2015 Regional Water Supply Plan

Heartland Planning Region

November 17, 2015

Prepared by:

Southwest Florida Water Management District

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With the Assistance of:

WADETRIM

2015 Regional Water Supply Plan
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Board Approved

November 17, 2015

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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
DO	Dissolved Oxygen
DOH	Department of Health
DSS	Domestic Self Supply
DWRM	Districtwide Regulation Model
EPA	U.S. Environmental Protection Agency
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-4	Interstate 4
I/C	Industrial/Commercial
ICI	Industrial/Commercial and Institutional

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
MAL	Minimum Aquifer Level
MALPZ	Minimum Aquifer Level Protection Zone
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
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
PRIM	Peace River Integrated Model
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
RPC	Regional Planning Council
RO	Reverse Osmosis
ROMP	Regional Observation & Monitor-well Program
RWSP	Regional Water Supply Plan
SCADA	Supervisory Control and Data Acquisition
SFWMD	South Florida Water Management District
SHP	Stormwater Harvesting Program
SMS	Soil Moisture Sensor
STAG	State and Tribal Assistance Grants
SWCD	Soil and Water Conservation District
SWCFGWB	Southern West-Central Florida Groundwater Basin
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management Program

SWIMAL	Saltwater Intrusion Minimum Aquifer Level
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 Loads
TWA	Tohopekaliga Water Authority
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
WSD	Water Supply Development
WTP	Water Treatment Plant
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 designated water supply planning regions: Northern, Tampa Bay, Southern and Heartland (Figure 1-1). This volume is the 2015 RWSP update for the Heartland Planning Region, which includes Hardee County and the portions of Polk and Highlands counties within the District. The District completed RWSPs in 2001, 2006, and 2010 that included the Heartland Planning Region.

The purpose of the RWSP is to provide a framework for future water management decisions in the District. The RWSP for the Heartland Planning Region shows that sufficient alternative water sources (sources other than fresh groundwater from the Upper Floridan aquifer [UFA]) exist to meet future demands and to replace some of the current fresh groundwater withdrawals causing hydrologic stress.

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 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 construct 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 an 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 permitted 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.

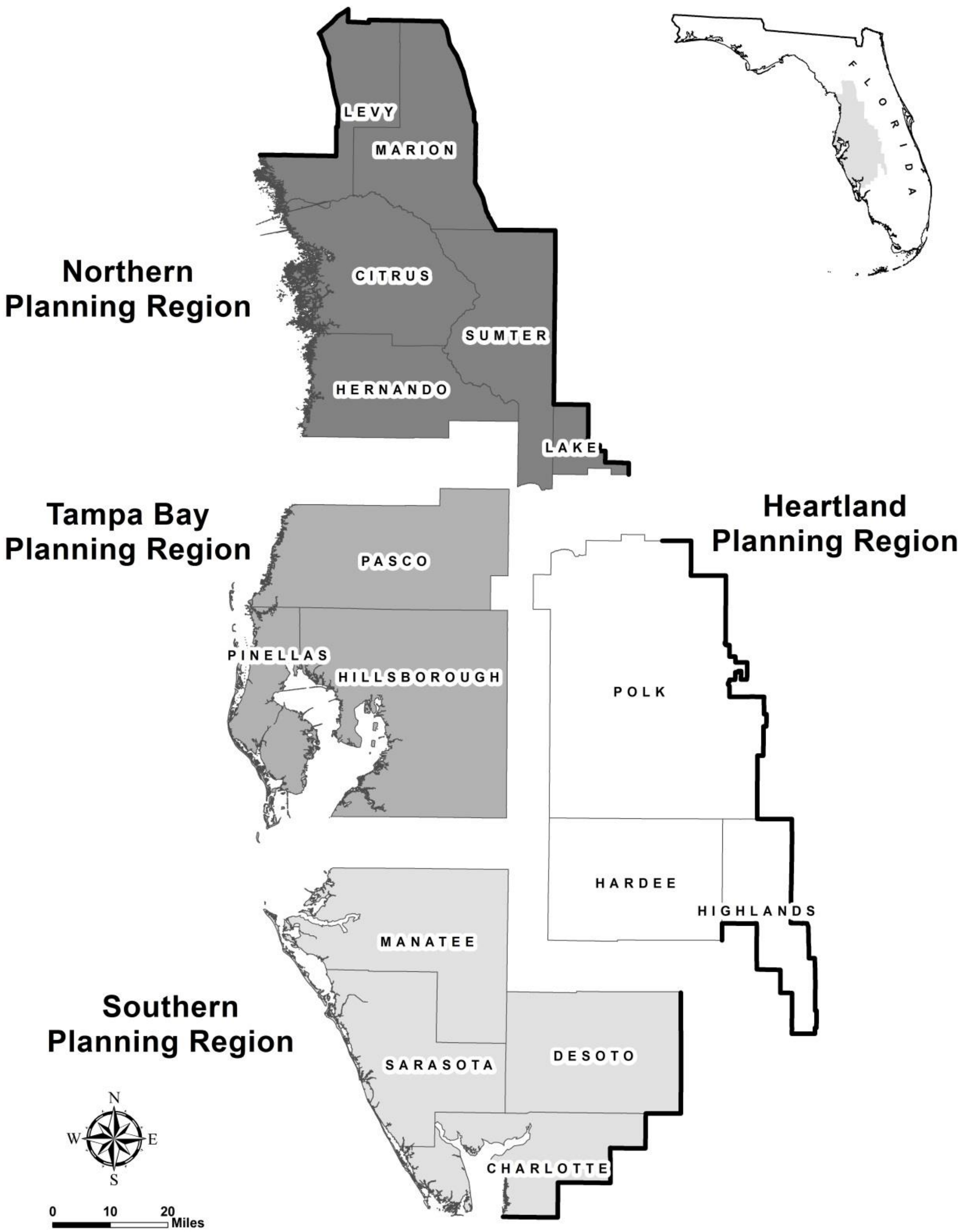


Figure 1-1. *Location of the four water supply planning regions within the District*

Part A. Introduction to the Heartland Planning Region RWSP

The following describes the content of the Heartland Planning Region RWSP. Chapter 1, Introduction, contains an overview of the District's accomplishments in implementing the water supply planning objectives of the 2010 RWSP; description of the land use, population, physical characteristics, hydrology and geology/hydrogeology of the area; 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 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 in the planning region. Chapter 5, Water Supply Development Component, presents a list of alternative and traditional WSD options for local governments and utilities, including surface water and stormwater, reclaimed water, water conservation, and fresh and brackish groundwater. 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 water supply development 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 (WRD). Chapter 8, Overview of Funding Mechanisms, provides an estimate of the capital cost of WSD and WRD 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 District's major accomplishments in implementing the objectives of the RWSP in the planning region since the 2010 update was approved by the Governing Board in July 2011.

Section 1. Alternative Water Supply Development, Conservation, and Reuse

1.0 Alternative Water Supply

The District is partnering with Polk County and several of its municipalities to explore the Lower Floridan aquifer (LFA) to assess its viability as an alternative water supply source and to gain a better understanding of its characteristics, including groundwater quality. To date, three sites have been funded for investigation. Additional sites may be funded in the future.

2.0 Water Conservation

The District continues to promote and cooperatively fund water conservation efforts to more efficiently use existing water supplies. In the public supply sector, this includes cooperatively funded projects for plumbing retrofits, toilet rebates, rain sensor device rebates, water-efficient landscape and irrigation evaluations, soil moisture sensor device rebates, and pre-rinse spray valve rebates. Since 2010, the District has funded conservation projects undertaken by Polk County, the Highlands County Soil and Water Conservation District (SWCD) and the cities of Winter Haven, Lakeland, Frostproof, and Lake Alfred.

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.

3.0 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).

Lake Placid

In 2010, utilities within the region were utilizing approximately 37 percent or 12 mgd of the 32 mgd of available wastewater treatment plant flows, resulting in an estimated 11 mgd of water resource benefits (92 percent efficiency). Since 2010, 11 additional reclaimed water projects in the planning region have been jointly funded with Polk County, the Tampa Electric Company (TECO), the Town of Lake Placid, and the cities of Lakeland, Mulberry, Auburndale, Avon Park, Haines City, Lake Wales, and Winter Haven. Of particular significance is the TECO Reclaimed Water Project, which involves the supply and advanced treatment of 10 mgd (expandable to 17 mgd) of reclaimed water from Polk County and the cities of Lakeland and Mulberry. This reclaimed water is ultimately delivered to a power station in southern Polk County. As a result of these projects, an additional 12 mgd is anticipated to be supplied by 2020.

Section 2. Support for Water Supply Planning

In 2008, the District, the South Florida Water Management District (SFWMD), and Polk County entered into a cooperative funding agreement to develop the Polk County Comprehensive Water Supply Plan. The emphasis of the plan was on identifying and quantifying viable water supply sources, particularly alternatives to fresh groundwater, through 2030. The results of this effort were incorporated into the 2010 RWSP and the District budgeted funds to cooperatively fund implementation of water supply projects identified in the plan. More recently, the District has budgeted additional funds to further develop solutions to meet the future demands of utilities in Polk County through 2035. This effort will incorporate the work completed as part of the Central Florida Water Initiative (CFWI). Additional information concerning the CFWI is provided in Section 5, Regulatory and Other Initiatives.

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 2011 for Crystal Lake and North Lake Wales in Polk County. A number of additional priority water bodies in the planning region are scheduled for MFLs establishment, and as part of the CFWI and Southern Water Use Caution Area (SWUCA) Recovery Strategy, several MFLs are scheduled to be reevaluated (see Chapter 2, Part B, and Appendix 2).

Peace River near Wauchula in Hardee County

2.0 MFLs Recovery Initiatives

The District's SWUCA recovery strategy, approved in 2006, relies on a wide range of activities that are collectively aimed at achieving MFLs for all priority water resources in the SWUCA by 2025. Key areas of progress since 2010 include the Lake Hancock Lake Level Modification project. This project raises the lake level to increase storage capacity so that water can be released to augment low flows in the upper Peace River during drier periods. A feasibility study was also completed in 2011 to examine ways of diverting flows around karst features in the upper Peace River. The study determined that building small berms around the larger karst openings or covering over smaller in-channel karst features with large plastic liners would reduce streamwater losses. The District will monitor the effectiveness of the Lake Hancock Lake Level Modification project on improving flows in the upper Peace River over at least a five-year operating period prior to implementation of a berm or liner installation project. The Lake Hancock project alone may allow the minimum flows to be met in the upper Peace River. Resource monitoring is ongoing and a SWUCA progress report is provided to the Governing Board annually.

In 2013, the District completed its first five-year assessment of the SWUCA recovery strategy (SWFWMD, 2013). The purpose of the five-year assessment, which is required by Rule, is to evaluate and assess the recovery in terms of resource trends, as well as trends in permitted and used quantities of water, and completed, ongoing, and planned projects. The assessment provides the information necessary to determine progress in achieving recovery and protection goals, and allows the District to revise its approach, if necessary, to respond to changes in resource conditions and issues. Based on the conclusions of the assessment, the District formed two separate stakeholder workgroups to obtain feedback on potential solutions for achieving the Saltwater Intrusion Minimum Aquifer Level (SWIMAL) in the Most Impacted Area (MIA) of the Floridan aquifer and the lake levels along Lake Wales Ridge. Feedback from these stakeholder groups will be used to develop potential options for consideration by the District's Governing Board. Refer to Figure 2-1 in Chapter 2 for a map of Water Use Caution Areas and the MIA of the SWUCA.

Section 4. Quality of Water Improvement Program (QWIP) and Well Back-Plugging

Since the 1970s, the QWIP has prevented waste and contamination of water resources (both groundwater and surface water) by plugging abandoned or improperly constructed artesian wells. The program focuses on the southern portion of the District where the UFA is under artesian conditions, creating the potential for mineralized water to migrate upward and contaminate other aquifers or surface waters. The program plugs approximately 200 wells per year and more than 6,000 wells have been plugged since its inception. In the Heartland Planning Region, 611 wells have been back-plugged since the program began.

A related effort, now part of the FARMS Program, involves the rehabilitation (or back-plugging) of agricultural irrigation wells to improve water quality in groundwater and surface waters and improve crop yields. The program initially targeted the Shell Creek, Prairie Creek and Joshua Creek watersheds to decrease the discharge of highly mineralized water into Shell Creek, the City of Punta Gorda's municipal water supply. The program has retrofitted 74 wells as of September 2014, with 55 of these in the target watersheds. All of the retrofitted wells are in the Tampa Bay or Southern planning regions.

Section 5. 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 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 Heartland 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.

Part C. Description of the Heartland Planning Region

Section 1. Land Use and Population

The Heartland Planning Region is characterized by a diversity of land-use types (Table 1-1), ranging from urban built-up areas in central Polk County and Lakeland, to predominantly agricultural land uses in Hardee County. Significant phosphate mining activities, primarily in Polk and Hardee counties, also occur in the region. However, mining operations are moving southward further into Hardee and DeSoto counties as phosphate reserves at existing mines are depleted. The population of the planning region is projected to increase from approximately 727,965 in 2010 to 1,018,095 in 2035. This is a gain of approximately 290,130 new residents, a 40 percent increase over the base year population. The majority of this population growth will be due to net migration.

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

Land Use/Land Cover Type	Acres	Percent
Urban and Built-Up	271,798.92	16.52
Agriculture	518,368.73	31.51
Rangeland	69,948.14	4.25
Upland Forest	102,661.61	6.24
Water	96,604.97	5.87
Wetlands	346,695.06	21.07
Barren Land	1,649.28	0.10
Transportation, Communications, Utilities	17,694.78	1.08
Industrial and Mining	219,816.20	13.36
Total	**1,645,237.69**	**100.00**

Based on: SWFWMD 2011 GIS LULC Layer (SWFWMD, 2011)

Section 2. Physical Characteristics

The region has a diverse physiography. In southern Polk County and Hardee County, a broad, gently sloping plain is drained by the Peace River and its tributaries. Farther north, in central Polk County, a poorly-drained upland area called the Winter Haven Ridge contains numerous lakes. The northernmost area of Polk County contains a portion of the Green Swamp, which is a mosaic of uplands and wetlands that forms the headwaters of four major rivers and overlies the Polk City potentiometric high of the UFA. On the eastern side of the planning region is the Lake Wales Ridge, a northwest-southeast trending series of hills characterized by high elevations, deep sands and sinkhole lakes.

Section 3. Hydrology

Figure 1-2 shows the major hydrologic features in the planning region.

1.0 Rivers

The Peace River, the primary river system in the region, is a blackwater river: a river system that drains pine flatwoods and cypress swamps and has dark, tannin-stained waters from decomposing plant material. The headwaters of the river are at the junction of Saddle Creek and Peace Creek in Polk County, north of Bartow and south of Lake Hancock. From this junction, the Peace River extends 106 miles south to the Charlotte Harbor estuary, where it blends with the outflows of the Caloosahatchee and Myakka rivers. There are many tributaries to the river including Payne Creek, Charlie Creek and Horse Creek.

Peace River near Bartow in Polk County

2.0 Lakes

Nearly 200 lakes and ponds are located along the Lake Wales Ridge in the planning region. The lakes are most likely the result of ancient sinkholes formed by the dissolution of the underlying limestone. The lakes range in size from a few tens of acres to the more than 5,500 acres that comprise Crooked Lake in southern Polk County. Water-control structures have been constructed on many of the lakes. Several of the lakes, especially in the uplands portion of the central ridge, had not discharged water for the past 25 years due to low water levels. However, wetter than normal conditions in 2003, excessive rainfall from three hurricanes in 2004 and wet conditions again in 2005 caused the lakes to rise to levels that had not been experienced since the 1960s. After the wet conditions of 2004 and 2005, lake and aquifer levels in the region dropped considerably again due to excessively dry conditions resulting from drought, with some reaching historically low levels.

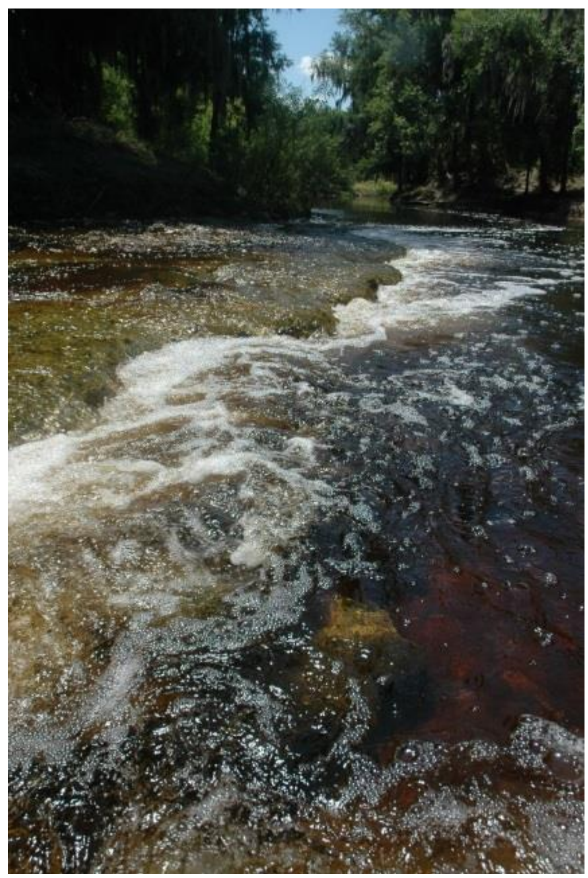
The Winter Haven Chain of Lakes is a priority water body of the Surface Water Improvement and Management (SWIM) Program and is composed of 19 interconnected lakes. The chain is made up of two major groups with five in the northern chain and 14 in the southern chain, spanning a watershed area of 32 square miles in Polk County. The lakes in the Winter Haven chain are a mixture of depressional and seepage lakes, with the latter being similar to the Lake Wales Ridge lakes. The lakes are interconnected through the construction of navigable canals to promote recreational access, which has impacted the hydrology, water quality and storage in the lakes.

3.0 Springs

There are no springs of significant magnitude in the planning region. The most prominent spring in the region, Kissengen Spring, ceased continuous flow in 1950 when large quantities of groundwater were withdrawn to supply the phosphate mining industry. In addition, during the 1940s, water from the UFA moved upward into the Peace River between Bartow and Homeland through a series of in-channel karst features. When water levels in the UFA dropped during the 1950s, the flow reversed. Now river flows drain down into the aquifer. The USGS estimates that on average 17 cfs (11 mgd) seeps down into the intermediate aquifer system and UFA from the river during typical dry season conditions (Metz and Lewelling, 2009).

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 can be grouped into saltwater and freshwater types. Saltwater wetlands do not exist in the planning region due to its inland location. Freshwater wetlands are common in inland areas of Florida. 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. These freshwater wetlands are the predominant type of wetland in the planning region and play a significant role in the health and flow of several major river systems.



Peace River near Wauchula in Hardee County

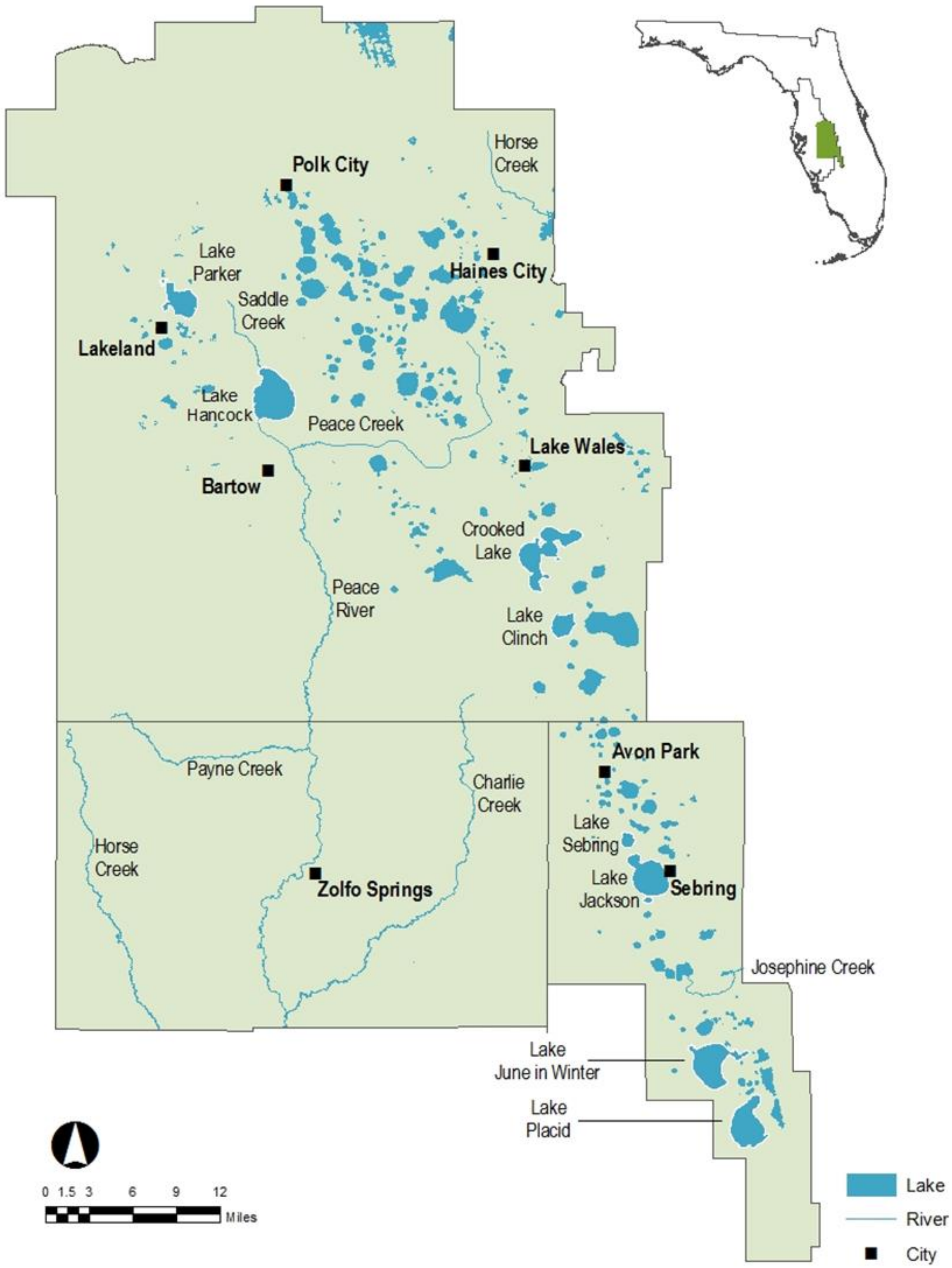


Figure 1-2. *Major hydrologic features in the Heartland Planning Region*

Section 4. Geology/Hydrogeology

Three principal aquifers, the surficial, intermediate, and UFA, are present throughout much of the planning region and are used as water supply sources. Figure 1-3 is a generalized north-south cross section showing the hydrogeology of the District and Figure 1-4 shows the west-central Florida groundwater basins. As seen in the figures, the Southern West-Central Florida Groundwater Basin (SWCFGWB) encompasses the southern half of the District where the intermediate aquifer system and its associated clay-confining units separate the surficial and UFA. This causes the UFA to be well-confined over most of the planning region except for the Green Swamp, Winter Haven Ridge, and the Lake Wales Ridge areas.

