aquifer (UFA) wells. The project would have a capacity of 9 mgd to meet the peak demands of the Marion Oaks service area. It is assumed that significant separation between the two wells is necessary; therefore, a raw water transmission pipeline would extend approximately 1.25 miles from the distant well to the treatment facility. The acquisition of approximately 5 acres of land was calculated in the capital costs shown in Table 5-3, below.

Table 5-3. *Marion County Utilities Marion Oaks Wellfield Option Costs*

Quantity Produced (mgd)	Capital Cost	Capital Cost/mgd	Total Cost/1,000 Gallons	O&M Annual Costs
9.0	$7,802,000	$870,000	$0.36	$758,000

Section 2. Water Conservation Options

1.0 Non-Agricultural Water Conservation

The District identified a series of conservation measures that are appropriate for implementation by the public supply, domestic self-supply (DSS), landscape/recreation (L/R) and industrial/commercial (I/C) water use sectors. A complete description of the criteria used in selecting these measures and the methodology for determining the water savings potential for each measure within each non-agricultural water use category is described in Chapter 4.

Some readily applicable conservation measures are not addressed due to the wide variance in implementation costs and the site-specific nature of their implementation. Two such measures are water-conserving rate structures and local codes/ordinances, which have savings potential but are not addressed as part of this RWSP. The District strongly encourages these measures and, when properly designed, they can be effective at conserving water. In addition, permittees are required to address these measures in their water conservation plan, which is part of the package provided by permittees during the water use permit application or renewal period. The following is a description of each non-agricultural water conservation option. Savings and costs for each best management practice (BMP) option are summarized by sector in the tables below.

Table 5-4. *Conservation BMP options for Public Supply sector*

BMP/ Conservation Measure	Public Supply Savings (mgd)	Average Cost Effectiveness ($/1,000 gal)	Public Supply Costs
Residential BMPs			
Toilet	0.26	$0.74	$2,620,225
Shower Head	1.57	$0.09	$2,061,184
Faucet	5.19	$0.40	$11,566,430
Soil Moisture Sensor	1.84	$1.07	$3,556,446
Non-Potable Irrigation System	0.41	$0.32	$1,016,515
Irrigation Audit	0.85	$2.65	$4,232,073
Commercial Industrial BMPs			
Toilet	0.17	$0.74	$1,708,843
Urinal	0.40	$0.52	$1,843,303
Shower Head	0.08	$0.09	$103,801
Faucet	0.44	$0.40	$982,769
Pre-Rinse Spray Valve	0.01	$0.04	$1,129
Water Audit	0.14	$2.41	$677,132
Total	**11.29**	**$0.67**	**$30,369,848**

Table 5-5. *Conservation BMP options for DSS sector*

BMP/ Conservation Measure	DSS Savings (mgd)	Average Cost Effectiveness ($/1,000 gal)	DSS Costs
Toilet	0.11	$0.74	$1,134,525
Shower Head	0.68	$0.09	$892,467
Faucet	2.24	$0.40	$5,008,119
Soil Moisture Sensor	0.80	$1.07	$1,539,897
Irrigation Audit	0.37	$2.65	$1,832,435
Total	**4.20**	**$0.68**	**$10,407,442**

Table 5-6. *Conservation BMP options for I/C sector*

BMP/ Conservation Measure	ICI Savings (mgd)	Average Cost Effectiveness ($/1,000 gal)	ICI Costs
Toilet	0.13	$0.74	$1,281,764
Urinal	0.30	$0.52	$1,382,620
Shower Head	0.06	$0.09	$77,858
Faucet	0.33	$0.40	$737,152
Pre-Rinse Spray Valve	0.01	$0.04	$847
Water Audit	0.10	$2.41	$507,901
Total	**0.92**	**$0.68**	**$3,988,142**

Table 5-7. *Conservation BMP options for L/R sector*

BMP/ Conservation Measure	L/R Savings (mgd)	Average Cost Effectiveness ($/1,000 gal)	L/R Costs
Soil Moisture Sensor	1.25	$1.07	$2,420,000
Irrigation Audit	0.58	$2.65	$2,880,000
Total	**1.83**	**$1.57**	**$5,300,000**

1.1 Description of Non-Agricultural Water Conservation Options

1.1.1 High-Efficiency Showerhead and Faucet Aerators Rebates

This practice involves installing Environmental Protection Agency (EPA) WaterSense®-labeled, high-efficiency kitchen and bathroom faucet aerators, as well as high-efficiency showerheads. This is a low-cost conservation option that is easy to implement for both residential and I/C users. Efficient aerator flow rates are 1.5 gallons per minute (gpm) for bathroom faucets, 2.5 gpm for kitchen faucets, and 2.5 gpm for showerheads.

Faucet aerators were identified as a major potential source of water conservation.

1.1.2 Ultra Low-Flow Toilet (ULFT) and High-Efficiency Toilet (HET) Rebates (Residential)

ULFT programs offer rebates as an incentive for replacement of high-flow toilets with more water-efficient models. ULFTs use 1.6 gallons per flush (gpf) as opposed to older, less-efficient models that could use 3.5 gpf up to 7.0 gpf, depending on the age of the fixture. Other fixtures such as WaterSense® high-efficiency toilets and dual-flush toilets (DFT) use even less water. Since they can usually be rebated for the same dollar amount, higher water savings result for the same cost. HETs use 1.28 gpf, or less, while DFTs have the option to use 0.8 gallons of water for liquid removal or 1.6 gallons for full-flush solid removal.

1.1.3 Landscape and Irrigation Evaluations/Audits

Water-efficient landscape and irrigation evaluations achieve water savings by evaluating individual irrigation systems, providing expert tips on opportunities to increase water efficiency, and offering targeted rebates or incentives based on those findings and recommendations. Audits can focus on three areas: operation, repair, and design. Evaluations are applicable to all accounts that use inground systems for landscape irrigation

1.1.4 Irrigation Controller: Evapotranspiration, Soil-Moisture, and Rain Sensors

Section 373.62, Florida Statute (F.S.), requires all new automatic landscape irrigation systems to be fitted with properly installed automatic shutoff devices. This is typically a rain sensor. "Smart" irrigation controllers go a step farther than rain sensors. Smart irrigation controllers monitor and use information about site conditions (such as soil moisture, rain, wind, slope, soil, plant type and more) and apply the amount of water necessary to meet plant needs based on those factors and plant species (for more information, see www.irrigation.org, or http://www3.epa.gov/watersense/products/controltech.html). These devices override scheduled irrigation events when sufficient moisture is present at the site. Rain sensors typically are used for this purpose, but advanced irrigation technologies, which have the potential for further improving water use efficiency, are evolving (e.g., soil moisture sensors (SMS), evapotranspiration (ET) sensors, weather-based shutoff devices).

1.1.5 Alternative Irrigation Source

Alternative irrigation sources reduce or eliminate outdoor potable water use through non-descriptive but reliable outdoor source modification. Examples of alternative sources may include irrigation wells, reclaimed water and rainwater harvesting. Alternative irrigation source programs present substantial opportunities for most regular users with automatic irrigation systems.

1.1.6 Ultra Low-Flow Toilet (ULFT), High-Efficiency Toilet (HET), Low-Flow Urinals (LFU) and Waterless Urinals (Industrial, Commercial, and Institutional)

Similar to the residential HET retrofit programs, a nonresidential fixture replacement program provides financial incentives to water customers to encourage conversion of higher flush volume toilets and urinals to HET and LFU models. LFUs use 1.0 gpf or less. These measures apply to office buildings, sports arenas, hospitals, schools, dormitories, and other commercial facilities. Waterless urinals are also available on the market and have been evolving in design over the years. This device is recommended primarily in new construction, as there are challenges to successful implementation in existing buildings due to potential drain line transmission issues.

1.1.7 Pre-Rinse Spray Valve (Industrial, Commercial, Institutional)

This measure offers rebates to hospitality facilities to replace high water-volume spray valves with water-conserving low-volume spray valves. The measure applies to non-residential customers of the public supply sector or any other applicable users within the I/C sector. A traditional pre-rinse spray valve uses 2 to 5 gpm, while high-efficiency spray valves use no more than 1.6 gpm. High-efficiency valves are also more effective at removing food from dishware.

1.1.8 Water Use Facility Assessments/Audit (Industrial, Commercial, and Institutional)

The objective of industrial, commercial, institutional (ICI) facility assessments is to identify the potential for improved efficiency and reduced water consumption by conducting evaluations of water use at non-residential facilities. ICI facilities can use water for a variety of purposes, including cooling, dissolving, energy storage, pressure source, raw material or for more traditional domestic uses. Surveys typically include a site visit, characterization of existing water uses, a review of operational practices and are followed by recommended measures to improve water use efficiency.

2.0 Agricultural Water Conservation Options

The District has a comprehensive strategy to significantly increase the efficiency of agricultural water use over the next 20 years. A key component of this strategy is the cooperative programs the District has established with other agencies to provide the agricultural community with a wide array of technical and financial assistance programs to facilitate increases in water use efficiency. For nearly 30 years, the District has administered programs that have provided millions of dollars to fund more than 100 projects that have helped farmers increase the efficiency of their water use and improve water quality. Water conservation options for which the District will provide assistance as part of the Facilitating Agricultural Resource Management Systems (FARMS) and other programs are described below. For some of the programs, examples of options that could be implemented by growers are included with basic technical specifications and costs.

2.1 Facilitating Agricultural Resource Management Systems (FARMS)

The District, in cooperation with the Florida Department of Agriculture and Consumer Services (FDACS), initiated the FARMS Program in 2003. The FARMS Program provides cost-share reimbursement for the implementation of agricultural BMPs that involve both water-quantity and water-quality aspects. It is intended to expedite the implementation of production-scale agricultural BMPs that will help farmers become more efficient in their water use, improve water quality and restore and augment natural systems. The FARMS Program is a public/private partnership among the District, FDACS, and private agriculturalists. Reimbursement cost-share rates for agriculturalists are based on the degree to which they implement both water quantity and water quality BMPs. The goal for the FARMS Program is to offset 40 mgd of groundwater use for agriculture by 2025. Out of 134 operational FARMS projects, there are seven operational projects within the NPR. The estimated offset from the operational projects within the NPR is approximately 0.039 mgd, with the actual offset for those operational projects approximately 0.66 mgd. Because the District classifies FARMS projects as water resource development, additional information pertaining to the program, status of project implementation, and water savings achieved to date is provided in Chapter 7.

2.2 Well Back-Plugging Program

The well back-plugging program provides funding assistance for property owners to partially back-plug wells with poor water quality. Back-plugging involves plugging the lower portion of deep wells with cement to isolate the geological formation where poor-quality groundwater originates. Back-plugged wells show a dramatic reduction in concentrations of chloride and sulfate, which are the constituents that typically exceed standards in the region.

2.3 Institute of Food and Agricultural Sciences (IFAS) Research and Education Projects

The District provides funding for IFAS to investigate a variety of agricultural issues that involve water conservation. These include development of tailwater recovery technology, determination of crop water use requirements, field irrigation scheduling, frost/freeze protection, etc. IFAS conducts the research and then provides the results to the agricultural community.

2.4 Mobile Irrigation Laboratory

The mobile irrigation lab program is a cooperative initiative between the District and the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). The NRCS conducts efficiency and conservation evaluations of agricultural irrigation systems. Since 1986, the mobile irrigation lab service has evaluated irrigation systems at more than 900 sites in the District and recommended management strategies and/or irrigation system adjustments.

2.5 Model Farms

The “model” farms concept is a tool to determine the potential for water savings for various scenarios of irrigation system conversions and/or BMPs for a number of different agricultural commodities. There are 20 model farms available with different best management/irrigation system modifications applied to the existing farms.

2.6 Best Management Practices (BMPs)

BMPs are innovative, dynamic and improved water management approaches applied to agricultural irrigation practices and crop production to help promote surface and groundwater resource sustainability. BMPs help protect water resources and water quality, manage natural resources and promote water conservation. Some BMPs are as simple as preparing a schedule for irrigation to help reduce water consumption in a rainy season, while others involve cutting-edge technologies, such as soil moisture monitors, customized weather stations and computer programs for localized irrigation systems. Below are a number of BMP options that the District, its cooperators, and the agricultural community have successfully implemented in the planning region.

BMP Option #1. Tailwater Recovery System

Tailwater recovery has proven to achieve both water-quality improvements and groundwater conservation. Tailwater ponds are typically excavated below ground level at the low end of a farm to collect excess irrigation water and stormwater runoff. To use the pond as a source of irrigation water, pumps, filters and other equipment are needed to connect the pond to the existing irrigation system. The use of these ponds for irrigation offsets a portion of the groundwater used to irrigate the commodity and can improve water quality of the downstream watershed by reducing the concentration of mineralized groundwater applied to fields.

The Bethel Farms project involves the operation of an existing 5-acre reservoir to collect tailwater and surface water from the property and surrounding watershed to offset UFA groundwater quantities used to irrigate approximately 130 acres of commercial sod. The Water Use Permit (WUP) authorizes an annual average groundwater withdrawal of 0.324 mgd gallons per day (gpd). FARMS project components consist of a surface water pump station, filtration system, and the mainline pipe to connect the surface water pump station to a center pivot irrigation system, automated pump controls, soil moisture sensors, hydraulic control valves, and a weather station. The estimated water savings is 0.07 mgd. Actual surface water use has averaged approximately 0.15 mgd. The table shown below summarizes the potential costs and savings.

Table 5-8. *Tailwater Recovery System costs/savings*

Option	Potential Savings (mgd)[1]	Capital Cost Per Acre ($)[2]	O&M Cost ($)/Acre[3]	Cost/1,000 Gallons[4]
Tailwater Recovery System	0.07	$190,000	NA	$1.71

[1] If implemented in year 2010 on all acreage.
[2] Costs estimated in 2008 and included depreciation, insurance, taxes and repairs (for a 300-acre farm).
[3] Hazen and Sawyer (2009 Update of Best Management Practices Cost Information for Model Farms Presented in the August 2000 and October 2004 HSW Reports), using 2008 construction costs.