The surficial aquifer is contained within near-surface deposits that mainly consist of undifferentiated sands, clayey sand, silt, shell and marl. The aquifer produces relatively small quantities of water, which are generally used for low-volume irrigation or domestic water supply, except along the Lake Wales Ridge where it is thick enough to supply large agricultural withdrawals. The aquifer ranges in thickness from 50 feet in Polk County to greater than 300 feet in southern Highlands County within the Lake Wales Ridge (Yobbi, 1996). East and west of the Lake Wales Ridge, thickness of the aquifer is generally less than 50 feet.

Green Swamp

Underlying the surficial aquifer is the intermediate aquifer system. This aquifer consists predominantly of discontinuous sand, gravel, shell, limestone and dolomite beds of the Hawthorn Group. In the southern portion of the planning region, the aquifer may contain one or more distinct production zones (Wolansky, 1983). The water-bearing zones are confined or semi-confined by low-permeability sandy clays, clays and marls. From central Polk County northward, the Hawthorn Group constitutes a confining unit, as significant permeable zones are no longer present. In general, the thickness of the aquifer increases from north to south and varies from less than 75 feet in Polk County to more than 375 feet in Hardee County (FGS 2006). Recharge to the aquifer varies from low to moderate depending upon the confining characteristics of the clayey sediments above and below it. Along the Lake Wales Ridge in Polk and Highlands counties, the aquifer and its confining units are extensively breached by karst features that are mostly buried but also expressed on the surface as sinkhole lakes. In this region, the surficial and UFA are generally in good hydraulic connection as a result of this karst geology.

The UFA, by far the most important source of water in the planning region, is composed of a thick, stratified sequence of limestone and dolomite units that include (in order of increasing geologic age and depth) the Suwannee Limestone, Ocala Limestone and Avon Park Formation. The aquifer can be separated into upper and lower flow zones. The Suwannee Limestone forms the upper flow zone. The lower zone is the highly transmissive portion of the Avon Park Formation. The two zones are separated by the lower permeability Ocala Limestone. The two flow zones are connected through the Ocala Limestone by diffuse leakage, vertical solution openings along fractures or other zones of preferential flow (Menke et al., 1961).

The Middle Confining Unit 2 (MCU II) of the Floridan aquifer lies near the base of the Avon Park Formation (Miller, 1986). It is composed of evaporate minerals such as gypsum and anhydrite, which occur as thin beds or as nodules within dolomitic limestone that overall has very low permeability. MCU II is generally considered to be the base of the freshwater production zone of the aquifer, except in the extreme eastern portion of Polk County. In this area, MCU II is absent and the LFA is present, which contains fresh water. This LFA on the eastern side of Polk County lies below another middle confining unit called MCU I (Miller, 1986). It is located in the upper portion of the Avon Park Formation and is comprised of tight, dense, carbonate rock. MCU I is only located in eastern Polk County. The base of the Floridan aquifer system occurs at more than 2,000 feet below land surface near the top of the Cedar Keys Formation where evaporate minerals form the basal confining unit (Miller, 1986).

In the western portion of the planning region, recharge to the UFA ranges from less than one inch to several inches per year (Sepulveda, 2002). This low recharge rate is due to the thick sequence of multiple clay-confining layers that overlie the aquifer. These clay layers restrict the vertical exchange of water from the surficial aquifer to the underlying UFA. Recharge to the aquifer along the Winter Haven and Lake Wales Ridge in the northern and eastern portions of Polk and Highlands counties is much higher. In this area, the intermediate confining bed becomes thinner or is breached by karst activity. Model-estimated recharge rates in the Winter Haven and Lake Wales Ridges range from approximately 10 to 20 inches per year (SWFWMD, 1993).

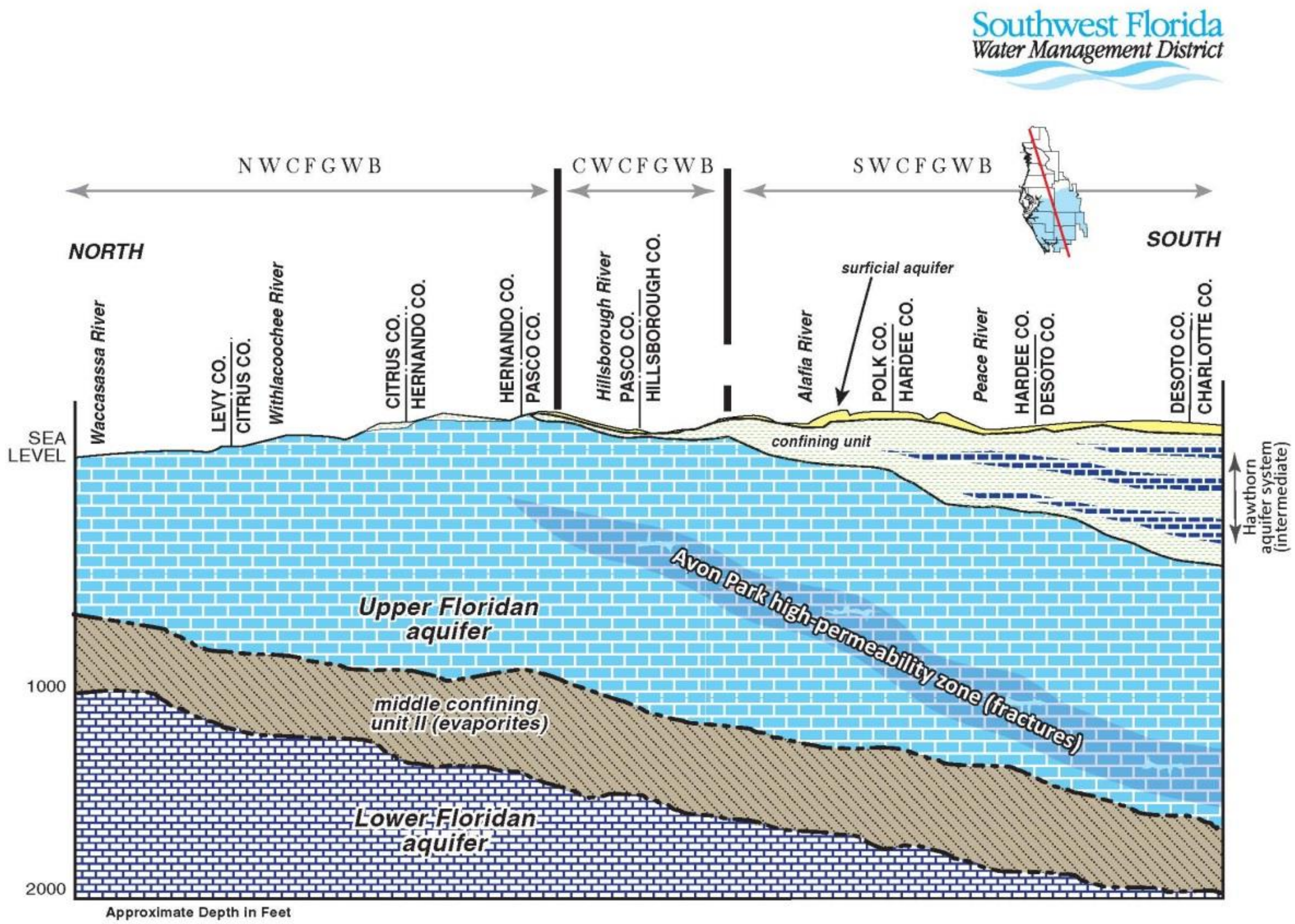


Figure 1-3. *Generalized north-south geologic cross section through the District*

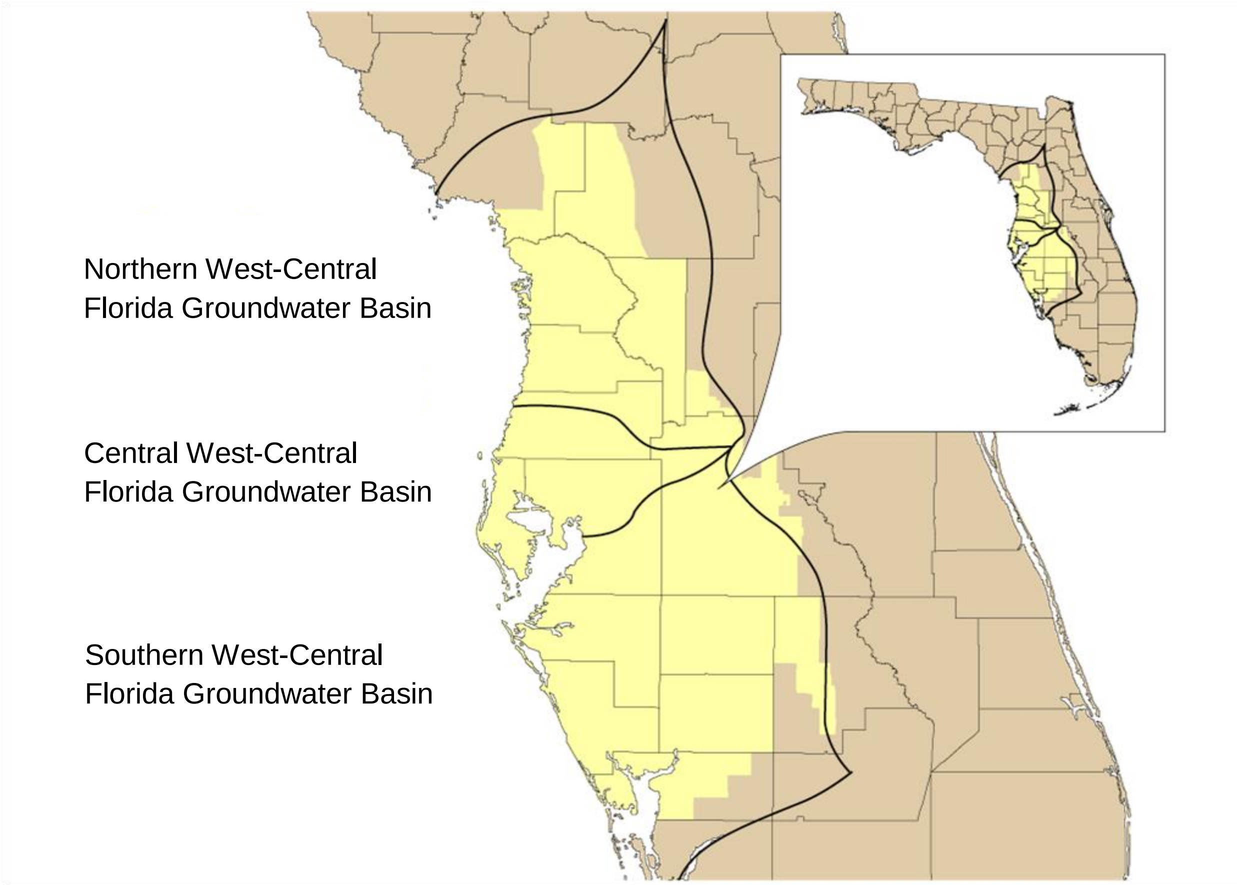


Figure 1-4. *The District and the West-Central Florida Groundwater Basins*

Part D. Previous Technical Investigations

The 2015 RWSP builds on a series of cornerstone technical investigations that were undertaken by the District and the United States Geological Survey (USGS) beginning in the 1970s. These investigations provide District staff with an understanding of the complex relationships between human activities (i.e., surface water and groundwater usage and large-scale land-use alterations), climactic cycles, aquifer/ surface water interactions, aquifer and surface hydrology, and water quality. Investigations conducted in the Heartland 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 of this investment 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 water 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.

In 1978, the Peace River Basin Board directed that a hydrologic investigation be performed to assess causes of lake level declines that were occurring since the 1960s along the Lake Wales Ridge in Polk and Highlands counties. The investigation (referred to as Ridge I) was completed in 1980 and concluded that the declines were due to below-normal rainfall and groundwater withdrawals. In 1987, the District initiated the Ridge II study to implement the data collection that was recommended in the previous study and to further assess lake level declines. The Ridge II investigation concluded that lake level declines were a result of below-average rainfall and aquifer withdrawals. Ridge II also recognized that groundwater withdrawals throughout the groundwater basin contributed to declines within the Ridge area. Additionally, it was concluded that in some cases alterations to surface drainage were significant and affected lake level fluctuations.

During the 1980s, hydrologic and biologic monitoring from the District's expanded data collection networks began to reveal water resource impacts in other areas. In the late 1980s, the District initiated water resource assessment projects (WRAPs) for the Eastern Tampa Bay (ETB) area to determine causes of water level declines and to address water supply availability. Resource concerns in this area included saltwater intrusion in the UFA.

Based on the findings of the Ridge II and WRAP studies and continued concern about water resource impacts, the District established the Ridge and the ETB WUCAs 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 ETB and Ridge area WUCAs. These meetings are summarized in the Highlands Ridge Work Group Report (SWFWMD, 1989) and Management Plan (SWFWMD, 1990) and Eastern Tampa Bay Work Group Report (SWFWMD, 1990) and Management Plan (SWFWMD, 1990). These deliberations led to major revisions of the District's water use permitting rules, as special conditions were added that were specific to each WUCA. It was also during these deliberations that the original concept of the SWUCA emerged. The ETB Work Group had lengthy discussions on the connectivity of the groundwater basin and how withdrawals throughout the basin were contributing to saltwater intrusion and impacts to lakes in the Ridge area. A significant finding of both the Ridge II study and the ETB WRAP was that the lowering of the potentiometric surface within those areas was due to groundwater withdrawals from beyond the areas as well as within the areas. Additionally, the ETB WRAP concluded that there was a need for a basin-wide approach to the management of the water resources. Based on results of these studies and work group discussions, in October 1992, the District established the SWUCA to encompass both the ETB and Ridge area WUCAs and the remainder of the groundwater basin.

The District established MFLs for several water bodies in the SWUCA and adopted a SWUCA Recovery Strategy (SWFWMD, 2006a) to address depressed aquifer levels causing saltwater intrusion along the coast, reduced flows in the upper Peace River, and lower lake levels in areas of Polk and Highlands counties. A five-year assessment of the recovery strategy for FY2007-2011 was completed in 2013 (SWFWMD, 2013). The District is currently working with key stakeholders and the public to develop additional recovery options over the next several years.

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 CFWI area includes Orange, Osceola, Seminole, Polk, and southern Lake 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 RWSP for the CFWI has been developed and current work is focused on the solutions and regulatory components of the initiative.

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 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 Heartland 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 Heartland Planning Region*

Investigation Type	Description
Completed Investigations	
Groundwater	Regional Groundwater Flow System Models of the SWFWMD, Highlands Ridge WUCA, and Hardee and DeSoto Counties
	Hydrogeologic Characterization of the Intermediate Aquifer System
	Hydrogeology and Quality of Groundwater in Polk County
	Hydrogeology and Quality of Groundwater in Highlands County
	Aquifer Test Simulation
Surface Water	Effect of Karst Development on Peace River Flow
	Hydrologic Budget of Lake Starr
	Hydrologic Budget of Lake Lucerne
	Lake Stage Statistics Assessment to Enhance Lake Minimum Level Establishment
	Charlie Creek Watershed Hydrologic Characterization
	Primer on Hydrogeology and Ecology of Freshwater Wetlands in Central Florida
	Factors Affecting Water Levels in the Central Florida Coordination Area
	Upper Hillsborough River Study on Surface and Groundwater Interactions and Water Quality
	Measuring Urban Evapotranspiration in Central Florida and Preparing Statewide Model
	Methods to Define Storm Flow and Base Flow Components of Total Stream Flow in Florida Watersheds
Groundwater and Surface Water	Use of Groundwater Isotopes to Estimate Lake Seepage in the NTB and Highlands Ridge Lakes
	Effects of Development on the Hydrologic Budget in the SWUCA
	Surface and Groundwater Interaction in the Upper Hillsborough River Basin
Data Collection	Nitrate and Pesticides in Ridge Lakes of Polk and Highlands Counties
Ongoing Investigations/Data Collection Activities	
Data Collection	Minimum Flows and Levels Data Collection
	Surface Water, Groundwater, Evapotranspiration 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.

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 (Section 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 (Ch. 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 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, 2006b). 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


USGS gauge site on river

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 past and future 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 as computers became more sophisticated, models developed by the District 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

The early groundwater models developed for the SWUCA were completed by the USGS. Since the early 1990s, the District developed the ETB model (Barcelo and Basso, 1993) that simulated flow within the SWCFGWB. Though this model was originally designed to evaluate groundwater withdrawals for the ETB WRAP, it has been used to evaluate effects of various proposed and existing withdrawals across the SWUCA in the SWCFGWB. Results of the modeling effort have confirmed the regional nature of the groundwater basin in the SWUCA. Following completion of the ETB model, the USGS was contracted to develop a model of the Lake Wales Ridge area (Yobbi, 1996), which has been used to provide assessments of the effects of regional groundwater withdrawals on surficial aquifer water levels in the Ridge area.

The Southern District Model Version 1.0 simulates groundwater flow in the entire District south of Hernando County (Beach and Chan, 2003). However, the model is primarily designed to simulate conditions throughout the District south of the Hillsborough River and Green Swamp. The Southern District Model Version 1.0 has replaced the ETB model as the principal tool for resource assessment and resource management in the SWCFGWB. It was recalibrated using automatic calibration procedures in 2006 (Beach, 2006).

2.0 Saltwater Intrusion Models

There have been three major models developed to simulate historical and future saltwater intrusion in the SWUCA. The first of these models was a series of three, two-dimensional, cross-section models capable of simulating density-dependent flow known as the Eastern Tampa Bay Cross-Section Models. Each model was designed as a geologic cross section located along flow paths to the Gulf of Mexico or Tampa Bay, and the models were used to make the initial estimates of movement of the saltwater-freshwater interface in the former Eastern Tampa Bay WUCA (ETBWUCA). To address the three-dimensional nature of the interface, a sharp interface code, known as SIMLAS, was developed by HydroGeoLogic, Inc. (1993) for the District. The code was applied to the ETB area, creating a sharp interface model of saltwater intrusion. Subsequent to this, the cross-sectional models were refined (HydroGeoLogic, Inc., 1994) and the results were compared to those of the sharp interface model (HydroGeoLogic, Inc., 1994). The cross-sectional models compared well with the sharp interface model.

In support of establishing a minimum aquifer level to protect against saltwater intrusion in the MIA of the SWUCA, a fully three-dimensional, solute transport model of the ETB area was developed in 2002 by HydroGeoLogic, Inc. (HydroGeoLogic, Inc., 2002). The model encompassed all of Manatee, Sarasota and the southern half of Hillsborough and Pinellas counties and simulated flow and transport in the UFA. The model was calibrated from 1900 to

2000, although there is only water quality data for the period from 1990 to 2000. The model was used to derive estimates of the number of wells and amount of water supply at risk to future saltwater intrusion under different pumping scenarios.

3.0 Integrated Surface Water/Groundwater Models

The Peace River Integrated Model (PRIM) is an integrated surface water and groundwater model of the entire Peace River Basin (HydroGeoLogic, 2011). The PRIM was developed using MODHMS, which is a proprietary model code by HydroGeoLogic, Inc. The surface water component of the model is grid-based. The PRIM was used to understand the effects on river flows from historical changes and to simulate the effects of future resource management options. The model is used to examine potential effects to wetlands, lakes, springs, and rivers from rainfall variation, land use changes, and regional groundwater withdrawals in the SWUCA.

The Myakka River Watershed Initiative is a comprehensive watershed study and planning effort to address environmental damage caused by excess water attributed to agricultural operations in the watershed. The Myakka River watershed water budget model was a component of this initiative. The objectives of the model were to estimate quantities and timing of excess flows in the upper Myakka River, investigate linkages between land use practices and excess flows, develop time-series of flow rates sufficient for pollutant load modeling, evaluate alternative management scenarios to restore natural hydrology and simulate hydroperiods for the Flatford Swamp under historic, existing and proposed flow conditions. The model is complete and has been calibrated and verified. It will be updated as knowledge of the system expands.

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 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 Focused 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.

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Chapter 2. Resource Protection Criteria

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

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. 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, 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 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 Southern Water Use Caution Area (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. 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.

The recovery of low flows on the upper Peace River is a District priority for the Heartland Planning Region

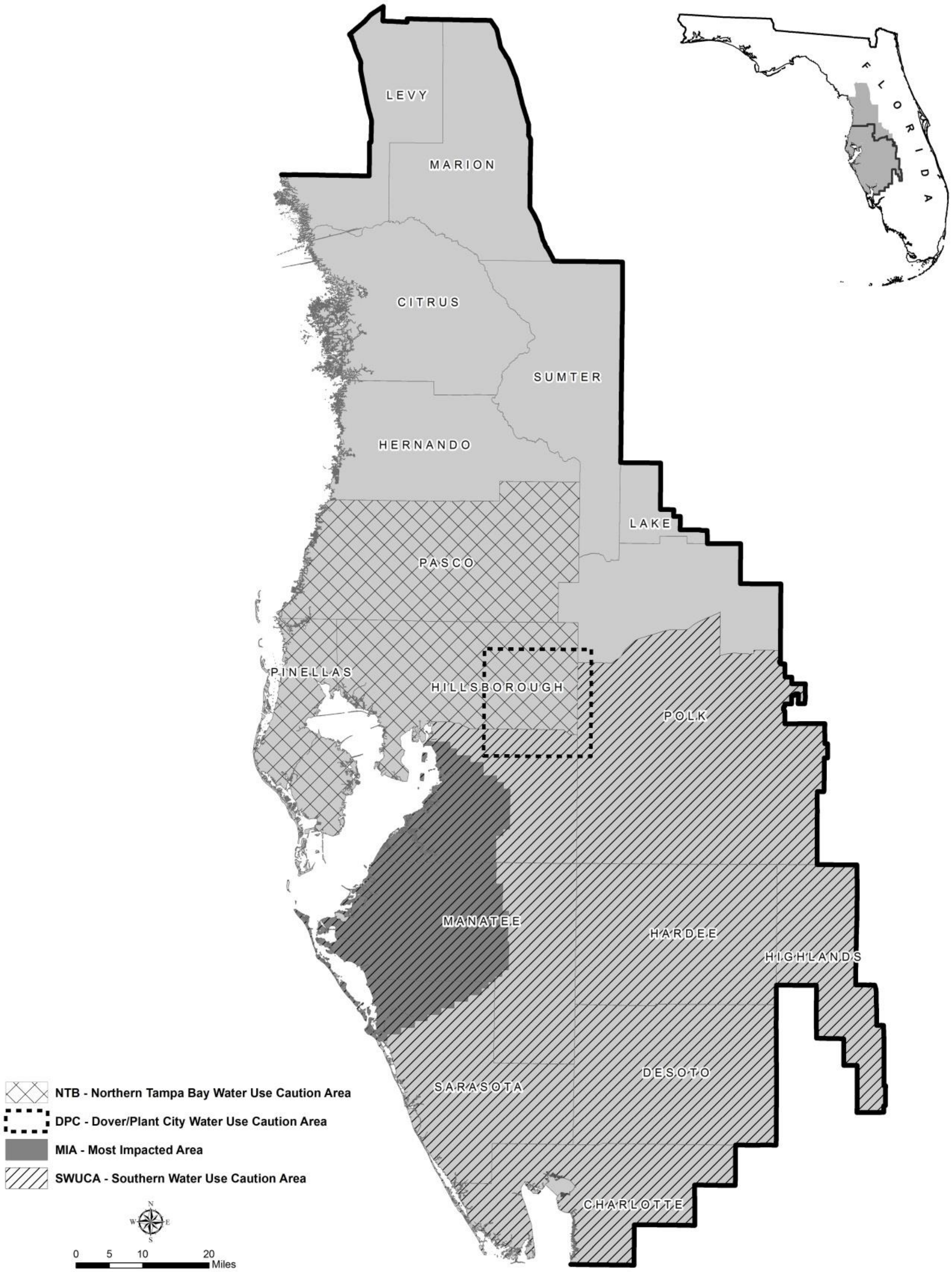

Figure 2-1. *Location of the District's water use caution areas and the MIA of the SWUCA*

1.0 Southern Water Use Caution Area (SWUCA)

Since the early 1900s, groundwater withdrawals have steadily increased in the Southern West-Central Florida Groundwater Basin (Figure 2-2) in response to growing demands for water from the mining and agricultural industries and later from public supply, power generation and recreational uses. Before peaking in the mid-1970s, these withdrawals resulted in declines in UFA levels that exceeded 50 feet in some areas of the groundwater basin. The result of the depressed aquifer levels was saltwater intrusion in the coastal portions of the UFA, reduced flows in the upper Peace River and lowered water levels in some lakes within upland areas of Polk and Highlands counties. In response to these resource concerns, the District established the SWUCA in 1992. The SWUCA encompasses all or portions of eight counties in the southern portion of the District, including all of the ETBWUCA and HRWUCA, and the MIA within these counties. Although groundwater withdrawals in the region have stabilized over the past few decades as a result of management efforts, area water resources continue to be impacted by the historic decline in aquifer water levels.

In 1994, the District initiated rulemaking to modify its water use permitting rules to better manage water resources in the SWUCA. The main objectives of the rules were to (1) significantly slow saltwater intrusion into the confined UFA along the coast, (2) stabilize lake levels in Polk and Highlands counties, and (3) limit regulatory impacts on the region's economy and existing legal users. The principal intent of the rules was to establish a minimum aquifer level and to allow renewal of existing permits, while gradually reducing permitted quantities as a means to recover aquifer levels to the established minimum. A number of parties filed objections to parts of the rule and an administrative hearing was conducted. In March 1997, the District received the Final Order upholding the minimum aquifer level, the science used to establish it, and the phasing in of conservation. However, in October 1997 the District appealed three specific components of the ruling and withdrew the minimum aquifer level. Withdrawal of the minimum aquifer level resulted because parts of the Rule linked the level to the provisions for reallocation of permitted quantities and preferential treatment of existing users over new permit applications, both of which were ruled to be invalid.

In 1998, the District initiated a reevaluation of the SWUCA management strategy and, in March 2006, established minimum "low" flows for the upper Peace River, minimum levels for eight lakes along the Lake Wales Ridge in Polk and Highlands counties, and a saltwater intrusion minimum aquifer level (SWIMAL) for the UFA in the MIA of the SWUCA. Since most, if not all, of these water resources were not meeting their established MFLs, the District adopted a recovery strategy for the SWUCA in 2006 (SWFWMD, 2006). As part of the strategy, the status of District monitoring efforts are reported to the Governing Board on an annual basis, and every five years a comprehensive review of the strategy is performed. Adjustments to the strategy will be made based on results of the ongoing monitoring and recovery assessments. In 2013, the District completed the first five-year review of the recovery strategy. Because adopted MFLs for many water bodies were still not being met, the District initiated a series of stakeholder meetings to review results of the technical assessments and identify potential recovery options. It is anticipated that the stakeholder process will be complete by the time this RWSP is published.

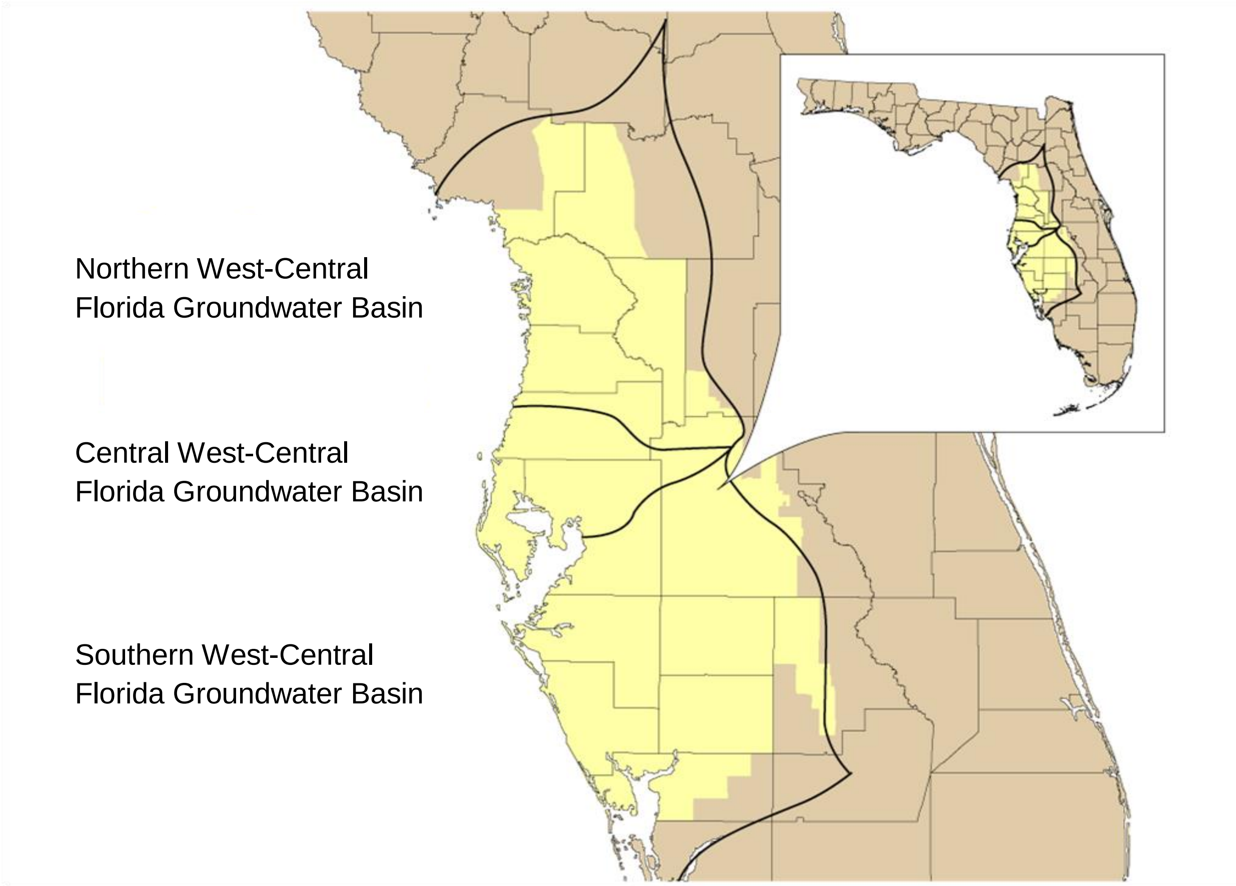

Figure 2-2. *The District and the West-Central Florida Groundwater Basins*

2.0 Dover/Plant City Water Use Caution Area (Dover/Plant City WUCA)

Groundwater withdrawals used for freeze protection of crops in the Dover/Plant City WUCA between January 3, 2010, and January 13, 2010, resulted in UFA drawdown that contributed to a large number of sinkhole occurrences and more than 750 dry well complaints from neighboring domestic well owners. Agricultural users growing strawberries, citrus, blueberries, nursery ornamentals, as well as tropical fish farms at risk of frost/freeze damage and crop loss, are permitted to use Floridan aquifer groundwater withdrawals as the primary freeze protection method. During an unprecedented nine nights of freezing temperatures over eleven consecutive days in January 2010, withdrawals totaling nearly 619,000 gpm occurred for approximately 65 hours in the Dover/Plant City area and were followed by withdrawals at a rate of approximately 433,000 gpm for an additional 19 hours. In 2011, based on impacts associated with these withdrawals, the District established the Dover/Plant City WUCA; a 256 square mile area located in northeast Hillsborough County and eastern Polk County within portions of the NTBWUCA as well as the SWUCA (see Figure 2-1). Concurrent with the establishment of the Dover/Plant City WUCA, the District adopted the Minimum Aquifer Level (MAL), Minimum Aquifer Level Protection Zone (MALPZ) and recovery strategy for the Dover/Plant City WUCA.

The recovery strategy established by Rule 40D-80.075, F.A.C., for the Dover/Plant City WUCA has the objective to reduce groundwater withdrawals used for frost/freeze cold protection by 20 percent by January 2020 (from January 2010 withdrawal quantities). Meeting this objective will lessen the potential for drawdown during future cold protection events to lower the UFA level at District monitor well DV-1 Suwannee below 10 feet NGVD (1929). Recovery mechanisms identified in the rule include non-regulatory and regulatory approaches. The non- regulatory mechanisms include assistance in offsetting groundwater withdrawals for cold protection through the FARMS program, providing enhanced data for irrigation system management and other means. Projects are cofounded by the District and private enterprise to develop and enhance water conservation projects for the direct benefit of reducing cold protection groundwater withdrawals. In the regulatory approach, water use permitting rules in Chapter 40D-2, F.A.C., and the WUP Applicant's Handbook, Part B, incorporated by reference in Rule 40D2.091, F.A.C., Section 7.4, address groundwater withdrawal impacts, alternative water supplies, frost/freeze cold protection methods and resource recovery. New groundwater withdrawals for cold protection are not authorized within the MALPZ and any new permitted groundwater withdrawals outside the MALPZ cannot cause new drawdown impact at the MALPZ boundary. Alternative methods to groundwater withdrawals used for cold protection are to be investigated and implemented where practicable.

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, 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 NTB area (Section 373.042[2], F.S.). Chapter 373, F.S., 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 District's priority list 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 on 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 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

Section 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 used to develop MFLs 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 2-3 depicts priority MFLs water resources that are located at least partially within the Heartland Planning Region. A complete list of water resources with established MFLs throughout the District is provided in the Chapter 2 Appendix. Water resources with established MFLs in the planning region include the following:

- Saltwater intrusion minimum aquifer level for the MIA of the SWUCA
- 26 lakes in Highlands and Polk counties
- Upper Peace River and Middle Peace River (partially located in the Southern Planning Region)
- Upper Myakka River (partially located in the Southern Planning Region)
- Upper Hillsborough River (partially located in Tampa Bay Planning Region)
- Upper Alafia River (partially located in Tampa Bay Planning Region)

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

- Upper and Middle Withlacoochee River system (three segments)
- Upper Peace River "middle" and "high" minimum flows
- Charlie Creek
- Horse Creek
- North and South Prong of the Alafia River
- Damon, Pioneer, Phythias, and Viola (Highlands County lakes)
- Hancock, Eva, Lowery, Amoret, Aurora, Bonnet, Easy, Effie, Josephine, Little Aurora, and Trout (Polk County lakes)
- Jackson, Letta, Little Jackson, and Lotela (Highlands County lakes for reevaluation)
- Clinch, Crooked, Eagle, McLeod, Starr, and Wales (Polk County lakes for reevaluation)

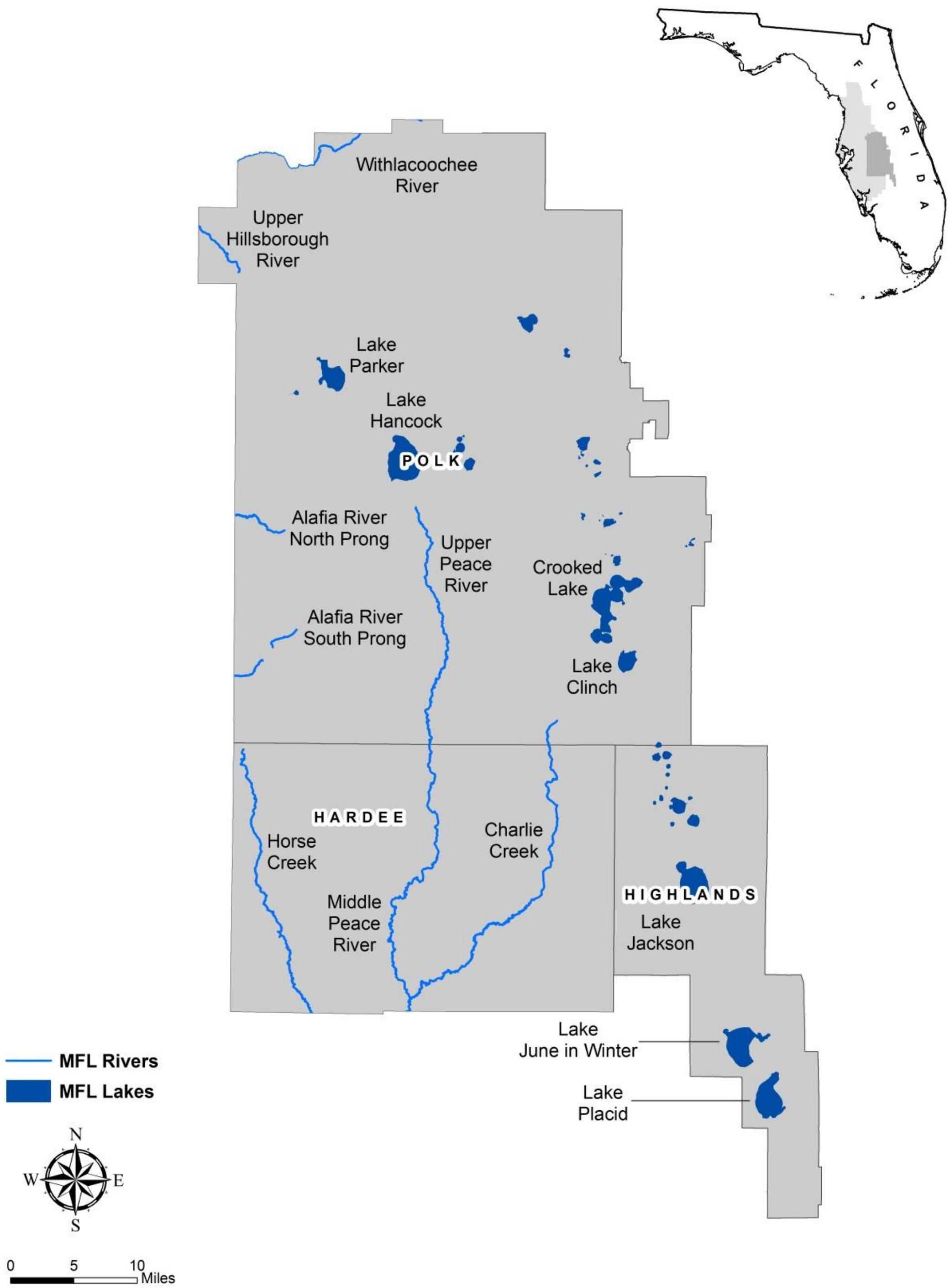

Figure 2-3. *MFL priority water resources in the Heartland Planning Region*

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 water supply planning activities initiated by the District, other entities in the planning region are involved in planning efforts in cooperation with those of the District. The goal is to ensure that future water supply demands will be met without adversely impacting proposed or established MFLs. Additional water supply planning activities in the planning region are listed below.

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).

The District has developed two recovery strategies for achieving recovery to established MFLs as soon as practicable in the Heartland Planning area. Regional strategies have been developed for the SWUCA and Dover/Plant City WUCA. Regulatory components of the recovery strategies for water resources in these areas have been incorporated into District rules (Chapter 40D-80, F.A.C.) and outlined in District reports.

1.0 SWUCA

The purpose of the SWUCA recovery strategy (Rule 40D-80.074, F.A.C., and SWFWMD, 2006) is to provide a plan for reducing the rate of saltwater intrusion and restoring low flows to the upper Peace River and lake levels by 2025, while ensuring sufficient water supplies and protecting the investments of existing WUP holders. The strategy has six basic components: regional water supply planning, use of existing rules, enhancements to existing rules, financial incentives, projects to re-establish MFLs, and resource monitoring. Regional water supply planning allows the District and its communities to strategize on how to address growing water needs while minimizing impacts to the water resources and natural systems. Existing rules and enhancements to those rules will provide the regulatory criteria to accomplish the majority of recovery strategy goals. Financial incentives to conserve and develop alternative water supplies will help meet water needs, while implementation of water resource development (WRD) projects will help reestablish minimum flows to rivers and enhance recharge. Finally, resource monitoring, reporting, and cumulative impact analysis will provide data to analyze the success of recovery.

Resource recovery projects, such as the project to raise the levels of Lake Hancock for release to the upper Peace River during the dry season, are actively being pursued. Whereas coastal areas will generally meet their future demands through development of alternative supplies, some new uses within inland areas can be met with groundwater from the UFA that will use groundwater quantities from displaced non-residential uses (i.e., land-use transitions) as mitigation for the impacts of the new groundwater withdrawals.

The success of the recovery strategy will be determined through continued monitoring of area resources. The District uses an extensive monitoring network to assess actual versus anticipated trends in water levels, flows and saltwater intrusion. Additionally, the District conducts an assessment of the cumulative impacts of the factors affecting recovery. Information developed as part of this monitoring effort is provided to the Governing Board on an annual basis. The water resource and water supply development components of the strategy simply require “staying the course,” which is how the District has addressed these issues for the past decade. However, based on completion of a five-year assessment of the SWUCA recovery strategy (SWFWMD, 2013), and because adopted MFLs for many area water bodies were still not being met, the District initiated a series of stakeholder meetings to review results of the technical assessments and identify potential recovery options.

Regarding the financial component of the recovery strategy, the District has developed a funding strategy that outlines how the alternative water supplies and demand management measures needed to meet demand in the SWUCA (and the remainder of the District) during the planning period can be funded. The funding strategy also includes water resource restoration projects in areas such as the upper Peace River. An overview of the strategy is included in Chapter 8, Overview of Funding Mechanisms.

The management approaches outlined in the recovery strategy will be reevaluated and updated over time. The five-year updates to the RWSP include revisiting demand projections, as well as reevaluation of potential sources using the best available information. In addition, monitoring of recovery in terms of trends in both water resource and water use quantities is an essential component of the strategy. Monitoring will provide the information necessary to determine progress in achieving recovery and protection goals. Monitoring will also enable the District to take an adaptive management approach to the resource concerns in the SWUCA to ensure those goals are ultimately achieved.

2.0 Dover/Plant City WUCA

In 2010, the District determined that groundwater withdrawals used for frost/freeze protection in the Dover/Plant City area contributed to water level declines that are significantly harmful to the resources of the area. In June 2011, the District adopted the Dover/Plant City WUCA MAL (Figure 2-3), related MALPZ (Rule 40D-80.075, F.A.C.), and a recovery strategy as part of a comprehensive management program intended to arrest declines in area water levels in the UFA during frost/freeze events. These efforts were also undertaken to minimize the potential for impacts to existing legal users and sinkhole occurrence. The Dover/Plant City WUCA MAL is the 10 ft. potentiometric surface elevation (NGVD 1929) at District Well DV-1 Suwannee. The District concluded that this was the elevation below which the greatest incidence of well failures and sinkholes occurred during the 2010 frost/freeze event. The objective of the recovery strategy is to, by January 2020, reduce groundwater withdrawals used for frost/freeze protection within the Dover/Plant City WUCA by 20 percent (i.e., compared to January 2010 withdrawal quantities). This should reduce the potential for drawdown during future frost/freeze events to lower the aquifer level at District Well DV-1 Suwannee below 10 feet (NGVD 1929).

Part D. Reservations

Section 373.223(4), F.S., authorizes reservations of water 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 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.

For example, within the Heartland Planning Region, the District is planning to reserve water to aid in the recovery of MFLs in the upper Peace River. To address identified recovery needs for the river, the District is implementing a project to raise water levels in Lake Hancock and use this stored water to provide a significant portion of the flows necessary for meeting the river’s MFLs. In May 2009, the District initiated rulemaking to reserve from permitting the quantity of water stored in the lake to support the recovery effort.

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 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 estimate 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 habitats 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 Orange, Osceola, Seminole, Polk, and southern Lake counties (Figure 2-4). 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 St. John’s River Water Management District (SJRWMD), South Florida Water Management District (SFWMD), DEP, 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 focused on water demand estimates and projections, water resource assessments (based in part on groundwater modeling), and development of 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 include 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 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 three 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 analyses, identification of governance structure options, and any potential recovery needs. This document is scheduled to be finalized 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.