BMP Option #2. Precision Irrigation Systems

Precision irrigation systems allow for the automatic remote control of irrigation pumps based upon information derived from soil moisture sensors, which measure and monitor discrete subsurface moisture levels. The system enables the grower to maintain soil moisture within optimized ranges, which reduces the potential for overwatering and prevents under-watering to avoid reduction in crop yields. A second system that increases irrigation efficiencies involves the use of automatic valves and on-off timers. These devices can be programmed to start and stop irrigation pumps to achieve maximum efficient irrigation durations. Without automatic valves and timers, the pumps must be manually turned off, which may not occur at the most optimum time. Several different types of electronic systems that increase irrigation system efficiency have been implemented through the FARMS Program.

BMP Option #3. Farm-Sited Weather Stations

Regional weather information is often generalized and cannot account for the wide spatial variation of rainfall and temperature. The use of basic weather monitoring stations on individual farms can provide the grower with an effective tool to make decisions of when to initiate a daily irrigation event or to turn pumps on or off during a frost/freeze event. Using water for cold protection has long been an accepted practice for a variety of crops in Florida, but it must be properly applied to avoid damage. During frost/freeze events, the weather stations can notify the grower when conditions are likely for damage to occur or when the danger of frost/freeze has passed. Turning pumps on too early before damaging conditions occur will waste water and fuel, while turning the pumps off too early could cause damage to crops through evaporative cooling. The use of a farm-sited weather station can reduce water consumption and improve surface water quality in areas where poor quality groundwater is used for cold protection.

2.7 Development of Alternative Water Sources for Agricultural Irrigation

The District has identified three alternative water sources that could be used for irrigation of row crops and citrus. These include: (1) rainwater harvesting; (2) substituting reclaimed water for groundwater; and (3) use of the surficial aquifer. Although these sources are not applicable to every site and are not necessarily the most cost-effective, they are examples of practical alternatives that could reduce the use of groundwater from the UFA.

Agricultural Alternative Water Source Option #1. Rainwater Harvesting

A farm-scale prototype rainwater harvesting plan was developed to generate planning estimates of potential water savings and costs. The prototypical site would be similar to many row crop farms in the planning region. The crops would be fall and spring tomatoes and strawberries grown on 1,000 acres, with only a third of the acreage in production at any one time. This scenario could be permitted for an annual average of approximately 1.5 mgd of irrigation quantities.

Components of the system would include a surface water withdrawal pump station, a 30-acre reservoir, a pump station and distribution system, and a surface water runoff interception/diversion ditch. A 500-foot intake ditch would convey water from an intermittent stream to a sump where it would be withdrawn by a 3,000-gpm pump and conveyed via a 6,000 foot, 16-inch diameter pipe to a 30-acre irrigation reservoir. Water from the

Farm-Sited Weather Station

reservoir would be distributed to the fields using two 2,500 gpm pumps and 25,000 feet of irrigation main. A 6,100-foot interception ditch would divert runoff to an existing wetland perimeter ditch that would discharge into the sump. Control structures would be installed on the interception ditch to maintain base flow downstream and allow large storm events to bypass the ditch.

The amount of rainwater that could be harvested is conservatively estimated to be 0.53 mgd, which is 35 percent of the annual average water use allocation and 76 percent of the fall allocation. Assuming the grower participated in incentive programs such as FARMS and the NRCS Environmental Quality Incentives Program, the cost to the grower could be significantly less than the $2,980,000 capital cost. The water savings that could be achieved by implementing similar rainwater harvesting systems in the planning region is conservatively estimated to be 12.4 mgd. See Table 5-9 for a summary of this option's potential costs and savings.

Table 5-9. *Rainwater Harvesting costs/savings*

Option	Potential Savings (mgd)[1]	Capital Cost[2]	O&M Cost	Cost/1,000 Gallons[3]
Rainwater Harvesting	12.4	$2,980,000	$98.90/Acre	$2.16

[1] If implemented in year 2010 on all acreage; does not include nurseries.
[2] Costs estimated in 2004 and included depreciation, insurance, taxes and repairs.
[3] HSW (2004).

Agricultural Alternative Source Option #2. Reclaimed Water

Reclaimed water has safely been used for more than 40 years for agricultural irrigation in Florida, and currently more than 9,000 acres of edible crops within the District are irrigated with reclaimed water (DEP, 2014). The feasibility of using reclaimed water for agriculture depends on the location of the reclaimed water infrastructure and the type of crop requiring irrigation. In accordance with Florida Administrative Code (F.A.C.) 62-610.475, edible crops irrigated with reclaimed water are required to be peeled, skinned, cooked or thermally processed before consumption. Indirect application methods are also allowable, such as ridge and furrow irrigation, drip irrigation or subsurface distribution systems for use on crops such as tomatoes, strawberries and vegetables. Chapter 4, Section 3, contains a discussion of reclaimed water availability, and Chapter 5, Section 3, contains a list of identified reclaimed water options, including agricultural supply.

Agricultural Alternative Source Option #3. Surface Water Sources

A field-scale example of this option is the M.D. Council and Sons Surface Water Withdrawal Project in Hillsborough County. The project includes a surface water irrigation reservoir, two surface water irrigation pump stations, and the necessary piping to connect the surface water reservoir to the existing irrigation system. The annual average groundwater withdrawal is 0.28 mgd for irrigation of 60 acres of strawberries and melons. The estimated water savings from this project is 30 percent of permitted quantity, or approximately 0.08 mgd. See Table 5-10 for a summary of this option's potential costs and savings.

Table 5-10. *Surface Water Sources costs/savings*

Option	Potential Savings (mgd)	Capital Cost	O&M Cost ($)/Acre	Cost/1,000 Gallons
Surface Water Project	0.08	$270,000	NA	$0.77

Section 3. Reclaimed Water Options

Reclaimed water systems in the planning region are generally in the early stages of development and, as such, the representative project options are dominated by golf course, large industrial and new residential development options. The focus is on selectively discontinuing the disposal of treated wastewater in rapid infiltration basins and spray fields and using it beneficially and/or increasing reclaimed water quality. Listed below are the different types of reclaimed water options that are compatible with the geology, hydrology, geography and available reclaimed water supplies in the planning region.

- **Augmentation With Other Sources:** introduction of another source (stormwater, surface water, groundwater) into the reclaimed water system to expand available supply
- **Distribution:** expansion of a reclaimed water system to serve more customers
- **Efficiency/Research:** the study of how utilities can maximize efficiency and offset potential of reclaimed water systems to conserve water (rate structures, telemetry control, watering restrictions, metering and others) and research (water quality, future uses)
- **Interconnect:** interconnection of systems to enhance supply and allow for better utilization of the resource or to enable agricultural or other water use permit exchanges
- **Natural System Enhancement/Recharge:** introduction of reclaimed water to create/restore natural systems and enhance aquifer levels (indirect potable reuse)
- **Saltwater Intrusion Barrier:** injection of reclaimed water into an aquifer in coastal areas to create a salinity barrier
- **Storage:** reclaimed water storage in ground storage tanks and ponds
- **Streamflow Augmentation:** introduction of reclaimed water downstream of water withdrawal points as replacement flow to enable additional utilization of the surface water supply
- **System Expansion:** construction of multiple components (transmission, distribution, storage) necessary to deliver reclaimed water to more customers
- **Transmission:** construction of large mains to serve more customers
- **Potable reuse:** purification of reclaimed water to meet drinking water standards prior to introduction

The beneficial utilization of reclaimed water has for decades been a key component of water resource management within the District. For the past several years, Districtwide reclaimed water utilization has been at around 50 percent for non-potable purposes such as landscape irrigation, agricultural irrigation, aesthetic uses, groundwater recharge, industrial uses, environmental enhancement, and fire protection purposes.

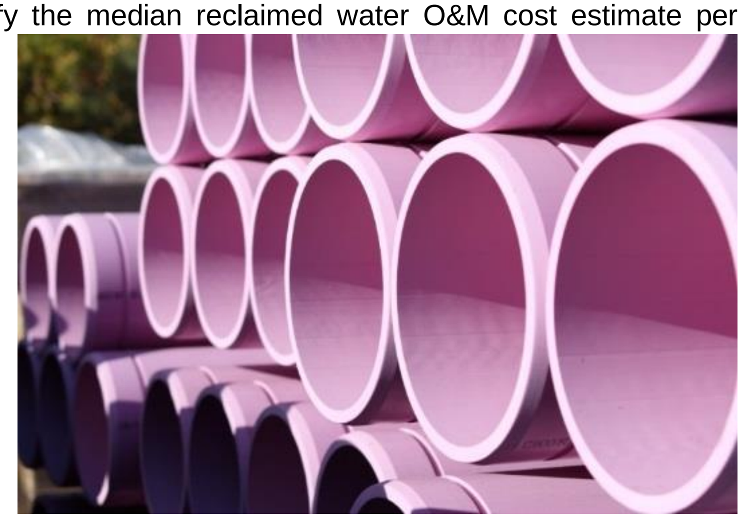
Recently, as drought and long-term water shortages have occurred within other states and countries, reclaimed water has been investigated as a potable source. The “unintentional” use of reclaimed water as a potable source is not new, as many surface water sources that are used for potable raw water supplies have upstream wastewater/reclaimed water discharges. For instance, much of the flow of the Trinity River in Texas during the dry season comes from Dallas and Fort Worth wastewater treatment plants and the Trinity River is the main source of drinking water for the City of Houston. However, what is relatively new is the discussion of “direct potable reuse” with little to no lag time between discharge of purified water from a reclamation facility and use as raw water by a potable water facility.

Several high profile projects have been investigated in western states and in other countries which involve the process of treating reclaimed water to state and federal drinking water standards so that it can be recycled for potable water supply uses. Three notable potable reuse projects that have been implemented using purified water are the Big Springs Texas Water Supply Project, the Las Vegas/Southern Nevada Water Supply Authority augmentation of Lake Meade, and the Singapore NEWATER Project.

Although direct potable reuse is not currently being implemented by utilities within the District, there is increasing interest in the concept, and it is included as a viable future water supply option in this RWSP.

The District developed 26 reclaimed water project options for the planning region with input from utilities and other interested parties. The District determined the quantity of reclaimed water available for each option based on an analysis of wastewater flows anticipated to be available in 2035 at a utilization rate of 70 percent (Chapter 4 Appendix, Table 4-1). It is recognized that the viability of some options depends on whether certain other options are developed, and not all options can be developed because some would use the same reclaimed water source. The options are listed in Table 5-11.

Flow and capital cost data for the 98 reclaimed water projects originally identified as being under development (post-2010) within the District were used to develop a representative cost per 1,000 gallons supplied and capital cost for each option. The data show that, for projects anticipated to come online between 2010 and 2020, the average capital cost is approximately $8.06 million for each 1 mgd supplied. This figure was used in cost calculations for individual reclaimed water options, unless specific cost data were available. In addition to capital costs, O&M costs for each of the representative options were estimated. Reclaimed water flow data and O&M cost data associated with existing reclaimed water systems were collected during past regional water supply efforts to identify the median reclaimed water O&M cost estimate per 1,000 gallons supplied. The data show that reclaimed water O&M costs are relatively consistent across system sizes, with a median cost of $0.30 per 1,000 gallons supplied. This figure was used in cost calculations for individual reclaimed water options, unless system-specific O&M cost data were available.



Reclaimed water pipes

Table 5-11. *List of reclaimed water options for the Northern Planning Region*

Option Name and Entity	County	Type	Supply (mgd)	Offset (mgd)	Capital Cost	Cost/Benefit	O&M/Offset
Reuse Expansion Williston WWTP 2016–2035, City of Williston	Levy	System Expansion	0.13	0.09	$1,047,800	$2.29	$0.30
Reuse Expansion Citrus Beverly Hills/Rolling Oaks WWTP 2016–2035, Citrus County	Citrus	System Expansion	0.35	0.24	$2,821,000	$2.31	$0.30
Reuse Expansion Citrus Brentwood WWTP 2016–2035, Citrus County	Citrus	System Expansion	0.42	0.29	$3,385,200	$2.30	$0.30
Reuse Expansion Citrus Meadowcrest WWTP 2016–2035, Citrus County	Citrus	System Expansion	0.20	0.15	$1,612,000	$2.12	$0.30
Reuse Expansion Citrus Sugar Mill Woods WWTP 2016–2035, Citrus County	Citrus	System Expansion	0.44	0.33	$3,546,400	$2.12	$0.30
Reuse Expansion Citrus Springs WWTP 2016–2035, Citrus County	Citrus	System Expansion	1.04	0.73	$8,382,400	$2.26	$0.30
Reuse Expansion Crystal River WWTP 2016–2035, (to existing customer) City of Crystal River	Citrus	System Expansion	0.05	0.05	$0	$0.00	$0.30
Reuse Expansion Point of Woods WWTP 2016 – 2035, Citrus County	Citrus	System Expansion	0.02	0.015	$161,200	$2.12	$0.30
Reuse Expansion City of Inverness WWTP 2016–2035, City of Inverness	Citrus	System Expansion	0.13	0.09	$1,047,800	$2.29	$0.30
Continental County Club WWTP Reclaimed Water Project 2016–2035, Continental Utilities	Sumter	System Expansion	0.07	0.05	$564,200	$2.22	$0.30
Reuse Expansion City of Bushnell WWTP 2016–2035, City of Bushnell	Sumter	System Expansion	0.35	0.26	$2,821,000	$2.14	$0.30
Reuse Expansion Little Sumter WWTP 2011–2030 to existing customers, The Villages	Sumter	System Expansion	0.09	0.07	$0	$0.00	$0.30
Reuse Expansion Central Sumter WWTP 2016–2035 to existing customers, The Villages	Sumter	System Expansion	0.71	0.49	$0	$0.00	$0.30
Reuse Expansion North Sumter WWTP 2016–2035 to existing customers, The Villages	Sumter	System Expansion	0.23	0.16	$0	$0.00	$0.30
Reuse Expansion Sumter Correctional WWTP 2016–2035 (to existing customer), Florida Department of Corrections	Sumter	System Expansion	0.02	0.02	$0	$0.00	$0.30
Reuse Expansion City of Wildwood WWTP 2016–2035 to existing customer (The Villages), City of Wildwood	Sumter	System Expansion	1.30	0.92	$0	$0.00	$0.30