Lake Lotela in Highlands County

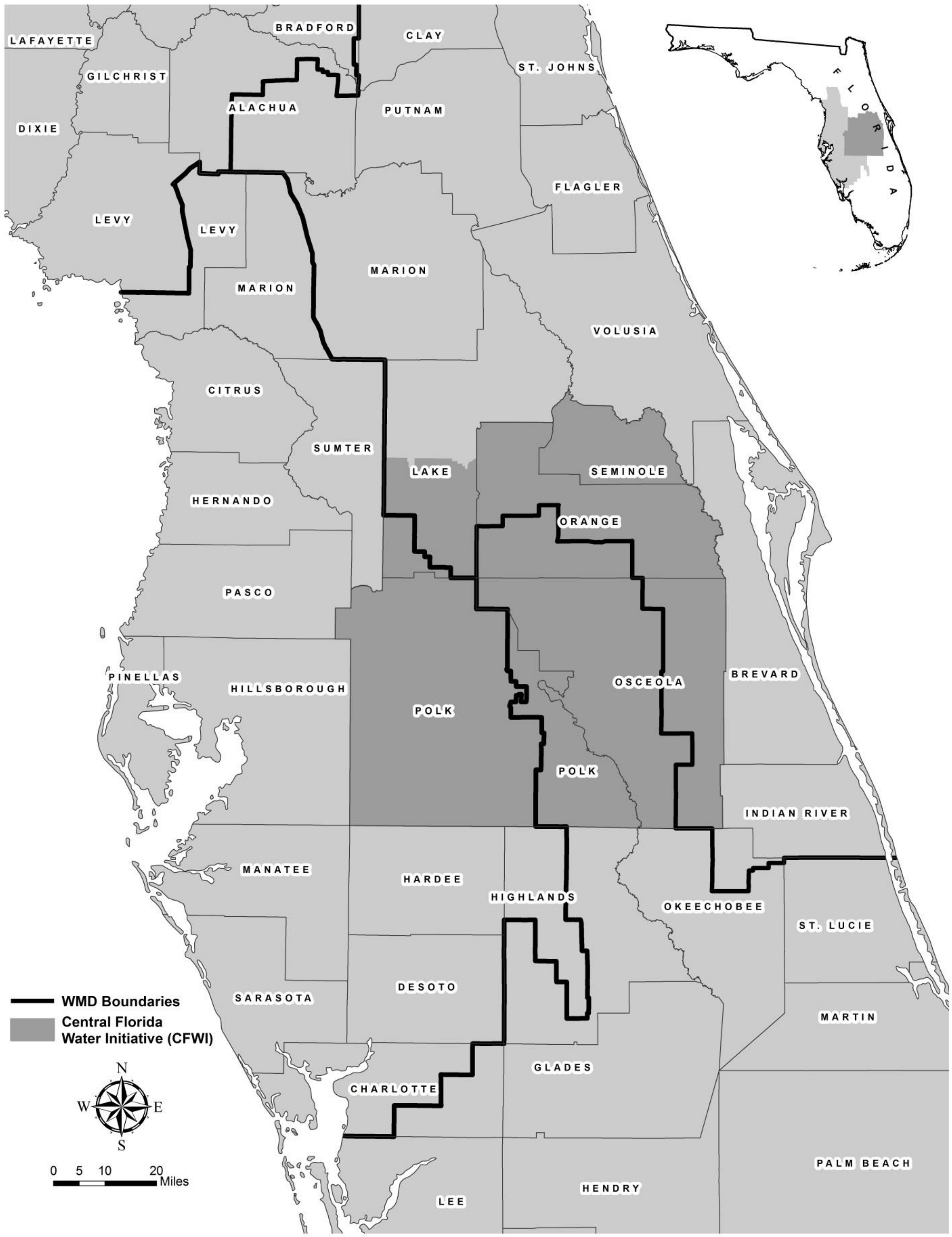

Figure 2-4. *Location of the Central Florida Water Initiative Area*

Chapter 3. Demand Estimates and Projections

This chapter is a comprehensive analysis of the demand for water for all use categories in the Heartland Planning Region for the 2010-2035 planning period. The chapter includes the 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 sectors 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) (Highlands and Polk) reflect only the anticipated demands in those portions located within the District's boundaries. Decreases in demand are reductions in the use of groundwater for the agricultural and industrial/commercial, mining/dewatering and power generation use categories. Increases in demand may be met with alternative sources and/or conservation and the retired groundwater quantities may be reallocated for mitigation of new groundwater permits for other use categories and/or permanently retired to help meet environmental restoration goals.

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:

- Establishment of a base year: The year 2010 was agreed upon as a base year for the purpose of developing and reporting water demand projections. This is consistent with the methodology agreed upon by the Water Planning Coordination Group. The data for the base year consist of reported and estimated usage for 2010; whereas, data for the years 2015 through 2035 are projected demands.
- Water use reporting thresholds: Minimum thresholds of water use within each water use category were agreed upon as the basis for projection.
- 5-in-10 versus 1-in-10: 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) commercial/industrial, mining/dewatering and power generation, (4) landscape/recreation, and (5) environmental restoration (also referred to as PS, AG, I/C, MD, 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 from GIS Associates, Inc.'s 2012 population estimate. Utilities with permitted quantities less than 100,000 gallons per day are not required to report population or submit service area information. Subsequently, population was obtained from the last 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 (DSS) base year is calculated by multiplying the 2010 DSS 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", 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 is the projected public supply water demand for the planning period. The table shows that public supply demand will increase by 38.72 mgd for the 5-in-10 condition and that 36.15 mgd, or 93 percent of the increase, will occur in Polk County.

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 Heartland 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
Hardee	2.11	2.23	2.12	2.25	2.14	2.27	2.16	2.29	2.17	2.30	2.19	2.32	0.09	0.09	4.1%	4.1%
Highlands	11.91	12.63	12.38	13.12	12.97	13.75	13.52	14.33	13.99	14.83	14.40	15.26	2.49	2.63	20.9%	20.9%
Polk	82.39	87.34	89.00	94.34	96.81	102.61	104.48	110.75	111.77	118.48	118.54	125.65	36.15	38.31	43.9%	43.9%
Total	**96.41**	**102.20**	**103.51**	**109.72**	**111.92**	**118.64**	**120.16**	**127.36**	**127.94**	**135.62**	**135.13**	**143.24**	**38.72**	**41.04**	**40.2%**	**40.2%**

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 data. As published historic acreage for non-citrus crops is 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 Polk County are derived from the Draft Central Florida Water Initiative (CFWI) RWSP (May 2015).

Hardee County is one of the few counties projected to have an increase in citrus acreage

The FDACS also prepared Florida Statewide Agricultural Irrigation Demand (FSAID2) projections through 2035; however, the District did not use the FSAID2 projections for several reasons. Foremost, they were not completed in a timeframe 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

Trends indicate that agricultural activities are expected to remain steady or increase slightly in the Heartland Planning Region during the planning period. In 2015, the District projects 181.06 mgd will be used to irrigate approximately 170,103 acres of agricultural commodities. From 2010 to 2035, irrigated acreage is expected to increase by approximately 1.55 percent, or 2,635 acres. Most of the increase in acreage will be in citrus in Hardee County. Hardee County is one of the few counties in the District projected to experience a significant increase in citrus acreage. It appears that these southwest District counties are recovering from the significant loss of citrus acreage likely related to the hurricanes of 2004 and the resulting spread of citrus canker. The largest amount of citrus acreage remains in Polk County, followed by Hardee County and then Highlands County. The most notable increase in water use over the planning period is for citrus.

Table 3-2 displays projected combined agricultural irrigation and non-irrigation demands[1] for the 5-in-10 (average) and 2-in-10 (drought) conditions for the planning period. For the 5-in-10 condition, total regional demand, including non-irrigation demand, is projected to increase by 4.43 mgd from the 2010 base year quantity of 183.41 mgd to 187.84 mgd in 2035, a 2.42 percent increase. 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 nor 2-in-10 agricultural demands were projected in the Draft CFWI RWSP (May 2015). Therefore, total drought quantities for Polk 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 Polk County would produce misleading totals, so they are addressed as

[1] CFWI projected water demand associated with aquaculture, livestock watering, dairy, poultry, swine, etc., are reported as "miscellaneous" in the Draft CFWI RWSP (May 2015), and are included as non-irrigation demand in the total water demands in Table 3-2 and in Appendix 3-1.

"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), the FDACS produced agricultural water demand projections for 2015 through 2035. Once some adjustments are made to the FSAID2 projections based on the two significant differences in data and methodology addressed above, there is only a Districtwide difference of approximately 1.85 percent 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-in application rates to 2015 rates throughout the planning period. Without the adjustments, the FSAID2 2035 Districtwide average condition irrigation projections are approximately 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, 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.

Table 3-2. *Projected total agricultural demand in the Heartland 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
Hardee	54.14	74.35	54.91	75.62	55.57	76.70	56.29	77.84	57.15	79.14	58.10	80.54	3.96	6.19	7.3%	8.3%
Highlands	41.90	55.57	41.79	55.38	41.95	55.47	42.18	55.64	42.43	55.84	42.71	56.06	0.81	0.49	1.9%	0.9%
Polk	87.37	NA	87.03	NA	87.03	NA	87.03	NA	87.03	NA	87.03	119.89	-0.34	NA	-0.4%	NA
Total	**183.41**	**NA**	**183.73**	**NA**	**184.55**	**NA**	**185.49**	**NA**	**186.61**	**NA**	**187.84**	**256.50**	**4.43**	**NA**	**2.4%**	**NA**

Notes: Polk County projections derived from Draft CFWI RWSP (May 2015) in which 2-in-10 projections for drought conditions are only available for year 2035. Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-1 for source values.

Mature citrus grove in the Heartland Planning Region

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

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

The 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 District, including phosphate, limestone, sand and shell.

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 and 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 data, there were 114 I/C water use permits and 18 M/D water use permits in the planning region as of 2010. Polk County demand projections are from Volume 2 of the Draft CFWI RWSP.

This methodology was applied for all sectors with the exception of Mosaic Company M/D permits (ore processing). The District was asked by Mosaic to consider data on future mining activity at current and future mine sites that was contained in a recently prepared environmental impact study. In lieu of changing 2010 baseline pumpage in accordance with growth factors based on projected gross regional product, percent changes in Mosaic projected permitted quantities by county were used to project use quantities from the 2010 baseline pumpage. See Appendix 3-2 for more detail.

3.0 Water Demand Projections

Table 3-3 shows the projected I/C and M/D water demand for the planning period. The table shows an increase in demand for the planning period of 1.63 mgd, or 2.9 percent. 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's water use permit bureau. 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, mining quantities permitted for product entrainment were not included in the 2010 or 2015 demand projections because the District considers such quantities incidental to the mining process and not part of the actual water demand (i.e., the quantities necessary to conduct the mining operation).

For 2010, 56.57 mgd of all I/C and M/D water use quantities are located in the Heartland planning region, more than in any other region. Most of the phosphate mines and fertilizer plants in the District are located in the Heartland and Southern planning regions.

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 Heartland Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2010 Base	2015	2020	2025	2030	2035	Change 2010-2035	% Change
Hardee	1.65	3.63	6.00	4.87	4.63	4.66	3.01	182.1%
Highlands	0.03	0.03	0.03	0.03	0.03	0.03	0.01	17.6%
Polk [2]	54.89	48.19	49.07	50.49	51.95	53.51	-1.38	-2.5%
Total	**56.57**	**51.85**	**55.10**	**55.39**	**56.61**	**58.20**	**1.63**	**2.9%**

Demand projections for the District's portion of Polk County are from Volume 2 of the Draft CFWI RWSP (May 2015). http://cfwiwater.com/planning.html

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 seen from the rounded values in the table. Source values are available in Appendix 3-2.

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.

Dragline at an active mine in the Heartland Planning Region

Section 4. Power Generation (PG)

1.0 Description of the PG Water Use Sector

The PG uses within the District include water for thermoelectric 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 and 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. Polk County demand projections are from Volume 2 of the Final Draft CFWI RWSP.

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 for the planning period of 4.55 mgd, or 29.6 percent for both Polk County and the region. Several thermoelectric power plants are located within Polk County. 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 Heartland Planning Region (5-in-10 and 2-in-10) (mgd)*

County	2010 Base	2015	2020	2025	2030	2035	Change 2010-2035	% Change
Hardee	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Highlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Polk [2]	15.35	15.95	16.81	17.75	18.80	19.90	4.55	29.6%
Total	**15.35**	**15.95**	**16.81**	**17.75**	**18.80**	**19.90**	**4.55**	**29.6%**

Demand projections for the District’s portion of Polk County are from Volume 2 of the Draft CFWI RWSP (May 2015). http://cfwiwater.com/planning.html

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 seen from the rounded values in the table. Source values are available in Appendix 3-2.

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 4. 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 the 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 3-4.

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 percentage changes in demand for 18-hole equivalent golf courses for each five-year period of the planning period. The percentage 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. In general, the new methodology produced smaller increases in projected demand.

Landscape and other recreation demands are based on population growth within each county. Water use for this sector is assumed to grow at the projected county-level percentage change in population. The five-year population percentage changes 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 projected L/R water demands for the planning period (both golf and other L/R demand). The table indicates an increase in demand of 9.18 mgd for the 5-in-10 condition, an increase of 50.61 percent from the baseline 2010 demand. While there have been regional and national concerns about long term declines in golf participation rates, the District's tourism industry and demographics tend to favor increasing demand for golf in the Heartland Planning Region and throughout the District. The irrigation demand for golf courses is considerable (53 percent of total 2010 average L/R demand in the region) and will continue to compete with other users of potable and non-potable supplies.

Reclaimed water has made a definite impact on golf course water use and this should continue into the future. Most L/R water use occurs near major population centers, which is also where large quantities of reclaimed water are located that can be used to offset the use of potable water for this category. The three interior counties that make up the planning region have two distinct land-use characteristics. Highlands, Hardee and southern Polk are largely agricultural, while northern Polk County, which is crossed by the Interstate 4 (I-4) corridor, is more densely populated and has numerous large developments with golf courses. Large developments also tend to have large demands for other L/R uses such as landscape irrigation. Many utilities in the region offset other landscape and recreation demand by providing reclaimed water for the irrigation of parks, playing fields and school grounds. Hardee, the least urbanized of the three counties, is projected to have the lowest percentage increase in L/R demand.

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 smaller percentage increase in demand from 2010 to 2035 than previously projected in the Heartland Planning Region.

Table 3-5. *Projected L/R demand in the Heartland 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
Hardee	0.10	0.14	0.11	0.14	0.11	0.14	0.11	0.14	0.11	0.14	0.11	0.14	0.00	0.01	4.0%	3.9%
Highlands	2.40	3.10	2.41	3.12	2.65	3.43	2.90	3.74	3.14	4.06	3.46	4.47	1.06	1.37	44.1%	44. 1%
Polk	15.64	NA	17.36	NA	18.94	NA	20.50	NA	22.07	NA	23.76	30.32	8.12	NA	51.9%	NA
Total	**18.14**	**NA**	**19.87**	**NA**	**21.70**	**NA**	**23.50**	**NA**	**25.32**	**NA**	**27.33**	**34.94**	**9.18**	**NA**	**50.6%**	**NA**

Notes: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-4 for source values. Quantities do not include reclaimed water, re-pumped groundwater from ponds, or stormwater.

Section 5. 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. Table 3-6 summarizes ER quantities that will be required for the planning region through 2035.

2.0 Water Resources to Be Recovered

2.1 Southern Water Use Caution Area (SWUCA)

The goal of the SWUCA Recovery Strategy is to achieve recovery in the Ridge Lakes area, which extends roughly 90 miles along the center of the state in Polk and Highlands counties (Ridge Lakes), the upper Peace River, and the Most Impacted Area (MIA) aquifer level by 2025. When the Recovery Strategy was adopted in 2006, it was estimated that recovery could be achieved if total groundwater withdrawals were reduced to approximately 600 mgd. As part of the first five-year review of the Recovery Strategy, completed in 2013, it was found that recent groundwater withdrawals in the region had declined to below 600 mgd; however, the upper Peace River, 16 lakes, and the MIA aquifer level all remained below adopted MFLs. Although projects have been implemented to help achieve recovery in the upper Peace River (i.e., Lake Hancock), additional work is needed before specific projects can be implemented to help achieve recovery of the lakes and aquifer level. As such, the quantities of water needed for recovery were not certain at the time this plan was written.

As previously discussed (Chapter 2, Part A, Section 1), in 2013, the District undertook a process to work with stakeholders in the region to assess results of the five-year review and identify potential project options that could be implemented to achieve recovery in the Ridge Lakes and MIA aquifer level. Results of this process are expected to be finalized by mid- to late-2015. Before constructing specific projects for recovery of the lakes, the District recognized the need to reassess currently adopted minimum levels. The purpose of the reassessments is to apply improvements to the technical methods that have been made since the levels were adopted to determine if modifications to the levels are needed. In 2014, the District initiated an effort to reassess minimum levels on 10 of the 16 lakes not meeting adopted levels. As part of the reassessments, determinations of whether the updated minimum levels are being achieved will occur. These reassessments are also a step in helping to understand the quantities that will be needed to achieve recovery. Following this determination, potential projects and the additional water needed to achieve recovery will be identified for lakes projected to fall below the updated levels. Results of these reassessments are expected to be available by 2017.

With respect to the MIA aquifer level, it has been estimated that approximately 15 mgd of recharge to the Upper Floridan aquifer (UFA) in the MIA would be required to achieve the level. Over the next few years, the District will investigate opportunities to work with local governments to implement recharge projects to achieve the Saltwater Intrusion Minimum Aquifer Level (SWIMAL). Additionally, it is possible that some of the benefits projected to occur from recharging 15 mgd in the MIA can be achieved through conservation or by providing alternative water sources to retire existing groundwater quantities.

2.2 Upper Peace River

Studies undertaken in support of minimum flow development indicate that actual flow in the upper Peace River between Bartow and Zolfo Springs is often below the established minimum low flow during the dry season. During this period, when river flows are typically lowest, the entire flow of the river can be diverted underground through sinkholes. These studies have also determined that an annual average of 5 mgd will be needed to meet the minimum low flows, including water lost from the river through sinkholes. The District has implemented water resource development projects to increase storage in Lake Hancock. The stored water will be released in the dry season to help meet minimum low flows. It is estimated that the Lake Hancock Lake Level Modification Project will provide an annual average flow of 2.7 out of the 5.0 mgd needed and is projected to be operational by 2015. The benefit of the Lake Hancock Lake Level Modification Project will be reassessed as it is operated. If it is determined through operation of the project, that minimum low flows can be met, additional projects would not be needed. However, if minimum low flows are not met with the project, the need for other projects to provide an additional 2.3 mgd to help meet minimum low flows will be assessed. One option would be to develop a storage reservoir that can be used to store and release up to 2.3 mgd during low flows, when minimum low flows are not being met. Another option to help achieve minimum low flows would be to reduce sink losses in the Peace River. Reduction of sink losses could conserve water in the river (i.e., prevent it from leaking out of the river into the ground), which would help make up the remaining 2.3 mgd estimated to be needed to achieve minimum low flows.

Table 3-6. *Projected increase in environmental restoration demand for the Heartland Planning Region (mgd)*

Water Resource to be Recovered	2010 Base	2015	2020	2025	2030	2035	Change 2010-2035
SWUCA SWIMAL	-	-	TBD	5.0+[2]	5.0+[2]	5.0+[2]	5.0+
SWUCA Ridge Lakes	-	-	TBD[3]	TBD[3]	TBD[3]	TBD[3]	TBD
Upper Peace River	-	-	2.7[1]	5.00	5.00	5.00	5.00
Total	**-**	**-**	**2.7+**	**10.0+**	**10.0+**	**10.0+**	**10.0+**

[1]The Lake Hancock Lake Level Modification project (anticipated to be operational in 2015) is expected to provide 2.7 mgd to the upper Peace River. If minimum low flows cannot be achieved with this project, additional projects could be implemented.

[2]The 15 mgd estimated to be needed for recovery of the MIA was divided equally between the Heartland, Tampa Bay, and Southern planning regions. This number will be refined as part of the next five year assessment of the SWUCA Recovery Strategy and could change.

[3]Ridge Lakes status will be determined following the five year assessment of the SWUCA Recovery Strategy, which may increase restoration demand.

Notes: Environmental restoration demands are shown in the column that corresponds to the earliest timeframe that they are anticipated to be developed. In subsequent years, these demands are represented as ongoing. Summation calculation differences occur due to rounding.

Section 6. Summary of Projected Change in Demand

Table 3-7 summarizes the projected change in demand, respectively, for the 5-in-10 and 1-in-10 conditions for all use categories in the planning region. Increases and decreases in demand were previously tracked separately; however, these are now combined to show the total projected demands. 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 environmental restoration goals.

Table 3-7 shows that 68.52 mgd of additional water supply will need to be developed and/or existing use retired to meet demand in the planning region through 2035. Public supply water use will increase by 38.72 mgd over the planning period. Table 3-7 also shows an increase of 4.43 mgd in agricultural water use, 1.63 mgd in I/C and M/D water use, and 4.55 mgd in PG water use. L/R water use will increase by 9.18 mgd over the planning period.

The District estimated that approximately 15 mgd is needed to recharge the UFA to meet the required MIA aquifer level. The 15 mgd estimated to be needed for recovery of the MIA was divided equally between the Heartland, Tampa Bay, and Southern planning regions and is subject to change as part of the next five-year assessment of the SWUCA Recovery Strategy.

The Ridge Lakes status will be determined following the five year assessment of the SWUCA Recovery Strategy. An additional 5 mgd is required to meet minimum flows for the upper Peace River. The Lake Hancock project will provide an expected annual average flow of 2.7 mgd by 2015 and additional projects will be assessed to address the additional 2.3 mgd needed.

Table 3-8 summarizes the projected demand for each county in the planning region for the 5-in-10 condition.

Table 3-7. *Summary of the Projected Demand in the Heartland 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	96.41	102.20	103.51	109.72	111.92	118.64	120.16	127.36	127.94	135.62	135.13	143.24	38.72	41.04	40.2%	40.2%
Agriculture	183.41	NA	183.73	NA	184.55	NA	185.49	NA	186.61	NA	187.84	256.50	4.43	NA	2.4%	NA
I/C & M/D	56.57	56.57	51.85	51.85	55.10	55.10	55.39	55.39	56.61	56.61	58.20	58.20	1.63	1.63	2.9%	2.9%
Power Gen.	15.35	15.35	15.95	15.95	16.81	16.81	17.75	17.75	18.80	18.80	19.90	19.90	4.55	4.55	29.6%	29.6%
Landscape/Rec.	18.14	NA	19.87	NA	21.70	NA	23.50	NA	25.32	NA	27.33	34.94	9.18	NA	50.6%	NA
Env. Restoration	0.00	0.00	0.00	0.00	2.70	2.70	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	NA	NA
Total	**369.89**	**174.12**	**374.91**	**177.52**	**392.78**	**193.25**	**412.29**	**210.50**	**425.28**	**221.03**	**438.40**	**522.77**	**68.52**	**57.22**	**18.5%**	**32.9%**

[1]Agriculture quantities in the 1-in-10 column are actually 2-in-10.

Notes: Environmental restoration demands are shown in the column that corresponds to the earliest timeframe that they are anticipated to be developed. In subsequent years, these demands are represented as ongoing. 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 seen from the rounded values in the table.