Option Name and Entity	County	Type	Supply (mgd)	Offset (mgd)	Capital Cost	Cost/Benefit	O&M/Offset
Reuse Expansion City of Dunnellon WWTP 2016–2035, City of Dunnellon	Marion	System Expansion	0.23	0.16	$1,853,800	$2.28	$0.30
Reuse Supply Expansion City of Ocala WWTPs #1 and #2 to existing customers, City of Ocala (supplies coming into District)	Marion	System Expansion	0.01	0.01	$0	$0.00	$0.30
Reuse Expansion Marion Landing WWTP 2016–2035, Marion Landing	Marion	System Expansion	0.03	0.02	$241,800	$2.38	$0.30
Reuse Expansion On Top of the World Bay Laurel WWTP 2016–2035 to existing customers, Bay Laurel	Marion	System Expansion	0.34	0.26	$0	$0.00	$1.30
Reuse Expansion Marion Oak Run WWTP 2016–2035, Marion County	Marion	System Expansion	2.18	1.52	$17,570,800	$2.28	$0.30
Reuse Expansion Rainbow Springs WWTP 2016–2035, City of Dunnellon	Marion	System Expansion	0.09	0.06	$725,400	$2.38	$0.30
Reuse Expansion Hernando County Airport WWTP 2016–2035, Hernando. County	Hernando	System Expansion	1.48	1.03	$11,928,800	$2.28	$0.30
Reuse Expansion Hernando Ridge Manor WWTP 2016–2035, Hernando County	Hernando	System Expansion	0.24	0.17	$1,934,400	$2.24	$1.30
Reuse Expansion Hernando County The Glenn WWTP 2016–2035, Hernando County	Hernando	System Expansion	1.45	1.01	$11,687,000	$2.28	$0.30
Reuse Expansion City of Brooksville WWTP 2016–2035, City of Brooksville	Hernando	System Expansion	0.53	0.37	$4,271,800	$2.27	$0.30
Totals: 26 Options			**12.13**	**8.57**	**$ 75,602,800**	**$1.56**	**$0.30**

The use of italics denotes SWFWMD estimations.
Not all projects have estimated costs. Some options are contingent upon others. WWTPs with no available (unused) 2035 flows were not included.
Benefit = (if estimated) Annualized Supply: 1. x 75% for Ag, & R/A/C, 2. x 100% for I/C, NSR, & PG. 3. x 75% for Variety and 4. for RES is number of customers X 300 gpd.
ASR & Intrusion Barrier Costs = (if estimated) Annualized Supply x 4 x $1,000,000 + $300,000.
Total Cost = (if estimated) = Annualized Supply x $8.06/Gallon (calc. of 98 Draft under development 2010–2020 District funded reuse projects (@ $473.6 million for 58.76 mgd reuse supply).
Preliminary Cost per 1,000 Gallons Benefit= Project Cost amortized over 30 years @ a 6 percent interest rate.
System Expansion Supply 2016–2035 = Projected 2035 WWTP Flow x 70% (rounded down) minus 2020 Reuse (existing & planned reuse projects).
Preliminary O&M cost estimates were calculated using a median O&M cost if no specific data was available (SWFWMD, 2005b).
Preliminary O&M costs per 1,000 gallons "Benefit" were calculated utilizing costs per 1,000 gallons "supplied" data normalized for individual project efficiency.

Section 4. Surface Water/Stormwater Options

Chapter 4 discusses the availability of surface water in the Withlacoochee River Basin for public supply water use. Use of surface water entails specific treatment, reliability of quantity and quality of source waters, and management of any associated environmental impacts to downstream ecology and water resources. These characteristics should be identified and addressed at the planning level. The surface water options identified below are based on the Withlacoochee River System's flow characteristics, future demand for water supply in the region and associated environmental resource data. More detail on all the surface water options can be found in the WRWSA Regional Water Supply Plan 2014 Update (Cardno-Entrix, 2014).

Surface Water/Stormwater Option #1. Withlacoochee River Surface Water Supply Facility in Northern Sumter County

- Entity Responsible for Implementation: WRWSA

This option is for a surface water supply facility that could provide up to 10 mgd on an annual average basis to customers in the City of Wildwood and The Villages. Water would be withdrawn from the Withlacoochee River in northern Sumter County, downstream of the Lake Panasoffkee Outlet River. During low-flow periods when withdrawals from the river would be limited, the facility would be supplemented by groundwater withdrawals in Sumter County, which would eliminate the need for a reservoir. The use of surface water would extend the availability of groundwater by reducing the frequency and duration of groundwater withdrawals. The proposed location of the facility is on property owned by the District west of Lake Panasoffkee and north of the Outlet River. Conceptual project components include a river intake and raw water pump station, a water treatment facility, two 10 million gallon tanks for finished water storage, a finished water pumping station, and approximately 22 miles of finished water transmission mains. See Table 5-12 for a summary of this option's potential costs.

Table 5-12. *Withlacoochee River Surface Water Supply Facility option costs (Northern Sumter County)*

Quantity Produced (mgd)	Capital Cost	Capital Cost/mgd	Total Cost/1,000 Gallons	O&M Annual Costs
10	$103,164,000	$10,300,000	$2.82	$4,500,000

Issues:

- A detailed study of the effect of the river intake on the natural environment in the area and on the river flow regime will need to be performed in order to determine the exact location and design of the intake structure.
- Minimum lake levels have been established for Lake Panasoffkee and the Tsala Apopka Chain of Lakes. Impacts to these lakes will be an important consideration during the process to permit additional groundwater and surface water withdrawals in the vicinity.

Surface Water/Stormwater Option #2. Withlacoochee River Surface Water Supply Near Holder

- Entity Responsible for Implementation: WRWSA

This option is for a surface water supply facility with a capacity of 25 mgd that could potentially serve customers in the City of Ocala and northwest Citrus and western Hernando counties. Water would be withdrawn from the Withlacoochee River near SR 200 and would require an off-stream reservoir to achieve the desired supply reliability. The proposed location of the facility is on property owned by the District in Marion County, northeast of the Town of Holder. Conceptual project components include a river intake and pumping station, an off-stream reservoir with a storage capacity of 3 billion gallons, a transfer pump station to move water from the reservoir to the treatment facility, a water treatment facility, finished water storage tanks, a finished water pumping station, and approximately 51 miles of finished water transmission mains. See Table 5-13 for a summary of this option's potential costs.

Table 5-13. *Withlacoochee River Surface Water Supply option costs (Near Holder)*

Quantity Produced (mgd)	Capital Cost	Capital Cost/mgd	Total Cost/1,000 Gallons	O&M Annual Costs
25	$406,409,000	$16,256,000	$3.74	$11,250,000

Issues:

- A detailed study of the effect of the river intake on the natural environment in the area and on the river flow regime will need to be performed in order to determine the exact location and design of the intake structure.
- Further geologic evaluation of the proposed reservoir area will be needed. Due to the high permeability of geologic units in the area, a reservoir liner to prevent excessive water loss was included in the conceptual design.

Surface Water/Stormwater Option #3. Surface Water Treatment Facility at Lake Rousseau

- Entity Responsible for Implementation: WRWSA

This option is for a surface water supply facility with a capacity of 25 mgd with the potential to serve customers in the City of Ocala and northwest Citrus and western Hernando counties. Water would be withdrawn directly from Lake Rousseau and pumped north of the lake, approximately four miles, to a water treatment plant in southern Levy County on property owned by the FDACS. An off-stream reservoir is not included because of the year-round high-volume inflow from Rainbow Springs via the Rainbow River. Project components include a river intake and pumping station, a raw water transmission main, a water treatment facility, finished water storage tanks, a finished water pumping station, and approximately 63 miles of finished water transmission main. A closer location south or east of the lake may reduce overall transmission lengths and should be explored if this location is considered in future evaluations. See Table 5-14 for a summary of this option's potential costs.

Table 5-14. *Surface Water Treatment Facility at Lake Rousseau option costs*

Quantity Produced (mgd)	Capital Cost	Capital Cost/mgd	Total Cost/1,000 Gallons	O&M Annual Costs
25	$306,530,000	$12,261,000,000	$3.12	$11,300,000

Issues:

- The District will not be setting a minimum level for Lake Rousseau because it is a reservoir. However, the USACE regulation schedule at the Inglis Dam will need to be considered.

Section 5. Brackish Groundwater Desalination Options

Brackish groundwater is treated and used extensively in the Southern and Tampa Bay planning regions for potable supply. In some areas of the Northern Planning Region, brackish groundwater could be a viable source of water supply. However, no groundwater options requiring costly brackish treatment systems have been evaluated for the RWSP because of the availability of fresh groundwater, reclaimed water, and high conservation potential to meet demands within the timeframe. Any requests for brackish groundwater withdrawals would be evaluated similarly to requests for fresh groundwater withdrawals.

Section 6. Seawater Desalination Options

As discussed in Chapter 4, the WRWSA reevaluated the option to co-locate a seawater desalination facility with the Crystal River power station in 2014. Operational changes at the power station have necessitated some conceptual modifications to the project option. The high-capacity flows for once-through cooling at the power station are scheduled for decommissioning, reducing the benefits using the station’s existing intakes and discharges for dilution of concentrate byproduct. The WRWSA RWSP 2014 Update included conceptual design alternates using similar production capacity and distribution configurations with a variety of concentrate disposal options, including deep well injection, ocean outfall, and zero-liquid discharge systems. The option utilizing deep well injection for concentrate disposal was found to be the most economically feasible and is presented below.

Seawater Desalination Option #1. Crystal River Power Station

- Entity Responsible for Implementation: WRWSA

This option is for the development of a seawater desalination plant with a capacity of 15 mgd that would be co-located with the Crystal River power station complex in Citrus County. The facility could serve multiple utilities in Citrus, Marion and Hernando counties. The facility’s production capacity would be 15 mgd. The withdrawal location would be in the Cross Florida Barge Canal, seaward of the Inglis Dam, and would consist of a concrete weir with screens and a floating barrier. The raw water intake and pumping station would require 3.7 miles of 42-inch raw water transmission lines to the treatment facility.

Since the Barge Canal receives large freshwater discharges from Lake Rousseau, water salinity or total dissolved solids (TDS) in the barge canal typically fluctuate between 15 to 20 ppt, and can vary from fresh to seawater (35 ppt). The typical salinity range of 20 ppt or below is desirable in comparison to direct seawater to reduce operating costs associated with pumping at high pressures for reverse osmosis. The facility would be designed to deal with the variability in Barge Canal water quality, including an extensive pretreatment system necessary during periods when Lake Rousseau is discharging to the Barge Canal in order to remove organic constituents that would impact performance of reverse osmosis membranes.

The treatment and appurtenant facilities would require a 10-acre site. Two storage tanks would be provided on site for plant downtime and transmission system interruptions. A deep well injection system would pump concentrate into confined subsurface rock formations, likely thousands of feet below surface, and capital expenses would include a geological evaluation at the site. The conceptual project cost, as shown below in Table 5-15, includes approximately 34 miles of transmission lines to provide regional supply to multiple demand centers and includes easement acquisitions. Due to the difference in chemistry between treated seawater and treated groundwater supplies at existing utility systems, blending stations capable of stabilization for corrosion control and disinfection bi-products would be necessary at utility connection points.

Table 5-15. *Crystal River Power Station option costs*

Quantity Produced (mgd)	Capital Cost	Capital Cost/mgd	Total Cost/1,000 Gallons	O&M Annual Costs
15	$221,804,000	$14,800,000	$5.68	$18,684,000

Issues:

- Changing land uses at and near the Crystal River power station and barge canal may impact the feasibility of the desalination option; including operation of the current power station, the proposed Levy Nuclear Power Plant, and other future developments.

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Chapter 6. Water Supply Projects Under Development

This chapter is an overview of water supply projects that are under development in the Northern Planning Region. Projects under development are those the Southwest Florida Water Management District (District) is co-funding and are either (1) actively in the planning, design, or construction phase, or (2) not yet in the planning phase, but have been at least partially funded through FY2015, or (3) have been completed since the year 2010 and are included to report on the status of implementation since the previous Regional Water Supply Plan (RWSP).

The demand projections presented in Chapter 3 show that approximately 62.83 mgd of new water supply will need to be developed during the 2015–2035 planning period to meet demand for all use sectors in the planning region. As of 2015, it is estimated that at least 7 percent of that demand (4.31 mgd) has either been met or will be met by projects that meet the above definition of being "under development."

In addition to these projects under development, it is probable that additional water supplies are being developed by various entities in the planning region outside of the District's funding programs.

Section 1. Water Conservation

1.0 Non-Agricultural Water Conservation

1.1 Indoor Water Conservation Projects

Since 2010, the District has cooperatively funded the distribution of approximately 1,565 ultra low-flow or high-efficiency fixtures in the planning region. These programs have cost the District and cooperating local governments a combined $231,276, and have yielded a potable water savings of approximately 29,238 gallons per day (gpd). Table 6-1 provides information on indoor water conservation projects that are under development.

Table 6-1. *List of indoor conservation projects under development in the Northern Planning Region*

Cooperator	Project Number	General Description	Savings (gpd)	Devices and Rebates	Total Cost[1]	District Cost	$/1,000 gal Saved
Marion County	N253	Toilet Rebate	4,700	272	$37,814	$18,907	$2.21
Bay Laurel CDD	N365	Toilet Rebate	4,708	399	$60,000	$30,000	$3.50
Marion County	N411	Toilet Rebate	6,030	344	$49,062	$24,531	$2.24
Citrus County	N634	Toilet Rebate	3,630	150	$19,400	$6,466	$1.47
Marion County	N639	Toilet Rebate	10,170	400	$65,000	$32,500	$1.76
Total			**29,238**	**1,565**	**$231,276**	**$112,404**	**$2.18[2]**

[1] The total project cost may include variable project-specific costs including marketing, education and administration.
[2] Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.

1.2 Outdoor Water Conservation

Since 2010, the District has cooperatively funded 1,050 rain sensor rebates and landscape and irrigation evaluations in the planning region. These programs have cost the District and cooperating local governments a combined $295,272 and have yielded a potable water savings of approximately 228,819 gpd. Table 6-2 provides information on outdoor water conservation projects that are under development.

Table 6-2. *List of outdoor conservation projects under development in the Northern Planning Region*

Cooperator	Project Number	General Description	Savings (gpd)	Sensors/ Audits	Total Cost[1]	District Cost	$/1,000 gal Saved
WRWSA	N278	Irrigation Evaluation	79,352	366	$138,258	$69,129	$1.16
WRWSA	N491	Irrigation Evaluation	80,667	304	$68,114	$34,057	$0.56
Citrus County	N620	Rain Sensor Rebate	10,000	100	$9,400	$3,133	$0.63
WRWSA	N640	Irrigation Evaluation	58,100	280	$79,500	$39,750	$0.90
Total:			**228,819**	**1,050**	**$295,272**	**$146,069**	**$0.86[2]**

[1] The total project cost may include variable project-specific costs including marketing, education and administration.
[2] Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.

2.0 Agricultural Water Conservation Projects

The following provides information on agricultural water conservation projects that are under development in the planning region. The District's largest agricultural water conservation initiatives, the Facilitating Agricultural Resource Management Systems (FARMS) Program and the well back-plugging program, are not included in this section because the District classifies the programs as water resource development. Details of the programs, including projects under development, are contained in Chapter 7, Water Resource Development.

2.1 Institute of Food and Agricultural Sciences (IFAS) Research and Education Projects

The District provides funding for IFAS to investigate a variety of agriculture issues that involve water conservation. These include, but are not limited to, development of tailwater recovery technology, determination of crop water use requirements, evaluation of alternative irrigation methods, field irrigation scheduling, and frost/freeze protection. IFAS conducts the research and then promotes the results to the agricultural community. In 2010, the District had 20 active IFAS research projects covering both urban landscape issues and agricultural commodity issues throughout the District region. Since then, the District has funded an additional 22 projects. During this time, the District has funded research on strawberries, citrus, tomatoes, potatoes, peaches, biofuel grasses, turf grass, peppers, blueberries, and various landscape and nursery ornamental plants and trees. Of the 42 research projects, 30 have been completed. Completed projects include eight projects dealing with urban landscape issues and 22 involving various agricultural commodities. While the research projects are not specific to each planning region, they are specific to a commodity group that has a strong presence in each region. The research will help develop best management practices that will conserve water District wide. Specific benefits to the planning region are dependent on the commodities dominant in that planning region. The 12 ongoing projects are described in Table 6.3.

Table 6.3. *List of agricultural water conservation research projects*

Project	Total Project Cost + District Cooperator	Total Project and Land Cost	Funding Source	Planning Region(s)[1]
Reduction of Water Use for Citrus Cold Protection	$16,500	$16,500	District	All
Florida Automated Weather Network Data Dissemination and Education	$450,000	$450,000	District	All
Irrigation Scheduling to Address Water Demand of Greening-Infected Citrus Trees	$96,000	$96,000	District	All
Evaluation of Bed Geometry for Water Conservation on Drip Irrigated Tomatoes in Southwest Florida	$200,000	$200,000	District	All
Determination of Differences in Water Requirements for Greening Infected Citrus Trees and Healthy Citrus Trees	$122,300	$122,300	District	All
Exploring the Feasibility of Converting Seepage to Center Pivot Irrigation for Commercial Potatoes	$204,000	$204,000	District	All
Automatic sprinkler irrigation in container nurseries using a web-based program	$252,500	$252,500	District	All
Determination of Irrigation Requirements for Peaches	$197,625	$197,625	District	All
Development of Irrigation Schedules & Crop Coefficients for Three Tree Species	$107,760	$107,760	District	All
Managing Forests for Increased Regional Water Availability	$101,661	$101,661	District	All
Development of Landscape Fertilizer Best Management Practices	$397,129	$397,129	District	All
Determination of Landscape Irrigation Water Use	$631,500	$631,500	District	All
Total	**$2,776,975**	**$2,776,975**		

[1] Selected research projects affect the Southern Planning Region, but the outcome can benefit other planning regions.

Section 2. Reclaimed Water

1.0 Reclaimed Water Projects: Research, Monitoring, and Education

Continued support of reclaimed water research and monitoring is central to maximizing reclaimed water use and increasing benefits. The District assists utilities in exploring opportunities for increased utilization of reclaimed water and supports applied research projects, which not only include innovative treatment and novel uses of reclaimed water, but also nutrient and constituent monitoring. Table 6-4 is a list, description and summary of the benefits and costs that have been or will be realized by 9 reclaimed water projects currently under development. It is anticipated that these projects will be online by 2020.

Table 6-5 includes general descriptions and a summary of 10 research projects for which the District has provided more than $1,026,000 in funding. The District has also committed to developing a comprehensive reclaimed water education strategy. All reclaimed water construction projects funded by the District require education programs that stress the value and benefits of efficient and effective water use, regardless of the source. To provide reclaimed water information to a broader audience, the District has developed a web page which is one of the top internet sources of reuse information, including GIS and other data. The District also produces reclaimed water publications that are offered to residents, utilities, engineering firms, environmental agencies and other parties interested in developing and expanding reclaimed water systems.

Construction of Crystal River to Duke Energy reclaimed water pipeline

Table 6-4. *List of Reclaimed water projects under development in the Northern Planning Region*

Cooperator	General Project Description	Reuse (mgd)			Customer (#)		Costs		
		Produced	Benefit	Stored	Type	Total	Total	District[1]	$/1,000[2]
Citrus County									
City of Inverness	Trans/Pump L468	0.41	0.31	3.00	GC, Rec	3	$2,010,000	$1,138,650	$1.26
Citrus County Meadowcrest	Trans/Pump N242	0.52	0.39	-	GC	1	$300,000	$150,000	$0.15
City of Crystal River	Trans/Pump/Store N358	0.75	0.75	1.5	IND	1	$6,228,712	$3,600,364	$1.63
Citrus Sugarmill Woods	Treat/Trans/Pump WC02	0.47	0.35	0	GC	2	$12,000,000	$8,000,000	$6.75
Hernando County									
City of Brooksville	Pump/Store/Trans L169	0.64	0.38	10.50	GC, Res	1	$5,089,140	$3,730,226	$2.64
Marion County									
Marion County	Pump/Store/Trans L650	0.50	0.35	5.00	GC	2	$3,116,000	$1,558,000	$1.64
Marion County Spruce Creek	Trans/Pump N279	0.35	0.26	0	GC	1	$1,622,000	$811,000	$1.23
Bay Laurel Center Community (OTOW)	Pump/Store/Trans L786	0.79	0.59	2.50	Rec, GC	4	$2,198,000	$1,099,000	$0.73
Sumter County									
City of Bushnell	Treat/Pump/Store/Trans N673	0.22	0.22	1.50	Ag	1	$1,609,833	$1,409,833	$1.44
Total	**9 Projects**	**4.65**	**3.60**	**24**		**16**	**$34,173,685**	**$21,497,073**	**$1.94**

[1] Costs include all revenue sources budgeted by the District.
[2] Cost per 1,000 gal calculated at 6 percent interest amortized over a 30-year project life.

Table 6-5. *List of reclaimed water research projects under development in the District*

Cooperator	General Project Description	Costs[1]	
		Total	District[2]
WateReuse Foundation	Water Treatment Study L112	$500,000	$275,000
WateReuse Foundation	Water Quality Study P872	$520,000	$282,722
WateReuse Foundation	Pathogen Study P173	$216,000	$34,023
WateReuse Foundation	Research Cost Study P174	$200,000	$70,875
WateReuse Foundation	Research Study ASR P175	$393,000	$72,410
WateReuse Foundation	Storage Study P694	$300,000	$100,000
WateReuse Foundation	Soil Aquifer Treatment P695	$200,000	$66,667
WateReuse Foundation	Wetlands Study P696	$200,000	$66,667
WateReuse Foundation	Nutrient Study P698	$305,100	$16,700
WateReuse Foundation	Nutrient II P966	$380,000	$41,666
TOTAL (DISTRICTWIDE)	**10 Projects**	**$3,214,100**	**$1,026,730**

[1] Cost per 1,000 gal benefits not applicable to research studies.
[2] Costs include all revenue sources budgeted by the District.

Section 3. Aquifer Recharge

1.0 Indirect Recharge

Although there are active projects using indirect aquifer recharge (AR) in the Northern Planning Region by implementation of reclaimed water rapid infiltration basins or spray field sites, the locations of these sites and the water quality of the reclaimed water sources are not optimal. Suitable indirect AR locations and source water quality are important when considering AR in regions where the Upper Floridan aquifer is unconfined and existing springs are in close proximity and susceptible to water quality degradation. Indirect AR projects should be located further inland and up-gradient in the regional groundwater flow systems to provide better reclaimed water quality with reduced nutrient loads. There are no direct AR projects in the planning region.

Chapter 7. Water Resource Development Component

This chapter addresses the legislatively required water resource development activities and projects that are conducted primarily by the District. The intent of water resource development projects is to enhance the amount of water available for regional-beneficial uses and for natural systems. Section 373.019, Florida Statutes (F.S.), defines water resource development as: *"Water resource development" means the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation, and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and groundwater recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities"* (Subsection 373.019[24], F.S.). The District is primarily responsible for implementing water resource development; however, additional funding and technical support may come from state, federal, and local entities.

Part A. Overview of Water Resource Development Efforts

The District classifies water resource development efforts into two categories. The first category encompasses data collection and analysis activities that support water supply development by local governments, utilities, regional water supply authorities and others. These activities are discussed in Section 1, below. The second category includes more narrowly defined "projects," which are regional projects designed to create an identifiable supply of water for existing and/or future reasonable-beneficial uses. These projects are discussed in Section 2.

Section 1. Data Collection and Analysis Activities

The District budgets significant funds annually to implement the water resource development data collection and analysis activities, which support the health of natural systems and water supply development. Table 7-1 displays the FY2015 budget and anticipated five-year funding levels for Districtwide data collection and analysis activities. Approximately $24.5 million will be allocated toward these activities annually for a five-year total of approximately $122 million. Because budgets for the years beyond FY2015 have not yet been developed, but are projected to be fairly constant, future funding estimates for activities are set equal to FY2015 funding. Funding for these activities is primarily from the Governing Board's allocation of ad valorem revenue collected within the District. In some cases, additional funding is provided by water supply authorities, local governments, and the United States Geological Survey (USGS). The activities listed in Table 7-1 are described in subsections 1.0 through 5.0, below.

Table 7-1. *Water Resource Development data collection and analysis activities*

	WRD Data Collection and Analysis Activities	FY2015 Funding	Anticipated 5-Year Funding	Funding Partners
1.0	**Hydrologic Data Collection**			SWFWMD, other WMDs, USGS, DEP, FFWC
1.1	Surface Water Flows and Levels	$1,987,417	$9,937,085	
1.2	Geohydrologic Data Well Network (includes ROMP)	$1,783,791	$8,918,955	
1.3	Meteorologic Data	$210,861	$1,054,305	
1.4	Water Quality Data	$671,138	$3,355,690	
1.5	Groundwater Levels	$567,438	$2,837,190	
1.6	Biologic Data	$852,693	$4,263,465	
1.7	Data Support	$2,247,794	$11,238,970	
2.0	**Minimum Flows and Levels Program**			SWFWMD
2.1	Technical Support	$1,528,773	$7,643,865	
2.2	Establishment	$445,260	$2,226,300	
2.3	Methodology Research	$48,313	$241,565	
3.0	**Watershed Management Planning**	$5,467,099	$27,335,495	SWFWMD, Local Cooperators
4.0	**Quality of Water Improvement Program**	$591,079	$2,955,395	SWFWMD
5.0	**Stormwater Improvements: Implementation of Storage and Conveyance BMPs**	$8,081,291	$40,406,455	SWFWMD, USGS
	TOTAL	**$24,482,947**	**$122,414,735**	

1.0 Hydrologic Data Collection

The District has a comprehensive hydrologic conditions monitoring program that includes the assembly of information on key indicators such as rainfall, surface and groundwater levels and water quality, and stream flows. The program includes data collected by District staff and permit holders, as well as data collected as part of the District's cooperative funding program with the USGS. This data collection allows the District to gauge changes in the health of water resources, monitor trends in conditions, identify and analyze existing or potential resource problems, and develop programs to correct existing problems and prevent future problems from occurring. This data collection also supports District flood control structure operations, water use and environmental resource permitting and compliance, minimum flows and levels (MFL) evaluation and compliance, the Surface Water Improvement and Management (SWIM) program, the Southern Water Use Caution Area (SWUCA) recovery strategy, modeling of surface water and groundwater systems, and many resource evaluations and reports.

The categories of hydrologic data that are collected and monitored by District staff are discussed below. The District also evaluates the hydrologic data submitted by Water Use Permit (WUP) permit holders to ensure compliance with permit conditions and to assist with monitoring and documenting hydrologic conditions.

1.1 Surface Water Flows and Levels. This includes data collection at the District's 749 surface water level gauging sites, and cooperative funding with the USGS for discharge and water-level data collection at 164 river, stream and canal sites. The data are available to the public through the District's Water Management Information System (WMIS), and through the USGS Florida Water Science Center Web Portal.

1.2 Geohydrologic Data Well Network. The Geohydrologic Data Well Network is a monitor well network that supports various projects throughout the District including the Central Florida Water Initiative, Water Resource Assessment Projects (WRAPs), Water Use Caution Areas, the Northern Tampa Bay Phase III program, the Springs Team, sea level rise and other salt-water intrusion assessments, and development of alternative water supplies. The network includes the Regional Observation and Monitor-well Program (ROMP) which has been the District's primary means for hydrogeologic data collection since 1974. Data from monitor well sites are used to evaluate seasonal and long-term changes in groundwater levels and quality, as well as the interaction and connectivity between groundwater and surface water bodies. During construction of new monitor well sites, valuable hydrogeologic information is collected including the lithology, aquifer hydraulic characteristics, water quality, and water levels.

1.3 Meteorologic Data. The meteorologic data monitoring program consists of measuring rainfall totals every 15 minutes at 135 near real-time rain gauges and 41 recording rain gauges. Annual funding is for costs associated with measurement of rainfall, including sensors, maintenance, repair and replacement of equipment. Funding also supports operation of a mixed-forest wetland evapotranspiration (ET) station by the USGS that measures actual ET. This program is a cooperative effort between the USGS and the five water management districts (WMDs) to map statewide potential and reference ET using data measured from geostationary satellites. The program also includes a collaborative effort between the five WMDs to provide high-resolution radar rainfall data for modeling purposes.