The agricultural sector includes cattle ranches and other farming operations

Table 3-8. *Summary of the Projected Demand for Counties in the Heartland Planning Region* (5-in-10) (mgd)

Water Use Category	Planning Period						Change 2010-2035	
	2010	2015	2020	2025	2030	2035	mgd	%
Hardee								
Public Supply	2.11	2.12	2.14	2.16	2.17	2.19	0.09	4.1%
Agriculture	54.14	54.91	55.57	56.29	57.15	58.10	3.96	7.3%
I/C & M/D	1.65	3.63	6.00	4.87	4.63	4.66	3.01	182.1%
Power Gen.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Landscape/Rec.	0.10	0.11	0.11	0.11	0.11	0.11	0.00	3.8%
Env. Restoration	0.0	0.0	TBD	TBD	TBD	TBD	TBD	NA
Cumulative Total	**58.00**	**60.77**	**63.81**	**63.42**	**64.06**	**65.06**	**7.06**	**12.2%**
Highlands								
Public Supply	11.91	12.38	12.97	13.52	13.99	14.40	2.49	20.9%
Agriculture	41.90	41.79	41.95	42.18	42.43	42.71	0.81	1.9%
I/C & M/D	0.03	0.03	0.03	0.03	0.03	0.03	0.01	17.6%
Power Gen.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Landscape/Rec.	2.40	2.41	2.65	2.90	3.14	3.46	1.06	44.1%
Env. Restoration	0.0	0.0	TBD	TBD	TBD	TBD	TBD	NA
Cumulative Total	**56.24**	**56.61**	**57.61**	**58.62**	**59.60**	**60.61**	**4.36**	**7.8%**
Polk								
Public Supply	82.39	89.00	96.81	104.48	111.77	118.54	36.15	43.9%
Agriculture	87.37	87.03	87.03	87.03	87.03	87.03	-0.34	-0.4%
I/C & M/D	54.89	48.19	49.07	50.49	51.95	53.51	-1.38	-2.5%
Power Gen.	15.35	15.95	16.81	17.75	18.80	19.90	4.55	29.6%
Landscape/Rec.	15.64	17.36	18.94	20.50	22.07	23.76	8.12	51.9%
Env. Restoration	-	-	2.7+	10.0+	10.0+	10.0+	10.0+	NA
Cumulative Total	**255.64**	**257.53**	**271.36**	**290.25**	**301.62**	**312.74**	**57.10**	**22.3%**
Region Total	**369.89**	**374.91**	**392.78**	**412.29**	**425.28**	**438.40**	**68.52**	**18.5%**

[1]The environmental restoration quantities in the planning region included 15.0 mgd for the SWIMAL and 5.0 mgd for the upper Peace River. The 5.0 mgd for the upper Peace River will be supplied from Polk County. Though the SWIMAL quantities are attributed to the entire SWUCA, for simplicity they are only shown in one county. The quantity estimated to be needed for recovery of the MIA was divided equally between the Heartland, Tampa Bay, and Southern planning regions in Table 3-6. These quantities will be refined as part of the next five-year assessment of the SWUCA Recovery Strategy and could change.

Notes: Environmental restoration demands are shown in the column that corresponds to the earliest timeframe they are anticipated to be developed. In subsequent years, these demands are represented as ongoing. 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 seen 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 Heartland demand projections in the agricultural, public supply and I/C, M/D, PG water use categories. 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 5.2 mgd for the 2005–2030 planning period, while the 2015 RWSP projects an increase of 4.43 mgd for the 2010-2035 planning period. Regarding the public supply category, the 2010 RWSP projected an increase of 74.5 mgd for the 2005–2030 planning period, while the 2015 RWSP projects an increase of only 38.72 mgd from 2010–2035, significantly lower than the 2010 RWSP. Most of the difference is due to a much higher demand projection for Polk County: 69 mgd for the 2010 RWSP compared to the 36.15 mgd projected for Polk County in the 2015 RWSP. For I/C, M/D, and PG categories the 2010 RWSP projected a net 6.2 mgd increase, while the 2015 RWSP projects a combined increase of 6.18 mgd. The 2010 RWSP projected a 10.7 mgd increase for the L/R water use category; however, the 2015 RWSP projects a 9.18 mgd increase.

Chapter 4. Evaluation of Water Sources

This chapter presents the results of 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 are evaluated include surface water, stormwater, reclaimed water, brackish groundwater desalination, fresh groundwater and conservation. Aquifer storage and recovery (ASR) is discussed as a storage option with great potential to maximize the utilization of surface water and reclaimed water. Aquifer recharge (AR) is discussed as a method to directly or indirectly recharge groundwater. 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) is currently by far the major source of supply for all use categories in the planning region. It is assumed that the principal source of water to meet the projected demands during the planning period will likely come from sources other than fresh groundwater. This assumption is based largely on the impacts of groundwater withdrawals on water resources in the Southern Water Use Caution Area (SWUCA), discussed in Chapter 2, and previous direction from the Governing Board. Limited additional fresh groundwater supplies will be available from the surficial and intermediate aquifers, and from the UFA, subject to a rigorous, case-by-case permitting review. The Lower Floridan aquifer (LFA) has the potential to be a significant source of additional water in the northern and eastern portions of the planning region, and projects to evaluate this potential source are ongoing. Water from the LFA is likely to be brackish and is therefore considered to be an alternative or non-traditional source.

Water users throughout the region are increasingly implementing conservation measures to reduce their water demands. Such conservation measures enable water supply systems to support more users with the same quantity of water and hydrologic stress. However, the region's continued growth will require the development of additional alternative sources such as reclaimed water, brackish groundwater and surface water with off-stream reservoirs and/or ASR systems for storage. To facilitate the development of these projects, the District encourages partnerships between neighboring municipalities and counties for purposes of developing regionally-coordinated water supplies. The following discussion summarizes the status of the evaluation and development of various water supply sources and the potential for those sources to be used to meet the projected water demand 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 and is considered a traditional source. In 2013, approximately 97 percent (317 mgd) of the 326 mgd of water (including domestic self-supply) used in the planning region was from groundwater sources. Approximately 27 percent (86 mgd) of the fresh groundwater used was for public supply (permitted and domestic self-supply). Fresh groundwater is also withdrawn from the surficial and intermediate aquifers for water supply, but in much smaller quantities. The following is an assessment of the availability of fresh groundwater in the surficial, intermediate and Upper Floridan aquifers in the planning region.

1.0 Surficial Aquifer

The surficial aquifer is mostly composed of fine-grained sand that is generally less than 50 feet thick. While small-diameter, low-yield wells can be constructed in the surficial aquifer almost anywhere, there clearly are more favorable areas for development. Along the Lake Wales Ridge, highly permeable sands averaging 200 to 300 feet thick make the area favorable for development of the surficial aquifer. More than 80 percent of water use permits for surficial aquifer withdrawals are located along the Lake Wales Ridge in Highlands and Polk counties.

The remaining 10 percent is divided among public supply, recreational, and industrial/mining use (Basso, 2009). Annual average water use from permitted withdrawals in the surficial aquifer in 2006 was 11.8 mgd, with 87 percent (10.3 mgd) occurring in Highlands County, 12.7 percent (1.5 mgd) in Polk County and 1.7 percent (0.2 mgd) in Hardee County. Small, unpermitted quantities are also withdrawn from the aquifer for lawn watering or individual household use. The quantity of water for these uses was estimated to total 0.6 mgd in Hardee, Highlands and Polk counties in 2006.

It is difficult to quantify the potential availability of water from the surficial aquifer on a regional basis due to the uncertainty in hydraulic capacity of the aquifer, local variations in geology and existing water use that may limit supply. For this reason, estimates of available quantities from the surficial aquifer were combined with estimates of available quantities from the intermediate aquifer system. These estimates are largely based on identifying the types of uses that could reasonably be supplied by these aquifers. These uses include residential turf and landscape irrigation and golf course and common area landscape irrigation.

2.0 Intermediate Aquifer System

The intermediate aquifer system, i.e., the Hawthorn aquifer system, is located between the surficial aquifer and the UFA. It is not present over much of the planning region, including the northern half of Polk County and the Lake Wales Ridge. Where it is present, water in the intermediate aquifer system is generally of sufficient quality and quantity for domestic self-supply (DSS) indoor use/outdoor irrigation and recreational uses. Annual average water use from permitted withdrawals in the intermediate aquifer system in 2006 was 7.3 mgd, with 53 percent (3.9 mgd) occurring in Hardee County, 40 percent (2.9 mgd) occurring in Polk County and 7 percent (0.5 mgd) occurring in Highlands County. Small unpermitted quantities are also withdrawn from the aquifer for lawn watering or individual household use. The quantity of water for these uses is estimated to be a combined total of 1.3 mgd in Hardee, Highlands and Polk counties in 2006. Due to its limited extent in Polk County, approximately one-third of future demand for DSS indoor use/landscape irrigation and recreational water use can be met from the intermediate aquifer system. Future demand supplied through withdrawals from the surficial and intermediate aquifers in the planning region is expected to total 8 mgd, with 4.6 mgd allocated to recreational use and 3.4 mgd to DSS indoor use/outdoor irrigation (Basso, 2009) (see Table 4-1).

Table 4-1. *Estimated demand for groundwater from the surficial and intermediate aquifers (mgd)*

County	Domestic Self-Supply Indoor Use/Outdoor Irrigation	Recreation	Total
Hardee	0.2	0.3	0.5
Highlands	1.6	1.4	3.0
Polk	1.6[1]	2.9[1]	4.5
Total	**3.4**	**4.6**	**8.0**

[1] Reduced due to limited extent of intermediate aquifer system in this county.

3.0 Upper Floridan Aquifer

During development of the SWUCA Recovery Strategy (2006), it was anticipated that development of new water supplies from the UFA in the region would be limited due to existing impacts to minimum flows and levels (MFL) waterbodies. Requests for new groundwater supplies are not allowed to cause further lowering of water levels in impacted MFL waterbodies. The Recovery Strategy emphasized the implementation of conservation measures and development of alternative water supplies as much as possible to meet future additional demands. Additionally, it was thought that changes in land use would result in the opportunity for some new demands to be met by accessing some portion of historically used groundwater withdrawals that were retired as a result of a change in land-use activities. However, based on demand projections prepared for the RWSP and work completed for the SWUCA Five-Year Assessment (SWFWMD, 2013), it appears the ability to meet future water demands based on changes in land use activities is more limited than previously anticipated. Chapter 3, Table 3-6, indicates a net demand increase of 3.38 mgd for I/C,M/D,PG and 4.43 mgd for agricultural irrigation by 2035, which is anticipated to be primarily met with groundwater. It is also anticipated that some reductions in the use of groundwater can be achieved as a result of the District’s comprehensive agricultural water conservation initiatives and the permanent retirement of water use permits on lands purchased for conservation. These reductions could be used to help meet the SWUCA Saltwater Intrusion Minimum Aquifer Level (SWIMAL) and lake minimum levels, and/or to mitigate impacts from new groundwater withdrawals.

3.1 Upper Floridan Aquifer Permitted/Unused Quantities

A number of public supply utilities in the planning region are not currently using their entire permitted allocation of groundwater. The District recognizes the potential for these utilities to eventually grow into their unused quantities to meet future demands. Based on a review of the unused quantities of water associated with public supply water use permits in the planning region, approximately 51.4 mgd of additional groundwater quantities are available. It is important to consider current impacts to MFL water bodies and other environmental features. Because of impacts that have occurred, it is possible that, in the future, some portion of currently permitted demands will need to be met using alternative water sources.

4.0 Lower Floridan Aquifer

Projects to characterize the water supply potential of the LFA are currently being implemented in the planning region. If the LFA meets brackish criteria (greater than 500 mg/L total dissolved solids (TDS) concentration based on Florida drinking water standards), it is considered a supplemental water supply that could (unlike other groundwater) be permitted to meet demand. In the SWUCA, use of the LFA will not be permitted if it impacts the UFA. The LFA is also discussed in Section 5 of this chapter, Brackish Groundwater.

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 has provided financial and technical assistance to water users and suppliers in the Heartland Planning Region for the implementation of local and regional water conservation efforts. The District has a long history of successful water use reduction projects, water users are encouraged to seek assistance by working with District staff when implementing water-saving and water conservation education programs.

Water savings have been achieved in the Heartland 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 (WUP) 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 all new construction built after 1994 to 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.

Repaired water main. The District performs leak detection surveys 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 improves 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. For the Heartland Planning Region, the leak detection team has conducted 40 comprehensive leak detection surveys that located 416 leaks of various sizes. This has resulted in an estimated 1.9 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 built to conventional standards. In addition, FWS offers installation and BMPs 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 education programs accompanied with other effective conservation measures can be an effective 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 trends for this planning region are shown in Figure 4-1.

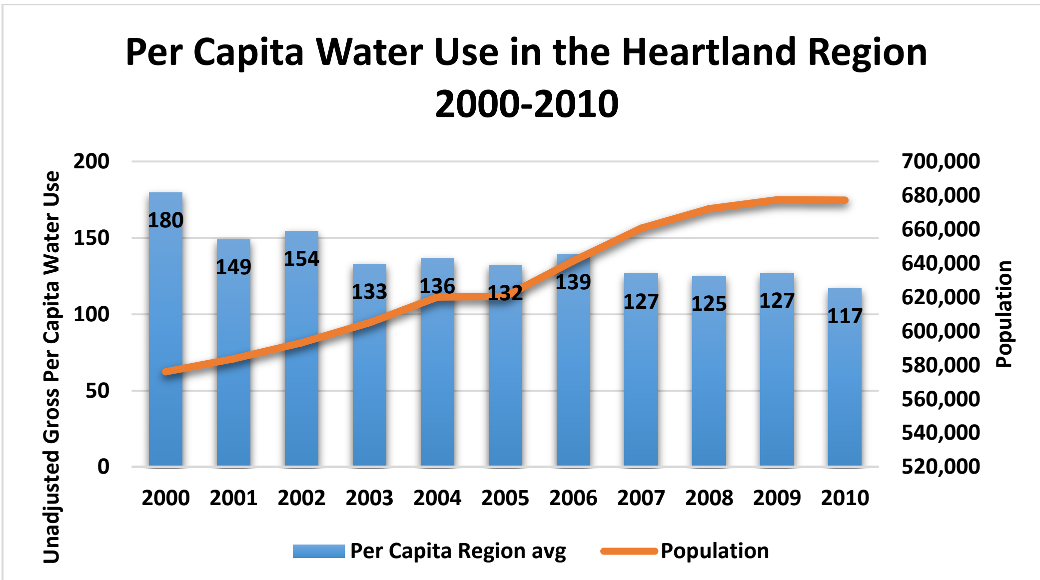

Figure 4-1. *Per capita water use in the Heartland Region, 2000-2010*

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's four planning regions. 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 District 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 5.09 mgd by 2035, if all water conservation programs presented below are implemented (Table 4-2).

1.1.1 Potential for Non-Agricultural Water Conservation Savings

A comprehensive assessment of public supply water conservation potential in the Central Florida Water Initiative (CFWI) five-county region was completed for the planning period using the University of Florida's Conserve Florida Water Clearinghouse (CFWC) EZ Guide Online water conservation tool. This is a web-based model designed to estimate conservation potential for public supply utilities.

1.1.2 Assessment Methodology

The CFWC EZGuide tool was used to estimate conservation potential for public supply. Estimates of water conservation potential are calculated for a group of seven utilities (located throughout the CFWI Planning Area), which individually range in 2010 estimated population from approximately 4,000 to almost 500,000, and which collectively represent 53 percent of the 2010 CFWI Planning Area public supply demand. The resultant demand-weighted 4.1 percent average water conservation potential for these utilities was then extrapolated to the remainder of the study area by applying it to the projected 2035 public supply demand of 653.27 mgd, resulting in 26.78 mgd of public supply water conservation potential. The following parameters were used to ensure the calculation of reasonable estimates of water conservation potential:

1. FWS specifications were used for plumbing fixture BMPs.
2. A cost effectiveness cap of $3 per 1,000 gallons, as defined by the EZ Guide, was used in BMP selection. This cost cap is consistent with the District's Regional Water Supply Plan (RWSP) (SWFWMD, 2011).
3. EZ Guide population was adjusted to be consistent with that used in CFWI Planning Area demand projections.
4. EZ Guide estimated water use was adjusted to reflect actual flows.
5. Participation rates (percentage of potential opportunities to implement a conservation practice realized through a water conservation program) were based on District studies of actual projects and used in the District's RWSP (2011). These rates are 23 percent for retrofit-based BMPs and 12.5 percent for BMPs that require another party to visit the site.
6. Effects of previous water conservation efforts on current and future conservation potential were included.

1.1.3 Results

The CFWC EZ Guide was used to calculate BMP-specific water savings and summarized estimates of total savings for indoor residential, outdoor residential, and publicly supplied Commercial/Industrial (C/I) water use. Indoor residential BMPs included replacements of toilets, showerheads, and faucets. Outdoor BMPs included irrigation system audits with subsequent system improvements and soil moisture sensors. C/I BMPs included replacements of pre-rinse spray valves, toilets, showerheads, faucets, urinals, and site specific water audits. The EZ Guide results for outdoor and C/I water use segments have been independently confirmed by Friedman et al. (2013) and Morales et al. (2013) utilizing model parameters adjusted for the CFWI Planning Area.

The resultant demand-weighted 4.1 percent average conservation potential described in the assessment methodology was applied to the 2035 public supply demand for Polk, Highlands, and Hardee counties to calculate the public supply conservation potential in the planning region (101.26 mgd x 4.1%). Based on this calculation, it is estimated that savings for the public supply category could be 5.09 mgd by 2035.

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 surface water supply for uses such as irrigation. DSS wells do not require a District water use permit, as the well diameters normally do not meet the District's requirements for a permit. DSS systems are not metered and, therefore, changes in water use patterns are less measurable than those in the public supply sector. Conservation programs for DSS users can still be 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 0.66 mgd by 2035 if all water conservation programs are implemented (Table 4-2).

1.2.1 DSS Assessment Methodology

The water conservation potential for DSS 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. 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 5.57 gallons per day. This public supply per capita water conservation estimate was then multiplied by the projected DSS population of 119,353 to get the DSS water conservation estimate of 0.66 mgd. This method was used in CFWI 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 reducing pumping, purchasing, treatment and disposal costs. To date, the District focused efforts on education, indoor and outdoor surveys, and commercial applications, such as spray valves and low-flow toilets. The industrial processes used in this category present unique opportunities for water savings and 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 0.43 mgd by 2035 (Table 4-2).

1.3.1 I/C Assessment Methodology

The water conservation potential for I/C is considered to be directly proportional to that of I/C uses 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 CFWI RWSP. The aggregate estimate of publicly supplied I/C water conservation potential was pulled from the CFWI RWSP and the percentage of savings for that use type was applied to the 2035 projected demand for the I/C category (35.75 mgd X 1.2% = 0.43 mgd). 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 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 category through the use of efficient irrigation practices and technology. Within the region, it is estimated that the savings for the L/R water use sector could be 0.78 mgd by 2035 (Table 4-2).

1.4.1 L/R Assessment Methodology

The estimate of water conservation potential for this sector was derived from the percentage of water conservation estimated by the CFWI RWSP for publically supplied outdoors water use. Savings were based on all available outdoor BMPs. The percentage of savings for that use type (outdoor use) was applied to the 2035 projected demand for the L/R sector (28.33 mgd X 2.8% = 0.78 mgd). This method was used in the CFWI RWSP and has been publicly vetted on a regional scale.

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

Through the implementation of all conservation measures listed above for all non-agricultural water use categories, it is anticipated that 6.96 mgd could be saved in the planning region by 2035 at a total projected cost of $28.97 million. (See Table 4.2)

Table 4-2. *Potential non-agricultural water conservation savings in the Heartland Planning Region*

Use Category	2035 Demand	Water Conserved in 2035 (mgd)	Percent Reduction	Average Cost-Effectiveness ($/1,000 gal)
Public Supply	124.04	5.09	4.1%	0.54
DSS	9.99	0.66	6.6%	0.54
I/C	35.75	0.43	1.2%	0.40
L/R	27.33	0.78	2.8%	1.77
Total	**197.11**	**6.96**	**3.5%**	**0.66**

2.0 Agricultural Water Conservation

The District uses the “model” farms concept to estimate the quantity of water that could potentially be saved through agricultural water conservation. The model farms concept is a 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.

Agricultural irrigation project

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 water conservation. Additional information on the FARMS program can be found in Chapter 7.

There are 20 model farms 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 selected four model farms options as being the most applicable in the planning region (HSW, 2004). The four model farms options represent BMPs for irrigation of citrus, melons, nurseries and sod. Information on these model farms is contained in Tables 4-3 and 4-4.

Sprinkler type systems are used for container nurseries, field crops and sod farms. Drip systems are used for row crops on plastic mulch and with a seepage system for bed prep/crop establishment. Microjet is the most common system for citrus. Surface irrigation, including semi-closed systems, is the most common type for non-citrus crops in Florida. For the four model farms chosen for the planning region, costs/acre to convert to a more efficient system and to implement BMPs were estimated based on publicly available data and information and interviews with local irrigation system and farm management providers. The savings associated with each of the model farm scenarios is included in Tables 4-3 and 4-4. Data in these tables represent the maximum potential savings if all growers were to install the most efficient irrigation systems and implement BMPs for their respective commodities.

Table 4-3. *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	Microjet	No, other BMPs only	5.67	5.17	4.57	4.24	3.83	3.58	100 percent implement, max improvement
8	Nurseries, container	Sprinkler	Line source emitter and other BMPs	0.48	0.55	0.55	0.55	0.55	0.57	100 percent implementation, maximum improvement
10	Sod	Semi-closed seepage	Center pivot and other BMPs	0.48	0.90	0.90	0.90	0.90	0.90	100 percent implementation, maximum improvement
15	Melons	Semi-closed seepage	Fully enclosed seepage and other BMPs	1.80	0.75	0.75	0.75	0.75	0.75	100 percent implementation, maximum improvement

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 (Nurseries): Replace existing sprinkler system with line source emitter irrigation system and implement other BMPs to achieve water savings. Model Farm Scenario 10 (Sod): Replace semi-enclosed seepage with center pivot irrigation system and implement other BMPs to achieve savings. Model Farm Scenario 15 (Melons): Replace semi-closed seepage with fully enclosed seepage irrigation system. 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. The 100 percent grower participation is assumed. Source: SWFWMD (2008a), Hazen and Sawyer (2009).

Table 4-4. *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	10.23	8.31	7.29	6.79	6.19	5.80	100 percent implementation, maximum improvement
8	Nurseries, container	Sprinkler	Line source emitter and other BMPs	2.60	2.32	2.33	2.33	2.33	2.40	100 percent implementation, maximum improvement
10	Sod	Semi-closed seepage	Center pivot and other BMPs	1.15	2.38	2.38	2.38	2.38	2.38	100 percent implementation, maximum improvement
15	Melons	Semi-closed seepage	Fully enclosed seepage and BMPs	4.04	1.12	1.12	1.12	1.12	1.12	100 percent implementation, maximum improvement

Model farm potential water savings were adjusted to be consistent with latest demand projections.

[1] Model Farm Scenario (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 (Nurseries): Replace existing sprinkler system with line source emitter irrigation system and implement other BMPs to achieve water savings. Model Farm Scenario 9 (Sod): Replace semi-enclosed seepage with center pivot irrigation system and implement other BMPs to achieve savings. Model Farm Scenario 15 (Melons): Replace semi-closed seepage with fully enclosed seepage irrigation system. 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. The 100 percent grower participation is assumed. Source: SWFWMD (2008a), Hazen and Sawyer (2009).

2.1 Potential Agricultural Water Conservation Savings

Table 4-5 summarizes savings by commodity through 2030 for the 5-in-10 condition. Citrus, nurseries, sod, and melons are discussed individually, and the remaining commodities are summarized together.