1.4 Water Quality Data. The District's Water Quality Monitoring Program (WQMP) collects data from water quality monitoring networks for springs, streams, lakes, and coastal and inland rivers. Many monitoring sites are sampled on a routine basis, with data analysis and reporting conducted on an annual basis. The WQMP develops and maintains the Coastal Groundwater Quality Monitoring Network, which involves sample collection and analysis from approximately 370 wells across the District to monitor saltwater intrusion and/or the upwelling of mineralized waters into potable aquifers.

1.5 Groundwater Levels. The District maintains 1,558 monitor wells in the data collection network, including 803 wells that are instrumented with data loggers that record water levels once per hour, and 755 that are measured manually by field technicians once or twice per month.

1.6 Biologic Data. The District monitors ecological conditions as they relate to both potential water use impacts and changes in hydrologic conditions. Funding for biologic data collection includes support for routine monitoring of approximately 190 wetlands to document changes in wetland health and assess level of recovery in impacted wetlands. Funding also supports an effort to map the estuarine hard bottom of Tampa Bay, as well as SWIM program efforts for mapping and monitoring of seagrasses in priority water bodies including Tampa Bay, Sarasota Bay, Charlotte Harbor, and the Springs Coast area.

1.7 Data Support. This item provides administrative and management support for the WQMP, hydrologic and geohydrologic staff support, the District's chemistry laboratory, and the District's Supervisory Control and Data Acquisition (SCADA) system.

2.0 Minimum Flows and Levels Program

Minimum flows and levels (MFLs) are hydrologic and ecological standards that can be used for permitting and planning decisions concerning how much water may be safely withdrawn from or near a water body. Florida law (Section 373.042, F.S.) requires the WMDs or the DEP to establish MFLs for aquifers, surface watercourses, and other surface water bodies to identify the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. Rivers, streams, estuaries and springs require minimum flows, while minimum levels are developed for lakes, wetlands and aquifers. MFLs are adopted into District rules, Chapter 40D-8, Florida Administrative Code (F.A.C.), and are used in the District's water use permitting program to ensure that withdrawals do not cause significant harm to water resources or the environment.

The District's process for establishing MFLs includes an independent scientific peer review and an opportunity for interested stakeholders to participate in a public review, both of which are considered by the Governing Board when deciding whether to adopt a proposed MFL. District monitoring programs also provide data for evaluating compliance with the adopted MFLs, determining the need for recovery strategies, and analyzing the recovery of water bodies where significant harm has been established.

3.0 Watershed Management Planning

The District addresses flooding problems in existing areas by preparing and implementing Watershed Management Plans (WMPs) in cooperation with local governments. The WMPs define flood conditions, identify flood level of service deficiencies, and evaluate best management practices (BMPs) to address those deficiencies. The WMPs include consideration of the capacity of a watershed to protect, enhance, and restore water quality and natural systems while achieving flood protection. The plans identify effective watershed management strategies and culminate in defining floodplain delineations and constructing selected BMPs.

Local governments and the District combine their resources and exchange watershed data to implement the WMPs. Funding for local elements of the WMPs is provided through local governments' capital improvement plans and the District's Cooperative Funding Initiative. Additionally, flood hazard information generated by the WMPs is used by the Federal Emergency Management Agency to revise flood insurance rate maps. This helps better define flood risk and is used extensively for land use planning by local governments and property owners. Since the WMPs may change based on growth and shifting priorities, the District also cooperates with local governments to update the WMPs, when necessary, giving decision-makers opportunities throughout the program to determine when and where funds are needed.

4.0 Quality of Water Improvement Program (QWIP)

The QWIP was established in 1974 through Section 373.207, F.S., to restore groundwater conditions altered by well drilling activities for domestic supply, agriculture, and other uses. The program's primary goal is to preserve groundwater and surface water resources through proper well abandonment. Plugging abandoned artesian wells eliminates the waste of water at the surface and prevents mineralized groundwater from contaminating surface water bodies. Thousands of wells constructed prior to current well construction standards were often deficient in casing, which interconnected aquifer zones and enabled poor-quality mineralized water to migrate into zones containing potable-quality water.

Plugging wells involves filling the abandoned well with cement or bentonite. Isolation of the aquifers is reestablished and the mixing of varying water qualities and free flow is stopped. Prior to plugging an abandoned well, geophysical logging is performed to determine the reimbursement amount, the proper plugging method, and to collect groundwater quality and geologic data for inclusion in the District's database. The emphasis of the QWIP is primarily in the SWUCA where the Upper Floridan aquifer (UFA) is confined. Historically, the QWIP has proven to be a cost-effective method to prevent waste and contamination of potable ground and surface waters.

5.0 Stormwater Improvements: Implementation of Storage and Conveyance BMPs

The District’s WMPs and SWIM programs implement stormwater and conveyance BMPs for preventative flood protection, to improve surface water quality particularly in urban areas, and to enhance surface and groundwater resources. The BMPs involve construction of improvements identified and prioritized in the development of WMPs. Most of the activities are developed through cooperative funding with a local government entity, Florida Department of Transportation, or state funding. Examples of the nearly 40 ongoing BMPs include the City of Tampa’s improvements to stormwater systems in the Manhattan and El Prado area and along Lois Avenue to relieve residential and street flooding, and Pasco County’s installation of a stormwater storage pond and facilities to mitigate flooding near the Riverside Oaks subdivision.

Section 2. Water Resource Development Projects

As of FY2015, the District has 14 ongoing projects that meet the definition of water resource development “projects.” The projects are listed in Table 7-2, below, along with their funding to date, total costs, participating cooperators, the estimated water quantity to be become available, and the planning region benefitted by the project. The total cost of these projects is approximately $203 million and a minimum of 54 mgd of additional water supply will be produced or conserved.

These projects include feasibility and research projects for new alternative water supply, Facilitating Agricultural Resource Management Systems (FARMS) projects to improve agricultural water use efficiency, and environmental restoration projects that assist MFLs recovery. District funding for a number of these projects is matched to varying degrees by local cooperators, including local governments, regional water supply authorities, and others; and some projects have received state and federal funding provided through mechanisms described in Chapter 8. The operation and maintenance costs for developed infrastructure will be the responsibility of local cooperators, unless otherwise noted in the project descriptions provided in this section.

Table 7-2. *Water Resource Development projects costs and District funding*

	Water Resource Development Projects	Prior District Funding through FY2015	Total Project Cost (District + Cooperator)	Funding Source	Water to Become Available	Planning Region of Benefit
1) Alternative Water Supply Feasibility Research and Pilot Projects						
1.1	Clearwater Groundwater Replenishment Project (N179)	$1,612,868	$3,149,230	SWFWMD, City of Clearwater	3 mgd	TBPR
1.2	Hydrogeologic Investigation of Lower Floridan Aquifer in Polk County (P280)	$6,228,949	$12,228,949	SWFWMD	TBD	HPR
1.3	South Hillsborough Aquifer Recharge Program (SHARP) (N287)	$1,245,466	$2,829,893	SWFWMD, Hillsborough County	2 mgd	TBPR
2) Facilitating Agricultural Resource Management Systems (FARMS)						
2.1	FARMS Projects	$44,679,967	$6,000,000 (annual)	SWFWMD, FDACS, State of FL, private farms	40 mgd	All
2.2	Mini-FARMS Program	$685,868	$50,000 (annual)	FDACS, SWFWMD	2 mgd	All
2.3	FARMS Irrigation Well Back-Plugging Program	$1,642,330	$60,000 (annual)	SWFWMD	TBD	SPR, HPR, TBPR
2.4	IFAS BMP Implementation Project	$270,336	$50,000 (annual)	SWFWMD, IFAS	TBD	All
3) Environmental Restoration and Minimum Flows and Levels (MFL) Recovery						
3.1	Lower Hillsborough River Recovery Strategy	$8,254,142	$16,432,407	SWFWMD, City of Tampa	TBD	TBPR
3.2	Lower Hillsborough River Pumping Facilities	$394,512	$4,850,044	SWFWMD, City of Tampa	TBD	TBPR
3.3	Pump Stations on Tampa Bypass Canal	$3,668,040	$3,668,040	SWFWMD, City of Tampa	7.1 mgd	TBPR
3.4	Hillsborough River Groundwater Basin Evaluation (P286)	$75,000	$150,000	SWFWMD	NA	TBPR
3.5	Lake Hancock Lake Level Modification	$9,989,166	$10,428,490	SWFWMD, State of FL, Federal	TBD	HPR, SPR
3.6	Lake Jackson Watershed Hydrology Investigation	$144,255	$443,768	SWFWMD, City or Sebring, Highlands County	NA	HPR
3.7	Upper Myakka /Flatford Swamp Hydrologic Restoration and Implementation	$4,155,475	$48,000,000	SWFWMD, Mosaic	TBD	SPR, HPR

1.0 Alternative Water Supply Research, Restoration and Pilot Projects

The following projects are research and/or pilot projects designed to further the development of the innovative alternative water sources described in the Regional Water Supply Plan (RWSP). Included in these projects are feasibility projects for recharging the UFA with excess reclaimed water and the exploration of Lower Floridan aquifer (LFA) zones as a viable water source for inland utilities. These projects may lead to the development and protection of major sources of water supply in the future.

1.1 Clearwater Groundwater Replenishment Project (N179). This is a multiyear indirect potable reuse study to determine if purified water can be utilized to directly recharge the UFA at the City of Clearwater's Northeast Water Reclamation Facility to supplement potable water withdrawals. The project would potentially enable the City to utilize 100 percent of its reclaimed water, supplement water supplies within the aquifer, and possibly provide a seawater barrier to help prevent saltwater intrusion along the coast. Phase 1 was a one-year desktop feasibility study to assess water level improvements, regulatory requirements and water treatment, estimate construction costs and conduct preliminary public outreach activities. Phase 2 includes permitting and constructing recharge and monitor wells, collecting lithologic cores, performing aquifer testing and groundwater modeling, conducting pilot treatment and aquifer recharge testing, and additional public outreach. If successful, this project could provide the City with the information needed to construct a full-scale aquifer recharge facility and potentially obtain up to 3 mgd in additional potable water supplies.

1.2 Hydrogeologic Investigation of the Lower Floridan Aquifer in Polk County (P280). This project explores the LFA in Polk County to assess its viability as an alternative water supply source and to gain a better understanding of the LFA characteristics and groundwater quality. Data will enhance groundwater modeling of the LFA, and determine the practicality of developing the aquifer as an alternative water supply in areas of Polk County facing future water supply deficits. The scope of the investigation is to drill exploratory wells at up to three key locations chosen for their locality to water demand centers and to improve data coverage for groundwater resource monitoring and the Districtwide Regulation Model (DWRM). If the tests demonstrate that the water quality and productivity are suitable, the water and facilities could be made available to utilities in Polk County. Regardless of the suitability of the LFA for water supply at each site, the exploration wells will be significant additions to the District's well monitoring network.

1.3 South Hillsborough Aquifer Recharge Program (SHARP) (N287). This is an aquifer recharge pilot testing project that will assess the effects of using up to 2 mgd of treated excess reclaimed water from the South-Central Hillsborough County reclaimed water system to directly recharge a non-potable zone of the UFA at the County's Big Bend aquifer storage and recovery (ASR) test well site. The project consists of the design, permitting, and construction of a reclaimed water recharge well system with associated wellhead and appurtenances, interconnects, and monitor wells. Project tasks include a multiyear aquifer recharge pilot study and groundwater modeling to evaluate water level improvements and water quality, including metals mobilization. The project may allow the County to utilize excess reclaimed water flows, improve water levels within the Most Impacted Area (MIA) of the SWUCA, and potentially provide a salinity barrier against saltwater intrusion; as well as additional mitigation offsets for future groundwater supplies.

2.0 Facilitating Agricultural Resource Management Systems (FARMS) Projects

The FARMS Program is an agricultural BMP cost-share reimbursement program consisting of many site-specific projects. The FARMS Program is a public/private partnership developed by the District and the Florida Department of Agriculture and Consumer Services (FDACS). The purpose of the FARMS initiative is to provide an incentive to the District's agricultural community to implement agricultural BMPs that will provide resource benefits including water quality improvement, reduced UFA withdrawals, and enhancements to the water resources and ecology.

The FARMS Program has five specific goals: (1) offset 40 mgd of groundwater within the SWUCA by 2025; (2) improve surface water quality impacted by mineralized groundwater within the Shell, Prairie and Joshua Creek watersheds (SPJC); (3) improve natural systems impacted by excess irrigation and surface water runoff within the Flatford Swamp region of the upper Myakka River watershed; (4) prevent groundwater impacts within the northern areas of the District; and (5) reduce frost-freeze pumpage by 20 percent within the Dover/Plant City Water Use Caution Area (WUCA). These goals are critical in the District's overall strategy to manage water resources.

2.1 FARMS Cost-Share Projects. FARMS projects employ many of the agricultural water conservation strategies described in the RWSP to reduce groundwater withdrawals by increasing the water use efficiency of agricultural operations. The projects have the added benefit of reducing agricultural impacts to surface water features. The projects are public/private partnerships where the District provides financial incentives to farmers to increase the water use efficiency of their operations. Each project's performance is tracked to determine its effectiveness toward program goals. Since actual use of permitted quantities is dependent on hydrologic conditions, one of the objectives of FARMS projects is to reduce groundwater use regardless of hydrologic conditions. FARMS projects not only offset groundwater use with surface water, but increase the overall efficiency of irrigation water use. The District has routinely budgeted approximately $6 million annually for these projects. A listing of cost-share projects within the planning region that meet the RWSP definition of being under development is provided in Table 7-3.

As of August 2015, there were 173 approved FARMS projects including 9 in the NPR. The projects are projected to have a cumulative groundwater offset of 25.5 mgd Districtwide and 0.45 mgd for the projects within the NPR.

Table 7-3. *Specific FARMS cost-share projects within the Northern Planning Region funded post-FY2010*

Project Description	District Budget FY2011-15	Benefit (mgd)
Bethel Farms, LLLP	$93,556	0.070
Bethel Farms, LLLP - Phase 2	$198,500	0.200
Blueberry Hill, LLC	$63,762	0.021
Brooksville Ridge Blueberries, LLC	$176,242	0.065
D and J Blueberry Farms, LLC	$16,365	0.007
Splendid Blue Farms - Phase 2	$13,841	0.028
Stardust Ranch	$111,000	0.061
Total	**$673,266**	**0.452**

Notes: Projects were selected by funds budgeted in years FY2011 to FY2015, meeting District RWSP definition of "projects under development." The benefit is based on projected offset, with exceptions for observed results on high performing projects. Sources: 2013 Annual FARMS Report A-1 and PIMS for newer unlisted projects. Offsets for some projects with only frost/freeze reductions were estimated by div/365 to assume one 24-hour freeze event per year.

2.2 Mini-FARMS Program. Mini-FARMS is a scaled down version of the District's FARMS cost-share reimbursement program to implement agricultural BMPs on agricultural operations of 100 irrigated acres or less to conserve water and protect water quality within the District. Mini-FARMS is intended to assist in the implementation of the SWUCA Recovery Strategy, Dover/Plant City WUCA Recovery Strategy, the Shell and Prairie Creek WMP, and the District's Strategic Plan. Much like the FARMS projects, the Mini-FARMS Program implements BMPs on agricultural operations to reduce UFA groundwater use and/or improve water quality conditions throughout the District. The maximum cost-share amount available from Mini-FARMS projects is $5,000 per agricultural operation per year, and the maximum cost-share rate is 75 percent of project costs.

From FY2006 through FY2014, the District's portion of the Mini-FARMS Program has reimbursed 83 water conservation BMP projects. The total cost of the Mini-FARMS projects was $506,200 and the District's reimbursement was $345,178. The Mini-FARMS Program continues to receive a strong demand from growers within the District, and it is projected that at least $50,000 will be budgeted for projects annually.

2.3 FARMS Irrigation Well Back-Plugging Program. This program offers financial and technical assistance to well owners within the SWUCA to back-plug irrigation wells that produce highly mineralized groundwater. Back-plugging is a recommended practice to rehabilitate irrigation wells by identifying and restricting the intrusion of highly mineralized groundwater that often occurs from deeper aquifer zones in certain areas of the District. This program is separate from the QWIP, which focuses on proper well abandonment. The program was initiated in 2002 to improve water quality in watershed systems of the SWUCA, and later became an addition to the FARMS Program in 2005. Field investigations indicated that highly mineralized groundwater produced from older or deeper irrigation wells was the most likely source adversely impacting water quality downstream in Punta Gorda's public supply reservoir. Growers experience several advantages from well back-plugging including elevated crop yields from reduced salts in irrigation groundwater, decreases in soil-water requirements and pumping costs, and reduced corrosion and fouling of irrigation equipment.

A total of 74 wells have been back-plugged in the SWUCA through FY2014, with 55 of these wells located in the SPJC priority watersheds. Analytical results for all back-plugged wells indicated conductivity, total dissolved solids (TDS), and chloride were decreased by averages of 42 percent, 42 percent, and 58 percent, respectively, with well volume yields retained at an average of 77 percent. Routine water quality monitoring of select back-plugged wells assures that these improvements are sustained long-term.

2.4 University of Florida's Institute of Food and Agricultural Services (IFAS) BMP Implementation Project. The primary goal of this project is to assist IFAS in promoting statewide FDACS-adopted agricultural BMPs, typical FARMS projects, and other practices and preparation. District participation promotes the establishment of additional FARMS projects, which provides water resource benefits throughout the District. Assistance is provided to growers in conducting site assessments, selecting applicable FDACS BMPs, and filing notices of intent (NOIs) to implement the practices. Technical assistance may be provided directly or by coordinating with the appropriate FDACS staff or IFAS extension agents. Growers are informed of available BMP-related programs offered by FDACS, the water management districts, and other entities. Field demonstrations, workshops, and other educational opportunities are provided to growers and their employees. Technical assistance also identifies areas of future educational needs.

3.0 Environmental Restoration and MFL Recovery Projects

As of FY2015, the District has seven ongoing environmental restoration and MFL recovery projects that benefit water resources. The Lower Hillsborough River Recovery Strategy, Lower Hillsborough River Pumping Facilities, Pump Stations on the Tampa Bypass Canal (TBC), and the Hillsborough River Groundwater Basin Evaluation projects are in the Tampa Bay Region. The Lake Hancock Lake Level Modification and the Lake Jackson Watershed Hydrology Investigation Projects are in the Heartland region. The Upper Myakka/Flatford Swamp Hydrologic Restoration and Implementation project is in the Southern Planning Region.

3.1 Lower Hillsborough River Recovery Strategy. Flows in the Lower Hillsborough River (LHR) have been reduced by a variety of factors including increased use of the Hillsborough River Reservoir, surface water drainage alterations, reduction in surface storage, long-term rainfall patterns, and induced recharge due to groundwater withdrawals. The District set minimum flows for the LHR, Sulphur Springs, and the TBC in 2007. These MFLs have been incorporated as amendments to Rule 40D-8.041, F.A.C. The LHR's flows have been below the adopted minimum flows in recent years, and the development of a recovery strategy was required by Florida Statutes. The recovery strategy outlines six proposed projects and a timeline for their implementation. Four projects are being jointly funded by the District and the City of Tampa, and two are being implemented by the District. Implementation of specific projects is subject to applicable diagnostic/feasibility studies and contingent on any required permits. These projects include TBC diversions, modifications to the Sulphur Springs weir and pump station, projects at Blue Sink and Morris Bridge Sink, and the investigation of storage options.

3.2 Lower Hillsborough River Pumping Facilities. This is a multiyear cooperative project with the City of Tampa for the design and construction of two permanent pumping facilities to implement the MFL recovery strategy for the LHR. Since 2008, the District has been operating two temporary pumping stations to transfer up to 7.1 mgd of water from the TBC to the Hillsborough River reservoir and up to 5.3 mgd from the reservoir to the river below the dam to meet the required minimum flows of the recovery strategy. The temporary facilities were implemented to get the recovery strategy underway while the City conducted studies to evaluate options for the permanent pumping facilities. The City is expected to assume responsibility of the water diversions once the new pumping facilities are complete.

3.3 Pump Stations on the Tampa Bypass Canal. This project accounts for District expenses for temporary pumping systems. Since 2008, the District has been responsible for diverting water from the TBC to the LHR in accordance with adopted MFL requirements (as described above). The diversion is achieved through two temporary pump stations located on the TBC and a pump station located at the City of Tampa Dam. This project also includes design and construction of a permanent pump station at the Morris Bridge Sink to divert 3.9 mgd to the TBC. Pump operation is expected to continue until the City of Tampa completes new permanent pumping facilities.

Tampa Bypass Canal

3.4 Hillsborough River Groundwater Basin Evaluation. This project is a study to determine the zone of influence for groundwater withdrawals from the UFA which impact the flow in the Hillsborough River. The study will utilize a new, fully integrated surface water/groundwater flow model called the Integrated Northern Tampa Bay model (INTBM) that covers a 4,000 square mile region surrounding Tampa Bay. The model was developed by the District and Tampa Bay Water in 2012 and underwent a successful peer review in 2013. This model is the most advanced simulation tool available to evaluate changes to the hydrologic system and is capable of directly determining flow impacts to the Hillsborough River from groundwater withdrawals. The project will evaluate the water resource condition of the Hillsborough River basin by analyzing data, performing statistical analyses, and using the INTBM to determine an appropriate zone or zones where increased quantities from either existing or new WUPs may significantly impact flow on the Hillsborough River.

3.5 Lake Hancock Lake Level Modification Project. Since the late 1990s, the District has worked to establish MFLs for segments of the Peace River and apply recovery strategy projects. Surface water drainage alterations, reductions in surface storage, variations in long-term rainfall, and induced recharge due to groundwater withdrawals have all contributed to reduced flows in the upper Peace River. A major component of the recovery strategy was a series of projects to store water in Lake Hancock by raising the lake's controlled water elevation, apply water quality treatment, and slowly release the water to the upper Peace River between Bartow and Zolfo Springs during the dry season to help meet the minimum flow requirements. The Lake Hancock Lake Level Modification project is an ongoing part of the upper Peace River and SWUCA recovery strategies. Complementary projects for the Lake Hancock Outfall Wetland Treatment System and the Lake Hancock P-11 Outfall Structure Replacement were completed in 2013.

Historically, Lake Hancock fluctuated more than a foot higher than it has during the past several decades. This project increases the normal operating level from 98.7 feet to 100.0 feet to provide the storage and increase the number of days the upper Peace River will meet minimum flows. Increasing the operating level also helps restore wetland function for several hundred acres of contiguous lands to Lake Hancock, and provides recharge to the UFA through exposed sinks along the upper Peace River. Operation and maintenance of the Lake Hancock projects will be conducted by the District's structure operations.

3.6 Lake Jackson Watershed Hydrology Investigation. Lake Jackson is a 3,412 acre lake located in the town of Sebring and is one of nine lakes in Highlands County with an established MFL. Lake Jackson has not met its MFL over the last 10 years. Residents and local officials have voiced concerns over persistent low water levels potentially related to stormwater canal structures, potential flow through the shallow aquifer to the canals, and possible leakage in the lake's hardpan bottom. This hydrologic investigation will collect data and attempt to identify the causes of the low water level in Lake Jackson and Little Jackson over the last decade and develop cost-effective recovery strategies. Aspects of the project include: (1) an assessment of the stormwater structures including the underwater portions, channel flow, and the installation of seepage meters; (2) installation of groundwater, lake level, and weather monitoring networks in order to calculate a more accurate lake water budget; and (3) modeling the effects of a proposed subsurface wall on the lateral movement of water from Lake Jackson through the shallow aquifer to downstream sources, and calculating its potential improvement to the level of Lake Jackson. The project will include a cost-benefit analysis if the investigation and modeling shows the subsurface wall or other recovery strategies may be beneficial to the lake water levels.

3.7 Upper Myakka/Flatford Swamp Hydrologic Restoration and Implementation. Hydrologic alterations and excess runoff has adversely impacted Flatford Swamp in the upper Myakka watershed. This project differs from MFL recovery projects as it intends to remove excessive surface water from the Flatford Swamp and portions of the surrounding area to restore the natural systems. The Flatford Swamp hydrologic restoration will work to re-establish hydroperiods close to historic levels. Work from the Myakka River Watershed Initiative has shown there is no single BMP that will mitigate problems within the Flatford Swamp. The hydrologic restoration alternatives have been divided into three parts: (1) withdrawals from the Flatford Swamp either by diverting flow before it reaches the swamp or removal from the swamp, (2) storage for excess water depending on where the end user of the excess water is located, and (3) transmission and water quality treatment to potential users.

The plan remains to address the issues with a multi-prong adaptive management approach, but it is apparent that a larger "workhorse" project is needed to successfully bring hydroperiods within the swamp back closer to historic levels. The most promising alternative is to transport the excess flows to the Mosaic Company for use in their mining operations. A joint feasibility study with Mosaic was completed in March 2013 indicating that a project to utilize approximately 4 to 8 mgd of excess water from the swamp is feasible. The District is considering a mutually agreeable partnership with Mosaic to implement a restoration project with conveyance of excess water for beneficial use. District staff is also researching an injection option for the excess water to recharge the aquifer and is collecting water quality information. The estimated cost for the Flatford Swamp Hydrologic Restoration depends on how the excess water is utilized, and ranges from $48 million to $100 million from conceptual estimates.

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Chapter 8. Overview of Funding Mechanisms

This chapter provides an overview of mechanisms available to generate the necessary funds to implement the water supply and water resource projects proposed by the District and its cooperators to meet the water supply demand projected through 2035 and restore minimum flows and levels (MFLs) to impacted natural systems. The chapter includes:

- A discussion of the District's statutory responsibilities for funding water supply development (WSD) and water resource development (WRD) projects.
- Identification of utility, water management district, state and federal funding mechanisms.
- A discussion of public-private partnerships and private investment.
- A review of water demands for which water supply and water resource projects should be developed.
- A projection of the amount of funding that is expected to be available from the various funding mechanisms.
- A comparison of proposed large-scale project costs to the projected funding available.

Table 8-1 shows the projected increase in demand for each planning region for the planning period, as described in Chapter 3 of each volume of the Regional Water Supply Plan (RWSP). The table shows that approximately 281.88 mgd of new water supply is needed to meet user demands and to restore natural systems.

Table 8-1. *Summary of total projected increases in demand (5-in-10) (mgd) by each planning region from base year 2010 to 2035*

Planning Region	Projected Demand Increase
Heartland	68.52
Northern	62.83
Southern	62.97
Tampa Bay	87.57
Total	**281.88**

Note: Summation differences occur due to decimal rounding.

A portion of the Districtwide total demand shown above will be met by existing permitted quantities; however, new regional infrastructure may be required to deliver permitted quantities to end users, and additional water supply development is necessary to maintain adequate capacity for peak demand periods and continuing growth shown in Table 8-1 funded by the District.

To prepare an estimate of the capital cost for projects needed to meet the portion of demand not yet under development, the District has compiled a list of large-scale WSD projects (Table 8-4) through the District. No large-scale WSD projects are listed for the Northern Planning Region because a significant portion of water demand in the region will be met with fresh groundwater, conservation, and reclaimed water initiatives available to the region. The District anticipates that a large portion of the remaining demand will be met through projects that users will select from the water supply options listed in Chapter 5 of this RWSP.

The amount of funding that will likely be generated through 2035 by the various utility, District, state and federal funding mechanisms is compared to the capital cost of the potential large-scale projects. This comparison allows an evaluation of funding adequacy for support of projects necessary to meet water demands.

Part A. Statutory Responsibility for Funding

Section 373.705, Florida Statutes (F.S.), describes the responsibilities of the Water Management Districts (WMDs) in regard to funding water supply development and water resource development projects:

(1)(a) The proper role of the water management districts in water supply is primarily planning and water resource development, but this does not preclude them from providing assistance with water supply development.