Table 4-5. *Summary of potential agricultural water conservation savings by commodity (5-in-10) through 2030*

Commodity	Total Estimated Savings (mgd)[1]	Total Cost ($/acre)[2]
Citrus	2.02	$105
Nurseries	0.27	$347
Sod	1.05	$751
Other	3.19	$100
Total	**6.53**	

[1]Based on 100 percent participation.
[2]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. Capital plus O&M cost, per planted acre for the first year of irrigation conversion

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.

Polk County has the largest number of reclaimed water systems in the planning region. As of 2010, customers within Polk County utility systems utilized an average daily flow of more than 12 mgd of reclaimed water for residential, golf course and other public access irrigation use. Funded projects are expected to result in reclaimed water increases of 12 mgd, bringing utilization within the planning region to approximately to 24 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 rate is the percent of treated wastewater from a WWTP that is beneficially used in a reclaimed water system. The utilization rate of reclaimed water systems 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 1.0 mgd average annual 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 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 also 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 (804 gpd) this amount. In this example, the benefit rate would be 37 percent (300 gpd benefit for 804 gpd reclaimed water utilization). Different types of reclaimed water uses have different benefit potentials. For example, a power plant or industry using 1 mgd of potable water for cooling or process water, after converting to reclaimed water, will 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 a 70 percent utilization rate of all WWTP flows and benefit efficiency of all reclaimed water used of 70 percent by the year 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.

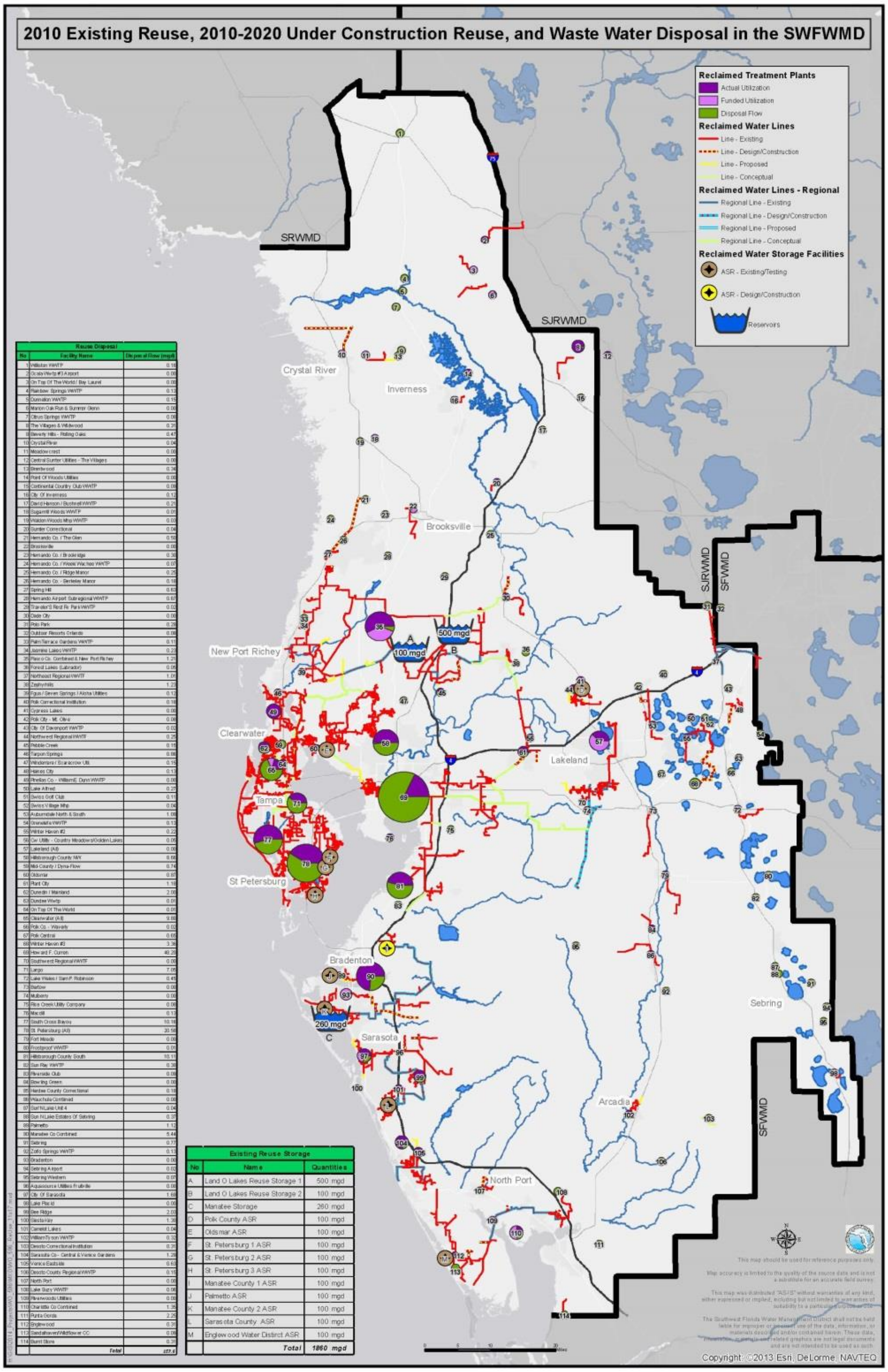

Figure 4-2. *Districtwide reclaimed water map*
To download this map, visit http://www.swfwmd.state.fl.us/conservation/reclaimed/

1.0 Potential for Water Supply from Reclaimed Water

Table 4-6 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 40 WWTPs in Polk, Hardee and Highlands counties, which collectively produced 32 mgd of treated wastewater. Of that quantity, 12 mgd was used resulting in 11 mgd of benefits to traditional water supplies. Therefore, only approximately 37 percent of the wastewater produced in the planning region was utilized for irrigation, 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 utilized, and that efficiency by the end user will average more than 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 45.8 mgd (more than 70 percent) of the 51.28 mgd of wastewater treated will be beneficially used and 28.5 mgd of additional post-2010 traditional sources will benefit (70 percent efficiency).

Table 4-6. *2010 Actual versus 2035 potential reclaimed water availability, utilization and benefit (mgd) in the Heartland Planning Region*

County	2010 Availability, Utilization and Benefit[1]				2010–2035 Potential Availability, Utilization and Benefit[2]			
	Number of WWTPs in 2010	WWTP Flow in 2010	Utilization in 2010	Potable-Quality Water Benefit in 2010 (93%)	2035 Total WWTP Flow	2035 Utilization (70%)[3]	2035 Potable-Quality Water Benefit (70%)[3]	Post 2010 Benefit
Polk	29	29.43	11.06	10.28	47.8	43.14	38.11	27.31
Hardee	5	1.20	.89	0.83	1.14	1.05	.93	0.10
Highlands	6	1.32	0.00	0.00	2.34	1.64	1.15	1.15
Total	**40**	**31.95**	**11.95**	**11.11**	**51.28**	**45.84**	**40.19**	**28.56**

[1] Estimated at 93 percent Region wide average.
[2] See Table 4-1 in Appendix 4.
[3] Unless otherwise noted.

Section 4. Surface Water

Within the planning region, the major river/creek systems include the Peace River and Josephine Creek. In addition, a small portion of the headwaters of the Alafia River is located in Polk County. A major public supply utility uses the Peace River in DeSoto County. The potential yield for the rivers will ultimately be determined by their minimum flows once they are established; however, yields associated with rivers that have in-stream impoundments also depend on the degree of structural alteration that has occurred and the habitat that is supported by the flows.

1.0 Criteria for Determining Potential Water Availability

The available yield for each river was calculated using its established minimum flow and/or hydrodynamic modeling (if available) and its current permitted allocation. If neither the adopted minimum flow nor the hydrodynamic model was available, planning-level minimum flow criteria were utilized. The five-step process used to estimate potential surface water availability includes (1) estimation of unimpacted flow, (2) selection of the period used to quantify available yield, (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 explanation of the criteria is in the Chapter 4 Appendix.

2.0 Overview of River/Creek Systems

The following are overviews of the Peace River and Josephine Creek, the two significant river/creek systems in the region.

2.1 Peace River

The Peace River begins in the Green Swamp and flows south to Charlotte Harbor. The Peace River watershed encompasses approximately 1,800 square miles. There are two major tributaries in the upper part of the watershed. Peace Creek drains approximately 230 square miles in the northeast part of the watershed, serving as an outlet for several lakes near the cities of Lake Alfred and Haines City. The Saddle Creek Canal drains 144 square miles in the northwest portion of the watershed in Polk County, where the dominant drainage feature is Lake Hancock. Numerous lakes are present in the area north of Bartow, ranging in size from a few acres to approximately 4,600 acres. In this area, surface water drainage is ill-defined. South of Bartow to near Fort Meade, the land surface is considerably altered by phosphate mining activities. Major tributaries south of Fort Meade include Horse, Joshua and Charlie creeks.

The major withdrawal from the Peace River is for public supply by the Peace River Manasota Regional Water Supply Authority (PRMRWSA). The PRMRWSA operates a regional water supply facility in southwest DeSoto County. Consistent with minimum flow methodology, annual flow was calculated by summing flow at the Peace River at Arcadia, Horse Creek near Arcadia and Joshua Creek at Nocatee for the reference period 1985 through 2013. Adjusted annual flow was 741.8 mgd (1,164.3 cfs). The PRMRWSA is permitted to supply an annual average of 32.7 mgd from the river. In 2009, a new reservoir with a capacity of 6 billion gallons was completed and the capacity of the water treatment plant was expanded from 24 mgd to 48 mgd, which will enable the PRMRWSA to utilize its entire permitted quantity from the Peace River of 32.7 mgd. Average annual withdrawals by the PRMRWSA during the period 2007 to 2011 have been 20.0

mgd. In addition to the permitted PRMRWSA withdrawals, two additional permittees withdraw an annual average of 0.0047 mgd and 0.06 mgd during the period 2007 to 2011. Total average annual withdrawals from 2007 to 2011 were 20.1 mgd.

Projects are being developed to divert and store water from the upper Peace River during high-flow periods for release to meet minimum flows during low-flow periods. Reservations of water for projects such as the Lake Hancock Lake Level Modification Project will affect future surface water availability. Flow assumptions used for the minimum flow reservations may be adjusted in the future as projects are finalized and could affect the calculations in Table 4-7.

All available surface water in the Peace River is allocated to the Southern Planning Region in Table 4-7 because more water is physically present and available downstream; however, future withdrawals from the river in the Heartland Planning Region are possible and likely. To maximize development of additional water supplies from the river, future withdrawals will need to be closely coordinated with the PRMRWSA and other users, as well as consider minimum flow requirements. Based on the minimum flow criteria, an additional 73.1 mgd of water supply is potentially available from the river.

2.2 Josephine Creek

Josephine Creek, with a watershed of 109 square miles, conveys water from more than 30 lakes on the Lake Wales Ridge to Lake Istokpoga (McDiffett, 1981). Wolf, Josephine, Red Beach, Ruth and Charlotte lakes drain into Josephine Creek from the north and Annie, Placid, June-in-Winter and Francis lakes drain north through Jack Creek, a tributary of Josephine Creek. Approximately 11 percent of the inflow into Lake Istokpoga is contributed by Josephine Creek (SFWMD, 2005). Land uses in the watershed are approximately one-third urban or built up, one-third water or wetlands, and one-third agriculture. The adjusted annual average discharge at Josephine Creek near the DeSoto City gage is 38.4 mgd (59.4 cfs). Annual average withdrawals of 0.97 mgd are permitted from the creek. Average annual diversions from 2007 to 2011 were 0.13 mgd. Based on the planning level minimum flow criteria, an additional 3.73 mgd of water supply is potentially available from the creek. Future use of Josephine Creek will be dependent on the MFL for Lake Istokpoga adopted November 2005; moreover, SFWMD has completed more recent rulemaking that limits further withdrawals from the lake beyond current levels. Development of this source requires coordination with the SFWMD on issues that include the effect on Lake Istokpoga minimum levels and existing legal users.

3.0 Potential for Water Supply from Surface Water

Table 4-7 summarizes potential availability of water from rivers in the planning region. The estimated additional surface water that could potentially be obtained from rivers in the planning region ranges from approximately 0.84 mgd to 4.57 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 unpermitted available surface water. It is important to note that although water available from the Peace and Alafia rivers is assigned to the Southern and Tampa Bay planning regions, respectively, there is potential for water supplies to be developed from these rivers in the Heartland Planning Region. Additional factors that could affect the quantities of water that are ultimately developed for water supply include the future establishment of minimum flows, the ability to develop sufficient storage capacity, variation in discharges to the river from outside sources, and the ultimate success of adopted recovery plans.

Table 4-7. *Summary of current withdrawals and potential availability of water from rivers/creeks in the Heartland Planning Region (mgd) based on planning-level minimum flow criteria (p85/10 percent) or the proposed or established minimum flow*

Water Body	Instream 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[5]	Days/Year New Water Available[6]		
							Avg	Min	Max
Peace River @ Treatment Plant[7]	See Southern Planning Region								
Josephine Creek @ WMD Boundary[8]	No	38.4	3.8	0.97	0.13	3.73	309	163	365
TOTAL				**0.97**	**0.13**	**3.73**			

[1] Mean flow based on recorded USGS flow plus reported water use permit (WUP) withdrawals added back in when applicable. Maximum period of record used for rivers in the region is 1980–2013.
[2] Based on 10 percent of mean flow for all water bodies with the following exceptions: minimum flows have been established and were applied to calculate potentially available quantities for the Peace River.
[3] Based on individual WUP permit conditions, which may or may not follow the current 10 percent diversion limitation guidelines.
[4] Based on average reported withdrawals during the period 2007–2011.
[5] 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).
[6] 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.
[7] All available surface water is allocated to the Southern Planning Region because the calculation was based on flows in the Southern Planning Region; however, future withdrawals from the River in the Heartland Planning Region are possible.
[8] Availability will be dependent on coordination with SFWMD regarding the adopted minimum level for Lake Istokpoga and existing legal users.

Section 5. Brackish Groundwater

Brackish groundwater is found in the District along coastal areas in the Upper Floridan and intermediate aquifers 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. Generally, water quality declines to the south and west in the District in both the UFA and Arcadia aquifers. Brackish groundwater may also be 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 groundwater 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 approximately 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 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. Figure 4-4 depicts the locations of brackish groundwater desalination facilities and potential sites for future facilities in the District.

Depending on the TDS concentration of raw water, 15 to 50 percent of the water used in the RO process becomes a concentrate byproduct 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 Pollution Discharge Elimination System (NPDES) permit and may be restrained by TMDL limitations. In some cases, RO facilities are 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.

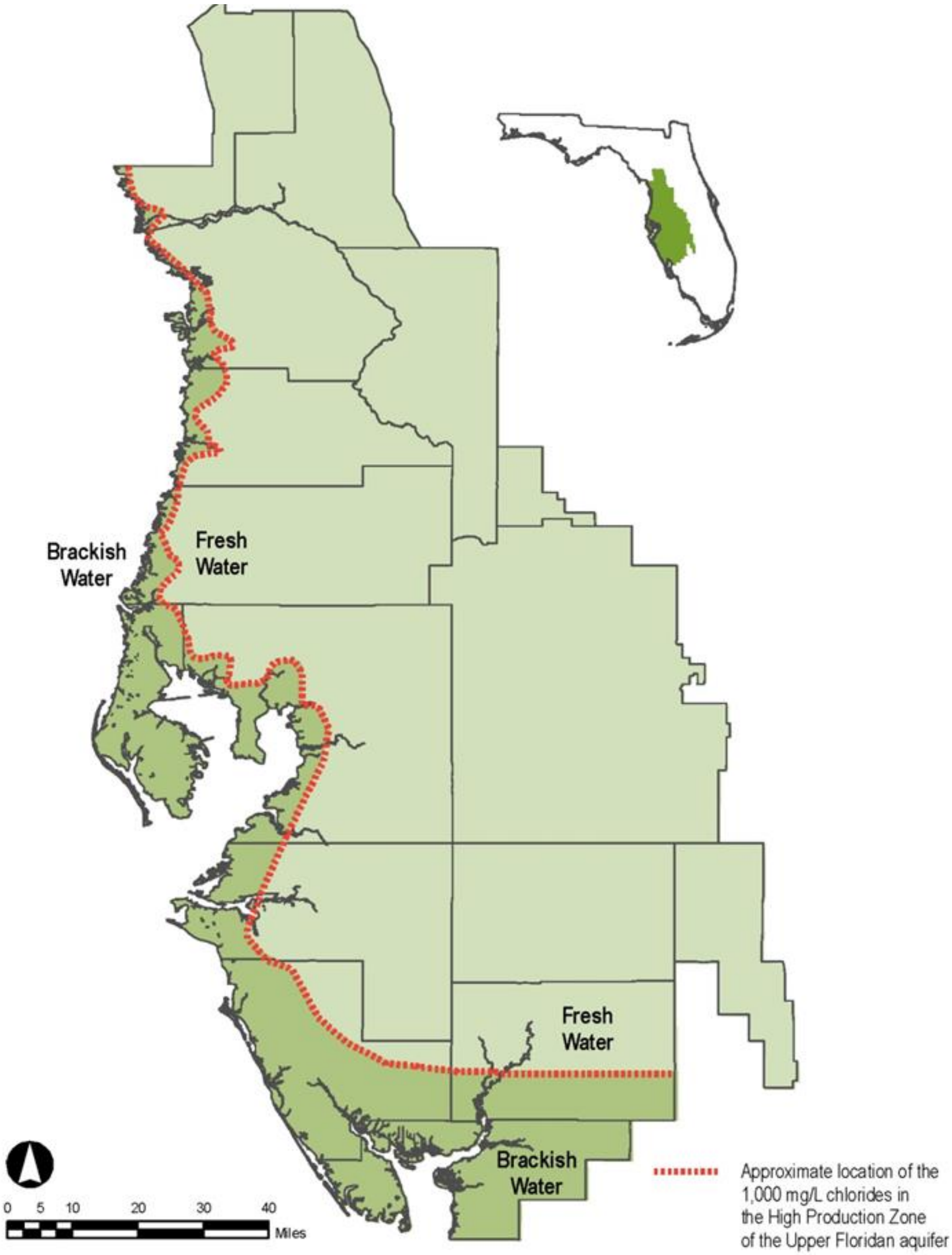

Figure 4-3. *Generalized location of the freshwater/saltwater interface in the District*

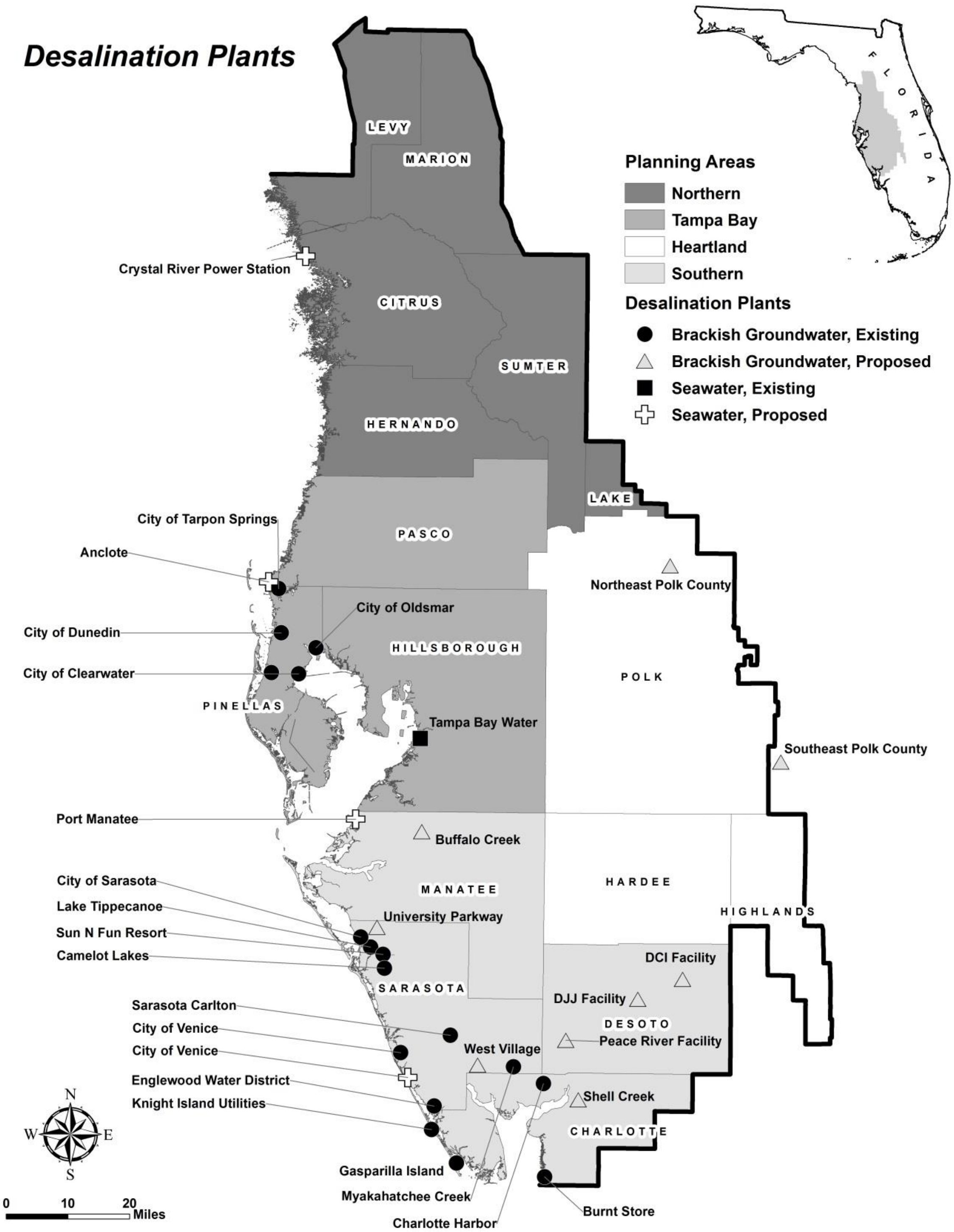

Figure 4-4. *Location of existing and potential seawater and brackish groundwater desalination facilities in the District*

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 concentrate disposal option for situations where other methods are not environmentally feasible, although the costs for 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, multijurisdictional 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.

Historically, the District’s regional water supply planning process has evaluated brackish groundwater (and other alternative water supply options) on the basis of meeting increasing demand projections. In recent years, a growing number of utilities are expressing interest in brackish treatment systems to address issues with deteriorating source water quality. The District recognizes the importance of maintaining the viability of existing supplies, but also encourages the consideration of alternate options based on economics and long-term regional benefit.

1.0 Potential for Water Supply from Brackish Groundwater

Brackish groundwater, defined as an alternative or non-traditional source, from the LFA is a potential water supply source that has not been used much in the Heartland Planning Region, and any additional groundwater use, fresh or brackish, may be limited by the SWUCA Recovery Strategy. Proposed withdrawals cannot impact UFA water levels in the most impacted area (MIA) of the SWUCA or other MFL water levels. Groundwater withdrawals have been evaluated by this criterion since the early 1990s and since that time, there has been no net increase in quantities of water permitted from the UFA in the MIA. Requests for new withdrawals outside the MIA will be granted only if it is demonstrated that the withdrawals have no effect on groundwater levels in the UFA in the MIA.