(1)(b) The proper role of local government, regional water supply authorities and government-owned and privately owned water utilities in water supply is primarily water supply development, but this does not preclude them from providing assistance with water resource development.

(2)(b) Water management districts take the lead in identifying and implementing water resource development projects, and they are responsible for securing necessary funding for regionally significant water resource development projects.

(2)(c) Local governments, regional water supply authorities, and government-owned and privately owned utilities take the lead in securing funds for and implementing water supply development projects. Generally, direct beneficiaries of water supply development projects should pay the costs of the projects from which they benefit, and water supply development projects should continue to be paid for through local funding sources.

Section 373.707(2)(c), F.S., further describes the responsibilities of the WMDs in regard to providing funding assistance for the development of alternative water supplies:

(2)(c) Funding for the development of alternative water supplies shall be a shared responsibility of water suppliers and users, the State of Florida, and the water management districts, with water suppliers and users having the primary responsibility and the State of Florida and the water management districts being responsible for providing funding assistance.

In accordance with the intent of the Florida Legislature, direct beneficiaries of WSD projects should generally bear the costs of projects from which they benefit. However, affordability and benefits to natural resources are valid considerations recognized in Section 373.705(4)(a), F.S. for funding assistance from the WMDs:

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

1. *The project supports establishment of a dependable, sustainable supply of water which is not otherwise financially feasible;*

2. *The project provides substantial environmental benefits by preventing or limiting adverse water resource impacts, but requires funding assistance to be economically competitive with other options; or*

3. *The project significantly implements reuse, storage, recharge, or conservation of water in a manner that contributes to the sustainability of regional water sources.*

Currently, the District funds both WSD and WRD projects. As discussed in Chapter 7, the District considers its WRD activities to include resource data collection and analysis, as well as projects. In terms of WSD, the District has typically funded the development, storage and transmission of non-traditional sources of water, including reclaimed water and conservation. Potential sources of funding for WSD and WRD projects are addressed below.

Part B. Funding Mechanisms

Section 1. Water Utilities

WSD funding has been, and will remain, the primary responsibility of water utilities. Increased demand generally results from new customers that help to finance source development through impact fees and utility bills. Water utilities draw from a number of revenue sources, such as connection fees, tap fees, impact fees (system development charges), base and minimum charges, and volume charges. Connection and tap fees generally do not contribute to WSD or treatment capital costs. Impact fees are generally devoted to the construction of source development, treatment and transmission facilities. Base charges generally contribute to fixed customer costs, such as billing and meter replacement. However, a high base charge, or a minimum charge, which covers the cost of the number of gallons of water use, may also contribute to source development, treatment, and transmission construction cost debt service. Volume charges contribute to both source development/treatment/transmission debt service and operation and maintenance.

Community development districts (CDDs) and special water supply and/or sewer districts may also develop non-ad valorem assessments for system improvements to be paid at the same time as property taxes. CDDs and special district utilities generally occur in developed areas not served by a government-run utility and generally serve a planned development. Regional water supply authorities, such as Tampa Bay Water, are also special water supply districts, but do not have retail customers. Facilities are funded through fixed and variable charges to the utilities they supply which are, in the end, paid for by the retail customers of the utilities. All the above-mentioned types of utilities and regional water supply authorities have the ability to issue secure construction bonds backed by revenues from fees, rates and charges.

A survey of water and sewer utility fees and charges in the District was conducted in October 2008, and updated in 2014, to estimate revenues that contribute to source development, treatment, and transmission capital projects. Distribution system impact fees, when applicable, and connection and tap fees were excluded from the calculations (developers are typically required to supply on-site distribution lines and may be required to contribute to off-site infrastructure as well, in addition to impact fees). Impact, base, and volume charges from surveyed utilities were weighted by the projected share in population growth of the utilities to form weighted average charges that were applied to the region’s future customers and water use. Revenue estimates exclude projected use by domestic self-supply populations and the additional use of private wells by public supply customers.

Between 2015 and 2035, new public water supply demand in the District will generate approximately $5.8 billion in one-time impact fees and recurring base and volumetric charges. Table 8-2 illustrates the projected new customer revenues into water and wastewater revenues and into one-time impact fees, recurring base/minimum charges, and recurring volume-based charges. Although wastewater revenues support sewer system development, treatment, and transmission projects, these revenues may also be used to support capital expenditures on reclaimed water system development.

Table 8-2. *Cumulative projected water and wastewater revenues from new customers in the District (2015 to 2035)*[1]

Revenue Source	Water (Millions)	Wastewater (Millions)
New Base Charges	$466	$808
New Volume Charges	$1,313	$1,642
New Impact Fees	$635	$972
Total	**$2,414**	**$3,422**

[1] Estimated in 2013 dollars.

While some of these revenues will go to pay existing facility debt service, most of that service will be retired in various stages over the next 20 years, and debt service for new projects will be added. Projects built late in the 20-year planning period will continue to generate revenues for debt service for many years after the planning period.

Financing through volume-related charges is the most economically efficient means to finance new WSD. Volume charge financing provides consumers and businesses the greatest degree of direct control over water-related costs and a direct incentive to conserve. Such financing increases utility revenue stream variability, but such variability may be reduced through the development of rate stabilization or reserve funds.

If volume charges are utilized to fund higher cost alternative water sources, the impact on rate-payers can be mitigated through existing and innovative rate structures and charges. High-usage rate blocks can be set to reflect the full marginal cost of the next source of supply. Usage by conserving customers can be set at the existing average embedded cost, as they are not driving the need for additional supply development (or below existing cost if a lifeline rate is necessary). If the rate change to implement this pricing is designed to exceed current revenue requirements, the additional revenue can be dedicated to new source development. Such pricing both encourages conservation and reduces the need for steeper increases in future rates.

Conservation incentivized by block rate structures, in combination with collecting project revenues in advance of construction, can distribute price increases more evenly over time and buffer price fluctuations inherent in common water-pricing practices. This allows customers to adjust water use practices and technology over time. Indexing of prices is another means of distributing price increases over time. If changes to water rates are revenue-neutral, additional conservation can still occur, as the difference between average and marginal price blocks for larger water users increases. There are a number of additional means available to mitigate the impact of higher cost sources to customers. Many of these are addressed in the American Water Works Association's publications Avoiding Rate Shock: Making the Case for Water Rates (AWWA, 2004) and Thinking Outside the Bill: A Utility Manager's Guide to Assisting Low-Income Water Customers (AWWA, 2005).

Section 2. Water Management District

The District's Governing Board provides significant financial assistance for conservation, planning, and alternative water supply projects through programs including the Cooperative Funding Initiative (CFI) and other District initiatives. Financial assistance is provided primarily to governmental entities, but private entities also participate in these programs. Portions of state funding are also allocated by the District through state appropriations for the state's Water Protection and Sustainability Program, the District's West-Central Florida Water Restoration Action Plan, the state's Florida Forever Program, the District's FARMS Program, and DEP funding for the Springs Initiative.

1.0 Cooperative Funding Initiative (CFI)

The primary funding mechanism is the District's CFI, which includes funding for major regional water supply and water resource development projects and localized projects throughout the District's 16-county jurisdiction. The Governing Board, through its Regional Sub-Committees, jointly participates with local governments and other entities to ensure proper development, use, and protection of the regional water resources of the District. The CFI is a matching grant program and projects of mutual benefit are generally funded 50 percent by the District and 50 percent by the public or private cooperators. Any state and federal funds received for the projects are applied directly against the project costs, with both parties benefitting equally. The CFI has been highly successful; since 1988, the District has provided over $1.3 billion in incentive-based funding assistance for a variety of water projects addressing its four areas of responsibility: water supply, natural systems, flood protection and water quality. In FY2015, the District's adopted budget included over $56 million in funding through the CFI, of which $20 million was for assistance with reclaimed water. Funding for new potable supply projects tends to fluctuate year to year, as utilities and water authorities request funding assistance for new projects in consideration of economic conditions and population growth.

2.0 District Initiatives

District Initiatives are funded in cases where a project is of great importance or a regional priority. The District can increase its percentage match and, in some cases, provide total funding for the project. Examples of these initiatives include: (1) the Quality of Water Improvement Program (QWIP) to plug deteriorated, free-flowing wells that waste water and cause inter-aquifer contamination, (2) the Water Loss Reduction Program to conserve water by having District staff inspect meters and detect leaks in public water system pipelines, (3) data collection and analysis to support major District initiatives such as the MFL program, and (4) the FARMS program and other various agricultural research projects designed to increase the water-use efficiency of agricultural operations, and (5) WRD investigations and MFL Recovery projects which may not have local cooperators. In FY2015, the District's adopted budget included over $34 million in District Initiatives, of which $6 million was for FARMS project grants.

The total commitment in FY2015 for CFI and District Initiatives was over $90 million. The continued level of investment for these programs depends on various economic conditions, resource demands, and the District's financial resources. However, the District believes it resources are sufficient to ensure the long-term sustainability of the region's water resources moving forward.

Section 3. State Funding

1.0 The Springs Initiative

The DEP Springs Initiative is a special legislative appropriation that has provided revenue for protection and restoration of major springs systems. The District has allocated Springs Initiative funding to implement projects to restore aquatic habitats, and to reduce groundwater withdrawals and nutrient loading within first-magnitude springsheds to improve the water quality and quantity of spring discharges. Projects include the reestablishment of aquatic and shoreline vegetation near spring vents, installation of wastewater force mains to allow for the removal of septic tanks and increase reclaimed water production, and the implementation of BMPs within springshed basins.

The Northern Planning Region contains several unique first-magnitude springs

The first year of the appropriation was FY2013 and $1.1 million was allocated by the District for an industrial reuse project that transfers reclaimed water from the City of Crystal River to the Duke Energy power generation complex. In FY2014, the District allocated $1.35 million of Springs Initiative appropriations to two stormwater improvement projects and one wastewater/reclaimed water project. In FY2015, $6.46 million of DEP Springs Initiative funding is budgeted for four wastewater/reclaimed water projects. The projects are primarily in the Northern Planning Region, where the majority of first and second magnitude springs within the District are located.

2.0 Water Protection and Sustainability Program

The state's Water Protection and Sustainability Program was created in the 2005 legislative session through Senate Bill 444. The program provides matching funds for the District's CFI and District Initiative programs for alternative WSD assistance. For 2006, the first year of funding, the Legislature allocated $100 million for alternative WSD assistance, with $25 million allocated to the District. The District was allocated $15 million in FY2007 and $13 million in FY2008. In FY2009, the District was allocated $750,000 for two specific projects. The reduced funding is related to the state's budget constraints resulting from the economic downturn and the declining real estate industry. From FY2010 through FY2015, the state did not allocate funding for the program. During the 2009 legislative session, the Legislature passed Senate Bill 1740, which recreated the Water Protection and Sustainability Trust Fund as part of Chapter 373, F.S., indicating the state's continued support for the program. It is anticipated that the state will resume its funding for the program when economic conditions improve.

The funds are applied toward a maximum of 20 percent of eligible project construction costs. In addition, the Legislature has established a goal for each WMD to annually contribute funding equal to 100 percent of the state funding for alternative WSD assistance, which the District has exceeded annually. If funding is continued by the Legislature, the state's Water Protection and Sustainability Program could serve as a significant source of matching funds to assist in the development of AWS and regional supply infrastructure in the region. Prior funding has not previously been allocated to projects in the region, for there has been minimal AWS development in the region.

3.0 The Florida Forever Program

The Florida Forever Act, as passed in 1999, was a $10 billion, 10-year, statewide program. A bill to extend the Florida Forever program was passed by the Legislature during the 2008 legislative session, allowing the Florida Forever program to continue for 10 more years at $300 million annually, and reducing the annual allocation to water management districts from $105 million to $90 million, with $22.5 million (25 percent) to be allocated to the District, subject to annual appropriation. For FY2010, the Legislature did not appropriate funding for the Florida Forever program, other than for the state's debt service. For FY2011, the 2010 Legislature appropriated $15 million in total with $1.125 million allocated to the District. From FY2012 through FY2015, the Legislature did not appropriate funding for the District. In FY2015, the District budgeted $2.75 million for land acquisition from prior year funds held in the State Florida Forever Trust Fund for this District and in the District's accounts. The funds held in District accounts have been generated through the sale of easements to the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) for the Wetland Reserve Program and the sale of land or easements for rights-of-way. These funds are available for potential land acquisitions consistent with the guidance provided by the DEP.

Since 1999, the District has allocated $95 million ($81.6 million for land acquisition and $13.4 million for water body restoration) of Florida Forever funding Districtwide in support of WRD. A "water resource development project" eligible for funding is defined in Section 259.105, F.S. (Florida Forever), as a project that increases the amount of water available to meet the needs of natural systems and the citizens of the state by enhancing or restoring aquifer recharge, facilitating the capture and storage of excess flows in surface waters, or promoting reuse. Implementation of eligible projects under the Florida Forever program includes land acquisition, land and water body restoration, aquifer storage and recovery (ASR) facilities, surface water reservoirs, and other capital improvements. Numerous tracts have been acquired in the northern region including Potts and Flying Eagle preserves, Three Sisters Springs, and coastal preserves at Weeki Wachee and Chassahowitzka Rivers. A primary example of how the funds were used by the District for WRD was the purchase of lands around Lake Hancock within the Peace River watershed, as the first step in restoring minimum flows to the Upper Peace River. In addition, the District Governing Board has expended $35.7 million in ad valorem-based funding to complete the acquisition of lands associated with the Lake Hancock project, acquired on a voluntary basis and through eminent domain proceedings.

4.0 State Funding for the Facilitating Agricultural Resource Management Systems (FARMS) Program

Operating under Chapter 40D-26, Florida Administrative Code (F.A.C.), the FARMS Program, through the District, utilizes additional state funding when available. Since the inception of the program, the District has received $6.4 million in state appropriations and $1.3 million from the Florida Department of Agriculture and Consumer Services (FDACS). No funding was provided by the state from FY2010 through FY2015.

5.0 West-Central Florida Water Restoration Action Plan (WRAP)

The WRAP is an implementation plan for components of the SWUCA recovery strategy adopted by the District. Although the Northern Planning Region is outside of the SWUCA, the WRAP is an example of how State funding could be generated for future recovery strategies. The WRAP document outlines the District's strategy for ensuring that adequate water supplies are available to meet growing demands, while at the same time protecting and restoring the water and related natural resources of the area. The WRAP prescribes measures to implement the recovery strategy and quantifies the funds necessary, making it easier for the District to seek funding for the initiative from state and federal sources. In 2009, the Legislature officially recognized the WRAP through Senate Bill 2080, creating Section 373.0363, F.S., as the District's regional environmental restoration and water resource sustainability program for the SWUCA. In FY2009, the District received $15 million in funding for the WRAP. No additional WRAP funding has been provided by the state from FY2010 through FY2015.

Section 4. Federal Funding

In 1994, the District began an initiative to seek federal matching funds for water projects. Since that time, the Office of the Governor, the DEP, other WMDs, and local government and regional water supply authority sponsors have joined with the District to secure federal funding. Through a cooperative effort with members of Florida's Congressional Delegation, the federal initiative has grown substantially. In 1999, the effort was expanded to seek funding for the development of alternative source projects and, in 2001, the state of Florida and the WMDs expanded a list of projects in order to seek all available resources to develop an environmentally sustainable water supply strategy that would meet the demands of growth throughout the state. The projects include the use of alternative water supply technologies, as well as stormwater retention and filtering and wastewater treatment. Each WMD certifies that the projects submitted for funding are regional in scope and that matching funds are available either from the District's budget or from a local government sponsor.

Within the District, Federal matching funds from this initiative helped fund the construction of the Peace River Manasota Regional Water Supply Authority (PRMRWSA) reservoir and plant expansion. Funding for Tampa Bay Water's C.W. Bill Young Regional Reservoir came from individual project grant allocations through the State and Tribal Assistance Grants (STAG) program. However, Congress has not funded any individual project STAG grants for several years, so future funding for individual projects through this mechanism is uncertain. Congressional authorization through the Water Resources and Development Act aids in the efforts to secure funding for the Peace River and Myakka River watersheds restoration initiative. District staff considers funding for water supply projects to be a top priority and continues to work with the Office of the Governor, the DEP, the U.S. Army Corps of Engineers, and the members of the Florida Congressional Delegation to secure federal funding.

1.0 USDA Natural Resources Conservation Service (NRCS) programs

The NRCS's Environmental Quality Incentives Program (EQIP) provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands. The program provides assistance to farmers and ranchers to comply with federal, state, and tribal environmental laws that encourage environmental enhancement. The program is achieved through the implementation of a conservation plan that includes structural, vegetative, and land management practices. The program is carried out primarily in priority areas where significant resource concerns exist. Agricultural water supply and nutrient management through detention/retention or tailwater recovery ponds can be pursued through this program.

In addition to EQIP, the FARMS Program has partnered with NRCS through the Agriculture Water Enhancement Program (AWEP) and the Florida West Coast Resource Conservation and Development Council (RC&D) to bring additional NRCS cost-share funding. The AWEP was created by the 2008 Farm Bill with similar goals as the EQIP program, including conserving and/or improving the quality of ground and surface water. The RC&D is a nonprofit organization that promotes sustainable agriculture and local community food systems in Hillsborough, Manatee, Pinellas, and Sarasota counties.

The District's FARMS Program works cooperatively with the NRCS EQIP, AWEP, and RC&D programs on both financial and technical levels, and dual cost-share projects have been coordinated whenever possible. By an agreement between the District, FDACS, and the NRCS, the maximum funding for using both FARMS and EQIP is 75 percent of total project cost. As of FY2015, 40 FARMS projects Districtwide have involved some level of dual cost-share with EQIP, AWEP, and/or the RC&D, with several additional cooperative projects expected in the near future. On a technical level, agency interaction includes using the NRCS mobile irrigation lab to investigate using FARMS cost-share for improvements to overall irrigation system efficiency, using NRCS engineering designs for regulatory agricultural exemptions, whenever possible, and coordinating cost-share on specific project related infrastructure. For example, FARMS may assist with an alternative source of irrigation water and EQIP assists with an upgrade to an irrigation delivery system. The relationship is mutually beneficial, extends cost-share dollars, and provides more technical assistance to participants in both programs.

Section 5. Public-Private Partnerships and Private Investment

As traditional water sources reach their capacity, alternative sources must be developed that involve specialized technical expertise and risky financial investments. The development of such technologies may be beyond the ability and level of tolerance of many water utilities. A range of public/private partnership options are available to provide this expertise and shift the financial risk. These options range from all-public to all-private ownership, design, construction, and facility operation. Investment and competition among private firms desiring to fund, build, or operate WSD projects could reduce project costs, potentially resulting in lower customer charges.

In addition to investor-owned public supply utilities, private risk sharing could be undertaken by three distinct forms of water supply entities: (1) public-private partnerships consisting of public utilities or regional water supply authorities contracting with private entities to design, build, or operate facilities (2) cooperative institutions such as irrigation districts contracting with private entities and (3) private entities, which could identify a customer base and become a water supplier to one or more water use types.

1.0 Public-Private Utility Partnerships

Two advantages of public-private partnerships are that (1) competition and economies of scale enjoyed by regional or national construction/operation firms or teams may reduce costs and complete a project in less time, and (2) some of the risk may be shifted to the private firms providing goods and services. As an example, Tampa Bay Water undertook a public-private partnership with Veolia Water, formerly USFilter, to design, build and operate its surface water treatment plant that has been in operation since 2002. Veolia assumed all risks for cost, schedule, plant design and construction, equipment supply, startup services, and facility performance through operation and maintenance. The cost savings over the life cycle of the contract is expected to be significant.

Public-private partnerships are becoming more common as water technology and regulation becomes increasingly complex. Increasing numbers of regulated pollutants and new higher-risk technologies drive privatization of some public water supply responsibilities. Partnerships work best where risks are beyond public sector tolerance, a project is new and standalone, construction and long-term operation are combined, there are clearly defined performance specifications, and there are clearly defined payment obligations (Kulakowski, 2005). Small utilities may not have the resources or project sizes sufficient to attract private interest, but may participate through multi-utility agreements or through a regional water supply entity. A significant benefit of cooperation in larger projects is the economies of scale common in the water supply industry.

2.0 Cooperatives

Cooperatives are arrangements where multiple self-supplied water users pool their resources to construct water facilities that they could not technically or economically undertake on their own. They also share the risks. Such private or public/private cooperative institutions are more common where lengthy transmission systems are required, such as in the western U.S. where surface water is distributed to water districts and for irrigation. Water is usually obtained from a supplier at a cost and then distributed among members by the water district. Members cooperatively fund the construction of transmission and distribution facilities. As groundwater resources become increasingly limited and reclaimed water systems expand, the same type of economic forces that created irrigation and water districts in the west could develop in portions of Florida. Cooperatives may also shift financial risk by entering into design, build, and operate arrangements with contractors. Other forms of cooperative institutions in Florida, such as drainage districts and grower cooperatives, have effectively reduced competition and litigation over resources (OPPAGA, 1999).

3.0 Private Supply Investment (Aside from Investor-Owned Public Supply)

Private Supply Investment is where investors identify an unserved customer base and develop water facilities to meet those needs. This type of investment may facilitate the development of alternative water supplies. Such private financial investment occurs where firm regulatory limits are in place to protect water resources and related environmental features, and further development of traditional sources are not allowable. Although the purpose of the regulatory measures is resource protection, they indirectly create a customer base for alternative source developers.

Section 6. Summary of Funding Mechanisms

There are many potential institutions and sources of funding for water supply and water resource development. Regional water supply authorities and public supply utilities will likely have the least difficulty in securing water supply funding due to their large and readily identifiable customer bases. Funding mechanisms are already established for alternative water supply projects, including state programs that were temporarily suspended during the recession.

Part C. Amount of Funding Anticipated to Be Generated or Made Available Through District and State Funding Programs and Cooperators

Section 1. Projection of Potentially Available Funding

Table 8-3 is a projection of the amount of funding that could be generated by the District and state funding programs discussed above. An explanation follows as to how the funding amounts in the table are calculated.

- Cooperative Funding Initiative (CFI). If the Governing Board maintains the current level of funding for cooperative funding projects at approximately $30 million per year, it is estimated that an additional $600 million could be generated from 2016 through 2035. If cooperators match all these funds, an additional $300 million could be leveraged. If the Governing Board elects to increase program funding for their other areas of responsibility (i.e., flood protection, water quality and natural systems), the funding projection for cooperative funding projects could be significantly influenced.
- District Initiatives. If the Governing board maintains a funding commitment of $15 million per year through 2035, it is estimated that $300 million could be generated. In some cases, the District funds the majority or the full amount of the initiatives. If local cooperators contribute matching shares to half of the initiatives on average, an additional $150 million could be leveraged.
- Springs Initiative. The amount of future state funding for the Springs Initiative cannot be determined at this time. Any funding allocated to this District will be used for projects for the protection and restoration of major springs systems, including projects to reduce groundwater withdrawals and improve stormwater systems.
- Water Protection and Sustainability Trust Fund. The amount of future state funding for this program cannot be determined at this time. As economic conditions improve and the state resumes funding, any funding allocated for this District will be used as matching funds for the development of alternative water supply projects.
- Florida Forever Trust Fund. The amount of future state funding for the Florida Forever Trust Fund cannot be determined at this time. Any funding allocated for this District will be used for land acquisition, including land in support of WRD.

Table 8-3 shows that a minimum of $1.65 billion could potentially be generated or made available to fund CFI and District Initiative projects necessary to meet the water supply demand through 2035 and to restore MFLs for impacted natural systems. This figure may be conservative, since it is not possible to determine the amount of funding that may be available in the future from the federal government and state legislative appropriations.

Table 8-3. *Projection of the amount of funding that could be generated or made available by District funding programs from 2016 through 2035*

Funding Projection	
Source	**Amount (millions)**
Cooperative Funding Initiative (CFI)	$600
Funding provided assuming all CFI water supply funds are used for projects that would be matched by a partner on an equal cost-share basis	$600
District Initiatives funding	$300
Funding provided assuming one-half of the District Initiative funds are used for projects that would be matched by a partner on an equal cost-share basis	$150
State of Florida, Water Protection & Sustainability Trust Fund	TBD
State of Florida, Springs Initiative	TBD
State of Florida, Florida Forever Trust Fund	TBD
State of Florida Legislative Appropriations	TBD
State of Florida Legislative Appropriations for FARMS	TBD
West-Central Florida Water Restoration Action Plan (WRAP)	TBD
Federal Funds	TBD
Total	$1,650

Section 2. Evaluation of Project Costs to Meet Projected Demand

Of the 281.88 mgd of Districtwide projected demand increases during the 2010–2035 planning period to meet the demand for all users and to restore MFLs for impacted natural systems, it is estimated that 60 mgd, or 21 percent of the demand, has either been met or will be met by reclaimed water and conservation projects that are under development as of December 30, 2015. The total District share of cost for the projects currently under development including regional transmission, ASR, and brackish groundwater treatment systems is $571 billion. Of this amount, $327 million has been funded through FY2015, leaving $244 million to be funded beginning in FY2016.

To develop an estimate of the capital cost of projects necessary to meet demand, the District compiled a list of large-scale WSD projects proposed for development within the 2035 planning timeframe, Districtwide. The projects have been proposed by the PRMRWSA, Tampa Bay Water, Tampa Electric Company and Polk County, and could produce up to 49 mgd of water supply. There were no major WSD projects proposed for development in the Northern Planning Region by the Withlacoochee Regional Water Supply Authority, as traditional sources, conservation, and reclaimed water initiatives are projected to meet demands in the region. The estimated costs and the quantity of water they will produce are listed in Table 8-4. The categories shown each contain several projects that could be chosen for development to meet future needs. Many of these are alternative water supply projects that would be eligible for co-funding by the District. The table shows the estimated total cost of the 34 to 49 mgd of water supply that will be produced by these projects is up to $1.65 billion.

Table 8-4. *Proposed large-scale water supply and water resource development projects by 2035 (millions of $)*

Project	Entity to Implement	Quantities (mgd)	Capital Costs	Land Costs	Total Costs (Capital + Land)
Regional Resource Development	PRMRWSA	8	$340	$10	$350
Regional Loop System	PRMRWSA	NA	$221	$12	$233
Polk County Regional Water Grid System	Polk County and Municipalities	NA	$219	$7	$226
Flatford Swamp Hydrologic Restoration	TBD	10	$44-96	$4	$48-100
TECO Polk Reclaimed Water Interconnects (Phase 2)	TECO	6	$53	-	$53
TBW System Configuration III	Tampa Bay Water	10-25	$216-612	TBD	$216-612
Subtotal Southern Planning Region		**18**	**$605-657**	**$26**	**$631-683**
Subtotal Heartland Planning Region		**6**	**$272**	**$7**	**$279**
Subtotal Tampa Bay Planning Region		**10-25**	**$216-612**	**TBD**	**$216-612**
Total – Districtwide		**34-49**	**$1,093 - 1,541**	**$33**	**$1,126 - 1,574**

A portion of new water demand in the Northern Planning Region will be met using available quantities of fresh groundwater, for which the District does not provide matching financial resources. The District is planning to assist with alternative water supply options, including reclaimed water and conservation projects, which can help meet future demands in the Northern Planning Region and help prevent negative impacts on water resources from occurring. The potential water supply project options are discussed in Chapter 5.

Section 3. Evaluation of Potential Available Funding to Assist With the Cost of Meeting Projected Demand

The conservative estimate of $1.65 billion in cooperator and District financial resources that will be generated through 2035 (Table 8-3) for funding is sufficient to meet the projected $1.1 to $1.5 million total cost of the large-scale projects listed in Table 8-4. In addition, the $244 million portion of the cost of projects currently under development will require funding in the near-term. The state and federal funding sources yet to be determined (Table 8-3) may assist with the remaining and high-end costs for future alternative water supply projects and water conservation measures where fresh groundwater resources are limited. Although it is not currently anticipated in the planning timeframe, future funding for major alternative water supply projects in the Northern Planning Region can be planned for in a similar manner. These financial projections are subject to economic conditions that may affect the level of District ad-valorem tax revenue and the availability of federal and state funding; however, such conditions may similarly affect future water demand increases.

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