The Floridan aquifer in the planning region is divided into Upper and Lower permeable units, separated by partially overlapping confining units MCU I and MCU II (Miller, 1986). The Lower Floridan aquifer is very productive for public supply in east central Florida and has fresh water quality, but the quality generally degrades westward of Orlando. This is due in part to the presence of MCU II which exists in west central Florida and is deeper than MCU I. The water contained in the LFA below MCU II is assumed to be older, and in contact with evaporitic minerals present in MCU II that contribute to its poorer quality.

Historically, LFA groundwater was not utilized or explored extensively for public supply because the water quality was generally considered too brackish to justify its development. The need for new water sources has driven new investigations since the mid-2000s. The District initiated exploratory drilling of the LFA at ROMP well 74X near Davenport in Polk County in 2003. Water quality at this site was found to have very low chloride, but high sulfate concentrations of approximately 2,000 mg/L. These sulfates are treatable and the source feasibility was better than anticipated, although some degradation could potentially occur with long-term pumping. The District has other multiple ongoing/planned exploratory drilling projects to evaluate the LFA at numerous locations within Polk County. The investigations are conducted as part of the District's Water Resource Development planning efforts. The projects will help improve understanding of water quality and productivity in the LFA, as well as the effective confinement from the UFA and the potential of future withdrawals to degrade existing water resources. The projects will also expand the District's well monitoring network and provide data to enhance groundwater modeling.

From a treatment perspective, small quantities of brackish water from the LFA may be diluted with other fresh groundwater from the UFA to augment public supply, so long as the finished water meets drinking standards. An evaluation of blending quantities was conducted for Polk County's 2009 Comprehensive Water Supply Plan, and many of the blending project options were adopted for the CFWI RWSP and herein. The additional capacity gained by the blending options ranged from only 0.1 to 0.6 mgd for most utilities. Larger supply projects using membrane treatment will require the installation of an injection well to dispose of the concentrate generated during desalination. Injection wells have been successfully constructed in the planning region, but they are completed to sub-Floridan depths from 4,000 to 8,000 feet below surface and are costly to develop. The high costs can negatively impact the financial viability of brackish groundwater treatment options, thus a regionalized implementation is preferred to benefit from economies of scale.

It is not possible to determine the quantity of brackish groundwater supply available for future needs in the Heartland Planning Region because the investigation of water resources the LFA is ongoing, and the availability of any groundwater supply must be determined on a case-by-case basis through the permitting process.

Section 6. Aquifer Storage and Recovery

Aquifers are reservoirs and conveyance systems that can provide tremendous storage capabilities enabling rapid storage or recharge of captured excess wet season flows. ASR and recharge projects enable the District to balance out the wet and dry cycles and better manage droughts, which are already challenging and could become even more difficult to manage as the impacts from climate change become more pronounced and population increases. Utilization of the aquifer system's reservoir potential is accomplished through either an ASR system, direct aquifer recharge (AR) system or indirect AR system. Each of the methods have different levels of regulatory constraints that are largely based on the source water quality and the water quality of the receiving aquifer. Each method offers unique opportunities that match up with the various sources and qualities of available water.

ASR is the process of storing water in an aquifer when water supplies exceed demand, and subsequently withdrawing the water when supplies are low and/or demands are high. The locations of ASR projects in the District are shown in Figure 4-5. ASR may be used for potable, reclaimed, groundwater or partially treated surface water. If water stored in the aquifer is for potable supply, when it is withdrawn from storage it is disinfected, retreated if necessary, and pumped into the distribution system. District projects include storage projects that use the same well to inject and withdraw water and aquifer recharge and recovery projects that use one location for injection and another for withdrawal.

ASR offers several significant advantages over conventional water storage methods including the ability to store large volumes of water at relatively low cost with little environmental impact and no evaporative losses. The success of an ASR project is generally measured in terms of recovery efficiency, which is the percentage of the original injected water recovered from the storage zone before water quality or impacts from the recovery phase (withdrawal) become unacceptable. Since brackish aquifers (those aquifers with high TDS) may be used for storage, mixing of the injected water with native water is generally the limiting factor on recovery efficiency.

Within the District, there are three fully permitted reclaimed water ASR projects and five fully permitted potable water ASR facilities. Recent advancements in pre-treatment technologies and Underground Injection Control regulations addressing arsenic mobilization issues in the aquifer (which were previously limiting) provide a viable means for successful completion of ASR projects. The past uncertainty associated with permitting ASR projects is no longer a major concern.

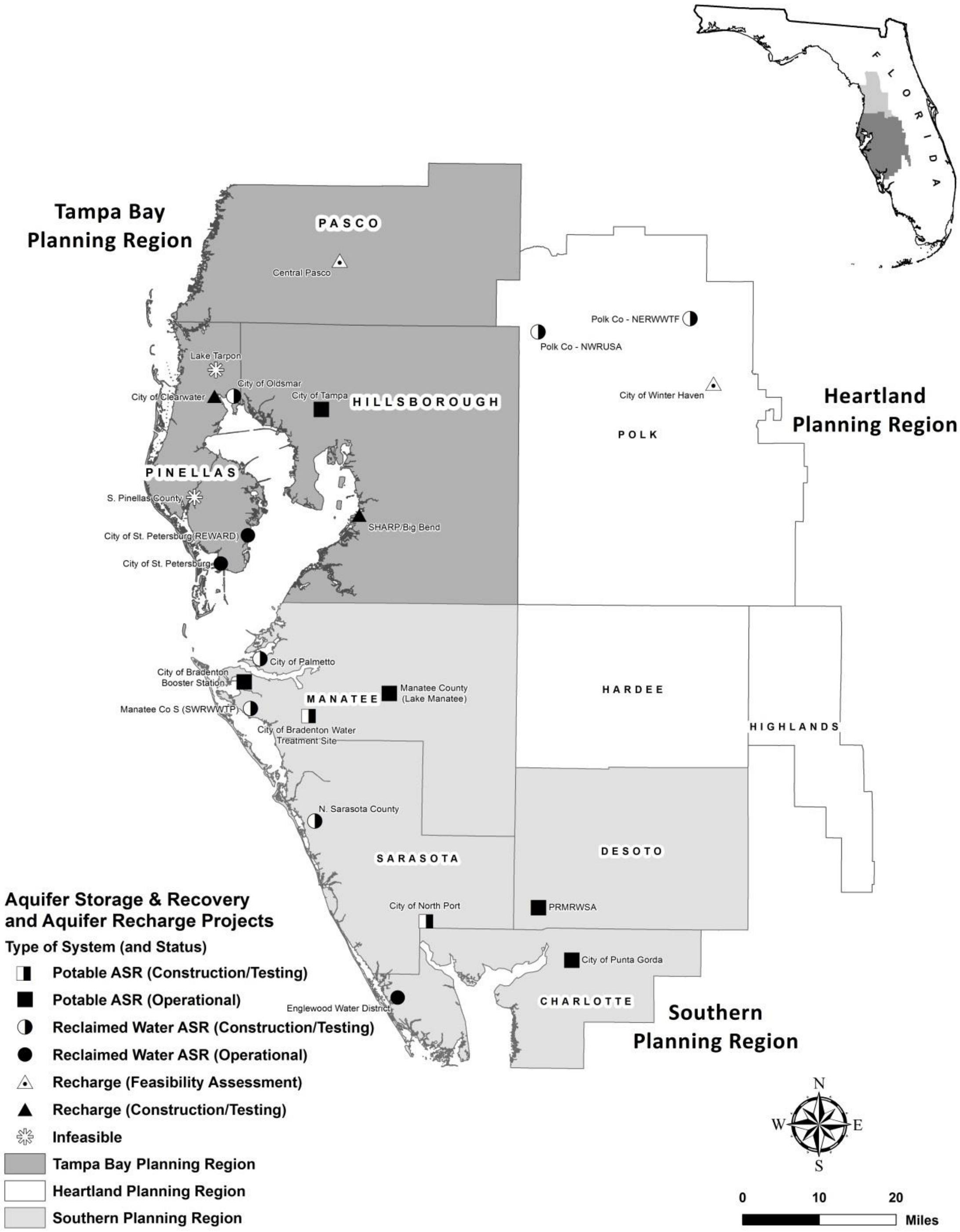

Figure 4-5. *Location of aquifer storage and recovery and aquifer recharge projects in the District that are operational or under development*

Projects under development are those the 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) been completed since the year 2010 and are included to report on the status of implementation since the previous RWSP.

1.0 ASR Hydrologic and Geochemical Considerations

The science behind ASR has advanced significantly since the first project at Manatee County's reservoir site. The focus in the early years was on the hydrologic conditions that control the rate of injection/recovery and degree of mixing with elevated TDS in the receiving zone. Early studies of the geochemical processes focused on the liberation of low concentrations of naturally occurring radio-nuclides at the Lake Manatee ASR site. Because the concentrations were below the drinking water standards, ASR projects proceeded while continuing to check for this issue. None of the ASR projects checked ever exceeded the radio-nuclide standards.

While checking the radio-nuclides for the City of Tampa ASR project, the first incidence of arsenic at concentrations greater than the drinking water standards were found, and geochemical processes became important to understand. Extensive research efforts to understand the cause of arsenic mobilization and methods to control it were successful, and multiple strategies to handle the arsenic mobilization are now available. Geochemical considerations have led to the reduction of oxidants such as dissolved oxygen (DO) and chlorine in the injection water, either through physical or chemical methods.

Hydrologic conditions that maximize the recoverability of the injected water include a moderately permeable storage zone that is adequately confined above and below by less permeable layers and that contains fairly good to moderate water quality. The permeability of the storage zone is important, since low permeability would limit the quantity of water that could be injected, while very high permeability would allow the injected water to migrate farther and mix more with native water. The presence of confining layers is necessary to limit or prevent the injected water from migrating upwards (a significant issue where density differences exist between the injected water and native water). Confining layers also serve to keep poorer quality water in adjacent zones from being captured during recovery. Poor native water quality in the storage zone will limit the percentage of usable water that can be recovered by degrading the injected water faster as a result of mixing processes. Additionally, the higher density of poor-quality water in the aquifer tends to cause the lower density injected water to migrate upwards and "float" in the upper portions of the storage zone.

In the District, the recoverable percentage of injected water is typically 70 to nearly 100 percent when the concentration of native groundwater in the ASR storage zone is less than 1,000 mg/L. Recovery can be less when the TDS concentration of native groundwater is higher. It is possible, depending on the hydrologic conditions, for the recoverable volume of water to be greater than the volume originally stored. This generally results when the native water quality is good to fairly good and mixing of the injected water and native water provides additional water of acceptable quality. In some cases, it may be desirable to leave behind a portion of injected water to restore depleted groundwater reserves. This also forms a buffer zone between the stored water and surrounding brackish or poor quality native water to increase recovery percentage and minimize adverse geochemical reactions between waters with different chemistries. Buffer zones are considered an investment of water that improves performance and results in reserves for future recovery during extreme droughts or emergencies.

2.0 ASR Permitting

Permits to develop ASR systems must be obtained from the District, the DEP, the Florida Department of Health (DOH) and possibly the U.S. Environmental Protection Agency (EPA) if an aquifer exemption is requested. The District is responsible for permitting the quantity and rate of recovery, including potential impacts to existing legal users (e.g., domestic wells), off-site land uses and environmental features. The DEP is responsible for permitting the injection and storage portion of the project, and the DOH is responsible for overseeing the quality of the water delivered to the public.

Significant clarifications of ASR regulations as they apply to public water supply systems storing treated drinking water underground were issued by the EPA in 2013. The 2013 guidance allows the DEP to evaluate ASR systems on a case by case basis to determine if mobilization of arsenic and subsequent recovery and treatment of the water can be done in a manner that does not endanger the aquifer. The facility would need to verify that no existing user would be impacted through either property ownership or use of institutional controls such as local ordinances prohibiting wells within a specified area around the ASR wells. The use of the ASR water re-treatment upon recovery to remove arsenic prior to distribution may be necessary. Re-treatment to remove arsenic has been successfully implemented by several public drinking water systems and to date arsenic concentrations have been within the drinking water standards prior to distribution to the public.

The DEP is now considering on a case by case basis handling other parameters, such as disinfection by products (DBP) and coliform bacteria, in a similar manner to arsenic, and including reclaimed water ASR and recharge projects.

3.0 ASR and Arsenic

When the last RWSP was under development in 2005, permitting of ASR facilities in Florida was hindered by the mobilization of naturally occurring arsenic in the aquifer by the interaction of DO and other oxidants in the injected water with the aquifer's limestone matrix, which contains natural arsenic as a trace mineral. Since the last RWSP, effective solutions to the arsenic mobilization issue have been developed.

The City of Bradenton ran a pilot project that removed DO from the injection water prior to injection and successfully eliminated the mobilization of arsenic. Arsenic concentrations in the recovered water were well below the drinking water standard of 10 ug/L, allowing the City to recover directly to the distribution system after standard disinfection requirements were met. At least one other site has duplicated the solution using the same technology. DO control offers one method of achieving an operation permit for ASR and recharge facilities. DO control can be achieved through physical removal, chemical scavenging or direct use of groundwater as a source for injection. Projects are currently testing chemical scavenging as a method for arsenic control.

Another method of achieving an operation permit is the attenuation of arsenic through removal during successive cycles of operation. The City of Tampa has seen arsenic concentrations consistently diminish over the years since startup in 1996. Most of the City's wells are now within the drinking water standard for arsenic and those that exceed it are just barely over the limit for a brief period during recovery. In 2013, the City received their operation permit and is now fully permitted. All sites show the similar attenuation with cycling suggesting that this may be an option to achieve an operation permit. Facilities that pursue this path will need to be capable of re-treating the water upon recovery to remove the mobilized arsenic. This option also requires control of the area adjacent to the ASR wells either through ownership or through institutional controls such as an existing ordinance prohibiting wells from withdrawing from the ASR storage zone.

Most ASR projects in the District are located in coastal areas where water in the UFA is brackish. In much of this area, the aquifer is not utilized for potable supply and the recovered water from ASR systems is treated to remove arsenic prior to distribution. Therefore, there has been no known exposure to arsenic above the current drinking water standard from water injected into the aquifer as a result of ASR operations.

Section 7. Aquifer Recharge

Natural recharge of rainfall infiltration to the surficial aquifer and underlying aquifers is the primary source maintaining aquifer levels. 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 freshwater portions of the aquifer.

Successful AR projects will improve groundwater levels. Water level improvement may result in (1) improving local groundwater quality, (2) mitigating or offsetting existing drawdown impacts due to withdrawals, (3) providing storage of seasonally-available waters and thereby augmenting water supplies, and (4) potentially allowing 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 storm water. Of the total volume of reclaimed water used Statewide in 2013 (719.49 mgd) (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 DO. In certain circumstances the DEP may allow these chemical reactions to occur if an adequate property area is controlled by ownership and it 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 DO content in the injection source water, in addition to maintaining a negative oxygen reduction potential. AR projects need to function in the same manner. Groundwater flow resulting from injection and the natural groundwater flow gradient has 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 sprayfields, 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 the 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, 2010).

Section 8. Seawater

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 Outstanding Florida Waters (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 the Tampa Bay Water (TBW) and other facilities have demonstrated the importance of pretreatment to the long-term 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 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

There are no seawater options proposed for the planning region due to its inland locality. The 2014 Final Draft CFWI RWSP identified a partnership between Polk County Utilities and TBW for a potential interconnect between the Lithia area of Hillsborough County and utilities in western Polk County. The import capacity would be secured through participation in a regional water supply development project, potentially including an expansion of the TBW desalination facility.

Section 9. Stormwater

In the coming years, additional effort 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 is 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 a 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; however, the alternatives might not 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 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 & 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 10. Summary of Potentially Available Water Supply

Table 4-8 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 quantity available could be as high as 106.35 mgd.

Table 4-8. *Potential additional water availability in the Heartland Planning Region through 2035 (mgd)*

County	Surface Water[1]		Reclaimed Water	Desalination		Fresh Groundwater		Water Conservation		Total
	Permitted Unused	Available Unpermitted	Benefits	Seawater	Brackish Groundwater	Surficial and Intermediate	Upper Floridan[2] Permitted Unused	Non-Agri-cultural	Agri-cultural	
Polk	-	-	27.31	-	-	4.5	46.45	6.04	3.40	87.70
Hardee	-	-	0.10	-	-	0.5	0.93	0.16	2.50	4.19
Highlands	0.84	3.73	1.15	-	-	3.0	3.98	0.76	1.00	14.46
Total	**0.84**	**3.73**	**28.56**	**NA**	**TBD**	**8.0**	**51.36**	**6.96**	**6.90**	**106.35**

[1] All available surface water from the Peace River is shown in DeSoto County, because the calculation was based on flows in DeSoto County; however, future withdrawals from the Peace River in Hardee and Polk counties are possible.
[2] Groundwater that is permitted but unused for public supply. Based on 2013 Estimated Water Use (SWFWMD, 2014).

Part B. Determination of Water Supply Deficits/Surpluses

Future water supply deficits/surpluses were calculated as the difference between projected demands for 2035 and demands for the 2010 base year (Table 3-7). The projected additional water demand for the planning period is approximately 68.52 mgd. As shown in Table 4-8, up to 106.35 mgd is potentially available from sources in the planning region to meet this demand. As discussed above, this does not include water that could be developed from the Peace River in Polk and Hardee counties and the Alafia River in Polk County and water that could be imported from TBW and the TWA from outside the planning region. An additional factor is a decline in groundwater demand of 11.5 mgd during the planning period. A portion of these reductions can be used as mitigation of impacts for new groundwater withdrawals. Based on a comparison of projected demands and available supplies, it is concluded that sufficient sources of water are available in the planning region to meet demands through 2035.

Peace River in Hardee County

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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 in the planning region 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, the sources of water that are potentially available to meet projected water demand in the planning region include fresh groundwater reallocation, water conservation, reclaimed water, surface and stormwater, Aquifer Storage and Recovery (ASR) and Aquifer Recharge, and brackish groundwater. 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 District's RWSP into their water supply planning and development of their comprehensive plans.

Part A. Water Supply Development Options

The District conducted preliminary technical and financial feasibility analyses of the options included in this chapter. The analyses are for reasonable estimates of the quantity of water that could be developed and the associated costs for development. The District references cost information from the Central Florida Water Initiative (CFWI) RWSP or other appropriate documents for each option.

The options presented in this chapter are not necessarily the District's preferred options, but are provided as reasonable concepts that water users in the region may pursue in their water supply planning. A number of the options are of such a scale that they would likely be implemented by either a regional water entity or a group of users. Other options, such as those involving reclaimed water and conservation, could be implemented by individual utilities or a group of users. It is anticipated that users will choose an option or combine elements of different options that best fit their needs for WSD, provided they are consistent with the RWSP. 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.

In the following sections, a description of several representative options for each source is included that more fully develops the concepts and refines estimates of development costs. These descriptions are followed by a table that includes the remaining options for each source.

Section 1. Fresh Groundwater Options

Fresh groundwater options were evaluated as part of the Heartland Water Alliance water supply planning efforts in 2003, the 2009 Polk County Comprehensive Water Supply Plan, and the 2015 Draft CFWI RWSP. Additional groundwater options utilizing the Lower Floridan aquifer (LFA) are discussed in Section 5 of this chapter. Future requests for groundwater from the Upper Floridan aquifer (UFA) in the planning region will be evaluated based on projected effects on existing legal users and water resources, including those with established minimum flows and levels (MFLs). In particular, projected effects of groundwater withdrawals cannot impact groundwater levels in the Southern Water Use Caution Area (SWUCA) Most Impacted Area (MIA) and cannot cause lake levels to fall below their established minimum levels or hinder their recovery.

Requests for groundwater for new uses will be considered if the requested use is reasonable and beneficial, incorporates maximum use of conservation, and there are no available alternative sources of water. If regional groundwater levels have declined to levels that are causing established MFLs in the SWUCA to be violated, it will be necessary for those effects to be offset prior to issuance of a water use permit. It may be possible to use permitted groundwater quantities transitioned from other uses to mitigate the predicted impacts of new withdrawals; however, no retiring uses are identified for this RWSP. The fresh groundwater options below are based on development of regional interconnects and redistribution of existing capacity.

Fresh Groundwater Option #1. Polk County Wellfield Sharing

- Entities Responsible for Implementation: Polk County Municipalities, District

The wellfield sharing option involves the interconnection of utility systems on a multijurisdictional level. The capacity of UFA wells throughout the county would be optimized for permit, rather than actual, use and to minimize impacts. Conceptual cost includes additional UFA wells and transfer pumping system. See Table 5-1 for a summary of this option's potential yield and costs.

Table 5-1. *Polk County Wellfield Sharing option yield/costs*

Option	User Group	Avg Annual Yield (mgd)	Capital Cost	Unit Cost ($/1,000 gal)	Annual O&M ($1,000)	Distribution Method
Wellfield Sharing	PS	6.0	$9,720,000	$0.33	TBD	Transfer of excess capacity among utilities in Polk County

Issues:

- The availability of excess capacity may be short-term, diminishing as exporting utilities grow into their permitted allocations.

Fresh Groundwater Option #2. Polk County Regional Water Grid System

- Entities Responsible for Implementation: Polk County Municipalities, District

The Regional Water Grid System involves connecting major cities, municipalities, and utility service areas to a countywide transmission system. The grid system would be managed by a new regional entity and may be designed to receive water from the southeast wellfield located in the South Florida Water Management District (SFWMD), as well as imported quantities from neighboring water alliances and supply authorities. The conceptual cost includes 90 miles of transmission main, booster pump stations, design and permitting costs, and infrastructure construction costs, including land costs, legal fees and contingencies. See Table 5-2 for a summary of this option's potential yield and costs.

Table 5-2. *Polk County Regional Water Grid System option yield/costs*

Option	User Group	Avg Annual Yield (mgd)	Capital Cost	Unit Cost ($/1,000 gal)	Annual O&M ($1,000)	Distribution Method
Regional Water Grid System	PS	6.0	$226,300,000	TBD	TBD	Interconnection and transfer by regional entity.

Fresh Groundwater Option #3. Joint TWA/Polk County Supply Transmission

- Entities Responsible for Implementation: Polk County Utilities, Tohopekaliga Water Authority (TWA), District

The supply transmission option would include partnering with the TWA to develop either a regional surface water and/or a groundwater supply facility from the Kissimmee River and the Cypress Lakes wellfield. Conceptual costs include sharing a regional source project and regional interconnections from the TWA to Polk County Utilities. See Table 5-3 for a summary of this option's potential yield and costs.

Table 5-3. *Joint TWA/Polk County Supply Transmission option yield/costs*

Option	User Group	Avg Annual Yield (mgd)	Capital Cost	Unit Cost ($/1,000 gal)	Annual O&M ($1,000)	Distribution Method
Joint TWA /Polk County Interconnection	PS	5.0	$60,000,000	$2.20	TBD	Regional interconnection and transfer of existing capacity from TWA

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, modification, 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	Average Cost Effectiveness ($/1,000 gal)	Public Supply Costs
Toilet*	1.41	$0.74	$14,281,508.27
Shower Head*	1.64	$0.09	$2,160,388.80
Faucet*	1.40	$0.40	$3,116,313.05
Soil Moisture Sensor	0.29	$1.07	$554,436.06
Irrigation Audit	0.23	$2.65	$1,147,109.10
Urinal	0.06	$0.52	$267,658.79
Pre-Rinse Spray Valve	0.04	$0.04	$3,823.70
Water Audit	0.02	$2.41	$95,592.42
Total	**5.09**	**$0.54**	**$21,626,830.19**

*for both residential and commercial properties

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

BMP/Conservation Measure	DSS Savings (mgd)	Cost Effectiveness ($/1,000 gal)	DSS Costs
Toilet	0.19	$0.74	$1,910,010.65
Shower Head	0.22	$0.09	$288,930.66
Faucet	0.19	$0.40	$416,776.09
Soil Moisture Sensor	0.04	$1.07	$74,150.35
Irrigation Audit	0.03	$2.65	$153,414.51
Total	**0.66**	**$0.54**	**$2,843,282.25**

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

BMP/Conservation Measure	IC Savings (mgd)	Cost Effectiveness ($/1,000 gal)	IC Costs
Toilet	0.13	$0.74	$1,340,714
Shower Head	0.15	$0.09	$202,812
Faucet	0.13	$0.40	$292,552
Urinal	0.01	$0.52	$25,127
Pre-Rinse Spray Valve	0.00	$0.04	$359
Water Audit	0.00	$2.41	$8,974
Total	**0.43**	**$0.40**	**$1,870,539**

Table 5-7. *Conservation BMP Options for L/R Sector*

BMP/Conservation Measure	HPR L/R Savings (mgd)	Cost effectiveness ($/1,000 gal)	L/R Costs
Soil Moisture Sensor	0.43	$1.07	$820,000
Irrigation Audit	0.34	$2.65	$1,700,000
Total	**0.77**	**$1.77**	**$2,520,000**

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.

High-Efficiency showerheads 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® HET 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 (evaluations) obtain 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 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, 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, or weather-based shutoff devices).

1.1.5 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.

1.1.6 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 gallons per minute, while high-efficiency spray valves use no more than 1.6 gpm. High-efficiency valves are also more effective at removing food from dishware.

1.1.7 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

Citrus is the predominant agricultural commodity in the Planning Region

Approximately 47.46 percent of irrigated agricultural acreage in the District is located in the planning region. In 2015, 181.06 mgd will be used to irrigate 171,103 acres of agricultural commodities. From 2010 to 2035, irrigated acreage is expected to increase by 1.55 percent, or 2,635 acres. Most of the increase in acreage will be in citrus. Citrus will remain the predominant commodity, accounting for 89.73 percent of the total irrigated acreage in the planning region. The majority of citrus acreage, 74,156 acres, is located in Polk County, followed by Hardee County with 47,754 acres. Agriculture will continue to be a large user of water in the planning region in 2035. The District has a comprehensive strategy to significantly increase the water use efficiency of agricultural users 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 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 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 Facilitation of 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. 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. Because the District classifies the well back-plugging program 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.

2.3 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 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. Currently, there are 15 model farms projects that are either in operation or planned for implementation in the planning region.

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 utilize 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 Polkdale Farms project located in Polk County is an example of a tailwater recovery system in the planning region that was developed through the FARMS Program. Polkdale Farms is a 20-acre blueberry farm located in northeastern Polk County. The project offsets groundwater withdrawals through the use of a tailwater recovery trench located on the downgradient side of the property. The project includes a surface water pump station, filtration and a pipeline to connect the reservoir to the existing irrigation system. This project is permitted for an annual average groundwater withdrawal of 0.04 mgd, which is offset nearly 100 percent by the use of tailwater.

BMP Option #2. Precision Irrigation Systems

Farm-sited weather station

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 such that damage is likely 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 time. This scenario could be permitted for an annual average irrigation quantity of approximately 1.5 mgd.

A 500-foot intake ditch would convey water from a stream to a sump where it would be withdrawn by a pump and conveyed via a pipeline to a 30-acre reservoir. Water from the reservoir would be distributed to the fields using two 2,500-gpm pumps and 25,000 feet of irrigation lines. 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 programs such as FARMS and the NRCS Environmental Quality Incentives Program, costs 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 5-8 for a summary of this option’s potential costs and savings.

Table 5-8. *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, but 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 it (DEP, 2014). The feasibility of using reclaimed water for agriculture depends on the location of the reclaimed water infrastructure and the type of crop to be irrigated. 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

This option involves the capture and storage of surface water for agricultural irrigation. An example of this type of project is the Turner Groves-Hickory Groves property located in Highlands County. This project reduces groundwater withdrawals through the use of an existing in-stream surface water reservoir to irrigate a portion of a citrus grove. Major components of the project include surface water withdrawal pumps, filtration system, piping and infrastructure necessary to connect the reservoir into the existing irrigation system. The operation is permitted for an annual average groundwater and surface water withdrawal of 4.9 mgd for the irrigation of 3,961 acres of citrus. The estimated reduction in groundwater withdrawals resulting from the project is 1.1 mgd. See Table 5-9 for a summary of this option's potential costs and savings.

Table 5-9. *Surface Water Sources costs/savings*

Option	Potential Savings (mgd)	Capital Cost	Cost/1,000 Gallons
Turner Groves Surface Water Project	1.1	$450,000	$0.08

Section 3. Reclaimed Water Options

The planning region's diverse mix of urban land uses along the I-4 corridor, extensive mining and industrial areas, and large tracts of agricultural lands provides opportunities to use large quantities of reclaimed water in numerous, beneficial ways. Since the WWTPs for the many towns are small, inter-system connections are not among the example options for maximizing reclaimed water. Instead, the focus is on selectively discontinuing the disposal of treated wastewater in rapid infiltration basins and spray fields and using it beneficially within the towns and surrounding agricultural lands. 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
- **Aquifer Storage and Recovery:** injection of reclaimed water into an aquifer during times of excess supply and the recovery of that same water for use during high demand

- **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 into a potable raw water source.

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 32 reclaimed water project options (Table 5-10) for the planning region through coordination with utilities and other interested parties in concert with the CFWI and the

Heartland Region. 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 or greater (see Chapter 4 Appendix, Table 4-1). The District recognizes that the viability of some options depends on whether certain other options are developed, and not all options can be developed because some would utilize the same reclaimed water source. These options are listed in Table 5-10.

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 and capital cost for each of the following options. 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, operation and maintenance (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 5-10. *Reclaimed water options for the Heartland Planning Region*

Option Name and Entity	County	Type	Supply (mgd)	Benefit (mgd)	Capital Cost	Cost/Benefit	O&M/Benefit
Reuse Expansion in Hardee Correctional WWTP 2016-2035, FL Dept. of Corrections	Hardee	System Expansion Ag Toilet Flushing/ Laundry	0.12	0.08	$967,200	$2.38	$0.30
Reuse Expansion in Zolfo Springs WWTP 2016-2035, Town of Zolfo Springs	Hardee	System Expansion AG	0.09	0.06	$725,400	$2.38	$0.30
Reuse Expansion in Sun n Lake (2) WWTP 2016-2035, Sun n Lake Improvement District	Highlands	System Expansion	0.61	0.43	$4,916,600	$2.38	$0.30
Sebring Airport Reuse Expansion 2016-2035	Highlands	System Expansion	0.01	0.01	$80,600	$2.38	$0.30
Reuse Expansion in Sebring WWTP 2016-2035, City of Sebring	Highlands	System Expansion	0.86	0.6	$6,931,600	$2.38	$0.30
Sebring Western Reuse, City of Sebring	Highlands	System Expansion	0.05	0.03	$403,000	$2.38	$0.30
Winter Haven Reuse Recharge WWTP 2016-2035, City of Winter Haven and others	Polk	Recharge	2.7	2.7	$23,682,500	$1.73	$0.30
Winter Haven Plt #2 and #3 WWTP, City of Winter Haven	Polk	System Expansion	5.78	4.04	$46,586,000	$2.38	$0.30
Winter Haven Potable Reuse, City of Winter Haven	Polk	Purification	3.08	3.08	$24,824,000	$2.38	$0.30
Lakeland/ Mulberry/ Polk WWTP Reuse Expansion to TECO 2016-2035, City of Lakeland	Polk	System Expansion/ Interconnect	7	7	$53,000,000	$1.49	$0.30
Reuse Expansion in Polk County NE Reg. WWTP 2016–2035, Polk County	Polk	System Expansion	2.92	2.04	$23,535,000	$2.38	$0.30
Reuse Expansion in Polk County. NW Reg. WWTP 2016–2035, Polk County	Polk	System Expansion	1.41	0.99	$11,364,000	$2.38	$0.30
Reuse Expansion in Polk County SE Reg. WWTP 2016–2035, Polk County	Polk	System Expansion	0.28	0.2	$2,256,000	$2.38	$0.30
Reuse Recharge to Polk County Polo Park site, Polk County	Polk	Recharge	0.2	0.2	$1,612,000	$2.38	$0.30
Reuse Expansion Polk County East Waverly WWTP 2016–2035, Polk County	Polk	System Expansion	0.72	0.51	$5,803,000	$2.38	$0.30
Reuse Expansion in Polk Central WWTP 2016–2035, Polk County	Polk	System Expansion	0.72	0.51	$5,803,000	$2.38	$0.30
Reuse TENOROC Expansion in Auburndale Regional 2016–2035, City of Auburndale	Polk	System Expansion/ NAT	0.92	0.92	$7,415,000	$2.38	$0.30
Potable Reuse in Auburndale, City of Auburndale	Polk	Purification	0.92	0.92	$7,415,000	$2.38	$0.30
Reuse Expansion In Dundee WWTP 2016–2035, City of Dundee	Polk	System Expansion	0.14	0.1	$1,128,000	$2.38	$0.30
Davenport Recharge, City of Davenport	Polk	Recharge	0.23	0.23	$1,853,000	$2.38	$0.30
Reuse Recharge In Frostproof WWTP 2016–2035, City of Frostproof	Polk	System Expansion	0.03	0.03	$241,000	$2.38	$0.30

Option Name and Entity	County	Type	Supply (mgd)	Benefit (mgd)	Capital Cost	Cost/Benefit	O&M/Benefit
Reuse Expansion in Haines City WWTP 2016–2035, City of Haines City	Polk	System Expansion	0.67	0.46	$5,400,000	$2.38	$0.30
Reuse Expansion (Industrial, Power, Other) in Lake Alfred System 2016–2035, City of Lake Alfred	Polk	System Expansion	0.31	0.22	$2,498,000	$2.38	$0.30
Lake Wales Recharge for MFL recovery 2016-2035, City of Lake Wales	Polk	Recharge	0.76	0.76	$6,125,600	$1.59	$0.30
Lake Wales Potable Reuse 2016-2035, City of Lake Wales	Polk	Purification	0.76	0.76	$6,125,600	$1.59	$0.30
Reuse Expansion in Lake Wales WWTP 2016–2035, City of Lake Wales	Polk	System Expansion	0.76	0.53	$6,125,000	$2.38	$0.30
Reuse Expansion and Interconnect in Polk City Mt. Olive, Cardinal Hill, and Florida Department of Corrections WWTP 2016–2035, City of Polk City	Polk	System Expansion/ Interconnect	0.5	0.35	$1,600,000	$0.90	$0.37
Reuse Expansion In Outdoor Resort WWTP 2016–2035, Outdoor Resort Utility	Polk	System Expansion	0.06	0.04	$483,000	$2.38	$0.30
Reuse Expansion In Swiss Golf WWTP 2016–2035, Swiss Utility	Polk	System Expansion	0.08	0.05	$644,000	$2.38	$0.30
Reuse Expansion In Swiss Village WWTP 2016–2035, Swiss Village. Utility	Polk	System Expansion	0.03	0.02	$241,000	$2.38	$0.30
Reuse Expansion In Greenelefe Golf WWTP 2016–2035, Greenelefe Utility	Polk	System Expansion/ Interconnect	0.09	0.07	$725,000	$2.38	$0.30
Reuse Expansion Polk County Correctional WWTP 2016–2035, Florida Department of Corrections	Polk	System Expansion / Toilet Flushing/ Laundry	0.12	0.09	$967,000	$2.38	$0.30
Total 32 Options			**32.93**	**28.03**	**$ 261,476,100**	**$2.24**	**$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) 2030 flows were not included.
Offset = (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

Capturing and storing water from river/creek systems in the planning region during times of high flow can supply significant quantities of water. The rivers/creeks that could potentially be utilized for water supply include the Peace River in Polk and Hardee counties, Josephine Creek in Highlands County, the Alafia River in Polk County, and the Kissimmee River (located outside the planning region on the eastern boundary of Polk County in the SFWMD).

The most prominent river system in the planning region is the Peace River. Although the availability of water is greater in downstream portions of the river, developing water supply options in the upper watershed has advantages, such as locating water supply options on mined lands. Mined lands are well suited to water supply projects because of the large expanses of mine cuts and clay settling areas that remain following mining activities that could be used, with modifications, as surface water reservoirs. An additional advantage of utilizing the river in the upper watershed is the reduction in distribution costs that results from locating the supply closer to demand centers. A complicating factor in developing water supply options in the upper watershed is the possibility that the availability of water may not be sufficient and must take into consideration the MFL. Several water supply development options that have been identified for the Peace River and the other rivers listed above are discussed in this section.

The surface water/stormwater options presented in this section are based on previous work that was prepared for the District's 2001 and 2006 RWSPs, the Draft CFWI RWSP (May 2015), Polk County's Comprehensive Water Supply Plan (2009), and the Draft CFWI 2035 Water Resources Protection Water Supply Strategies Plan (2015), which further refined Polk County's options. Table 5-11 is a list of surface water/stormwater options identified in those other plans. Table 5-12 is an updated list of options developed by the District.

Construction of P-11 structure in Heartland Planning Region

Table 5-11. *Surface water/stormwater options for the Heartland Planning Region (*Polk County Comprehensive Water Supply Plan and CFWI RWSP*)*

Option, Water Body and Entity Responsible for Implementation	User Group	Avg Annual Yield (mgd)	Capital Cost ($1,000/mgd)	Unit Cost ($/1,000 gal)	Annual O&M ($1,000)	Storage Method/Level of Treatment	Distribution Method
Polk County							
Surface water stormwater ponds	PS	0.8	18,822	4.32	Included in unit cost	Stormwater ponds	Stormwater would supplement reclaimed water
Alafia River (confluence of North and South Prongs)	PS	13.2	31,148	7.14	Included in unit cost	Reservoir	Piped to WTP(s) for public supply, possibly with Tampa Bay Water
Peace River\ Conjunctive Use Joint PRMRWSA	PS	5.1	TBD	TBD	Included in unit cost	Interconnect	Piped from PRMRWSA in DeSoto to public supply/regional system
Peace River near Zolfo Springs	PS	10	28,277	6.48	Included in unit cost	Reservoir	Piped to WTP(s) for public supply/regional system
South Prong Alafia River	PS	5.8	30,797	7.06	Included in unit cost	Reservoir	Piped to WTP(s) for public supply/regional system
North Prong Alafia River	PS	5.2	30,814	7.06	Included in unit cost	Reservoir	Piped to WTP(s) for public supply/regional system

Table 5-12. *Surface water/stormwater options for the Heartland Planning Region (District)*

Option, Water Body, and Entity Responsible for Implementation	User Group	Avg Annual Yield (mgd)	Intake Capacity (mgd)	Capital Cost ($1,000/ mgd)	Unit Cost ($/1,000 gal)	Annual O&M ($1,000)	Storage Method/Level of Treatment	Distribution Method
Highlands County								
Josephine Creek Highlands County and/or others [1]	Ag, PS, Ind	3.7	4	6077	2.27	960	AR / 1	Aquifer conveyance to ag, public supply and industrial.
Hardee County								
Charlie Creek TBD	Ag	12	66	17,923	6.76	11,600	AR / 2	Aquifer conveyance to ag.
Charlie Creek TBD	Ag	12	66	4,933	1.89	3,340	Off-stream reservoir / 3	Piped to ag.
Charlie Creek TBD	Ag	12	66	5,086	1.87	3,103	Off-stream reservoir, AR / 2	Aquifer conveyance to ag.
Upper Horse Creek TBD	Ag, PS, Ind	1.4	8.3	12,947	4.12	590	Off-stream reservoir, AR / 2	Aquifer conveyance to ag, public supply and industrial.

[1] Development of this source will require compliance with Lake Istokpoga MFLs set by the SFWMD and consideration of current legal water users in the permitting process.

Surface Water/Stormwater Option #1. Polk County Regional Alafia River Basin Project

- Entities Responsible for Implementation: Polk County Municipalities, District

The Polk County Regional Alafia River Basin Project would harvest 10 mgd of surface water from the Alafia River within the boundaries of Polk County during high flows at two intake locations, treat/store it, and make it available to customers on the west side of Polk County. The treated river water may be blended with groundwater to augment the existing resources before transmission to partners and/or customers. Since the river flow is highly seasonal with a higher flow during the rainy season, an off-stream reservoir(s) and/or ASR system will be used to store water to provide for a more uniform supply. The project components include two raw water intakes, raw water transmission mains, a potable water treatment and storage facility, potable water transmission facilities, and potentially potable water re-treatment by the end users (depending on blending and final regional partners receiving the water). See Table 5-13 for a summary of this option's potential yield and costs.

Table 5-13. *Polk County Regional Alafia River Basin Project option yield/costs*

Option	User Group	Avg Annual Yield (mgd)	Capital Cost	Unit Cost ($/1,000 gal)	Annual O&M ($1,000)	Distribution Method
Polk County Regional Alafia River Basin Project	PS	10.0	$263,400,000	$4.33	$3,570	Interconnection and transfer by regional entity.

Surface Water/Stormwater Option #2. Kissimmee River Potable Supply

- Entities Responsible for Implementation: Polk County Utilities, SFWMD

This option consists of the development of a surface water supply facility on the Kissimmee River. The quantity to be made available will be based on the results of the SFWMD analysis. The project would include an intake structure, treatment plant, reservoir, ASR wells, and associated pipelines and ancillary facilities, and would be located within the SFWMD in the vicinity of Lake Kissimmee. Water would be withdrawn from the river and distributed via pipeline interconnects to nearby municipal systems. Utilities in the District that could interconnect with this system include Polk County Utilities, the cities of Lakeland, Lake Alfred, Auburndale, Winter Haven, Haines City, and Davenport, and the towns of Dundee and Lake Hamilton. Utilities and municipalities in the SJRWMD and the SFWMD could also obtain water from this facility. It is anticipated that water would be available most of the year.

Issues:

- Available quantities from this project depend on the outcome of ongoing studies conducted by the SFWMD to develop a water reservation. The SFWMD is establishing reservations for the Kissimmee River and the Kissimmee Chain of Lakes, which may affect water availability for out-of-district allocations.
- An inter-District transfer will be required under Section 373.2295, F.S.
- The SFWMD is assessing the effects of surface water diversions from the river on downstream users and natural systems to ensure proposed withdrawals do not interfere with downstream restoration efforts.

Section 5. Brackish Groundwater Options

As discussed in Chapter 4, the Upper and Lower Floridan aquifers are divided within the planning region by two partially overlapping confining units, MCU I and MCU II. The water quality in the LFA may vary in part by its proximity to a particular confining unit. Below MCU I, it is often fresh or near potable quality, and is used extensively in central Florida for water supply. Below MCU II, it has been less utilized and explored due to poorer water quality, but in some areas the aquifer may be significantly confined enough to avoid impacts to surface water bodies and be considered an alternative water supply. Studies are ongoing to enhance the District's geologic understanding of the LFA below MCU II and its viability as a water supply.
The following project options include projects where mildly brackish supplies could be diluted to potable standards by mixing with water from other sources and larger scale projects requiring

advanced membrane treatment and concentrate disposal systems. Requests for brackish groundwater withdrawals will be evaluated similarly to requests for fresh groundwater withdrawals because all withdrawals, regardless of quality, cannot impact or delay the recovery of a stressed MFL water resource.

Brackish Groundwater Option #1. Lower Floridan Aquifer Groundwater Blending

- Entities Responsible for Implementation: Polk County, Municipalities, District, SFWMD

This option involves drilling a production test well into the LFA to develop additional supplies for an existing fresh groundwater facility. If the water is determined to be fresh, it could be used directly for water supply following disinfection. If it is brackish (an alternative or non-traditional source of water), it may be blended with fresh/treated water to meet drinking water standards.

The Polk County Comprehensive Water Supply Plan identified over 50 potential locations near existing UFA supply wells and facilities where this option may be feasible. Additional outreach and utility coordination conducted for CFWI planning efforts has refined the potential locations to 30 sites. The conceptual capacities are based on the location's current fresh water capacity and anticipated blending ratios. The conceptual costs that comprise the development of a LFA well include planning, permitting and design fees, infrastructure construction costs, and land costs. Unit costs include both capital and annual O&M costs. Cost information for this option at all potential locations is contained in Table 5-14.

Issues:

- Depending on the location of the wells, more than one water management district (WMD) may need to be involved in the water use permitting process.
- The blending options have cost advantages, as they would not require reverse osmosis (RO) treatment and sub-Floridan well injection systems; however, production quantities are restricted by water quality which may degrade over time and use.

Table 5-14. *Brackish Groundwater options for the Heartland Planning Region*

Description	User Group	Potential Quantity Available (mgd)	Capital Cost	Cost/mgd	Unit Cost ($/1,000 gal)	Annual O&M
Auburndale: Atlantic WTP Groundwater Blending	PS	0.62	2,100,000	3,387,000	0.66	Included in Unit Cost
Bartow: 7 Mgd WTP – Groundwater Blending	PS	0.63	2,100,000	3,333,000	0.65	Included in Unit Cost
Davenport: Davenport WTP Groundwater Blending	PS	0.17	1,800,000	10,588,000	2.02	Included in Unit Cost
Dundee: Lake Riner WTP #1 Groundwater Blending	PS	0.06	1,740,000	29,000,000	5.38	Included in Unit Cost
Dundee: Lake Ruth WTP #1 Groundwater Blending	PS	0.05	1,730,000	34,600,000	6.53	Included in Unit Cost
Fort Meade: Fort Meade WTP Groundwater Blending	PS	0.16	1,820,000	11,375,000	2.14	Included in Unit Cost
Frostproof: Frostproof WTP #1 Groundwater Blending	PS	0.04	1,720,000	43,000,000	8.1	Included in Unit Cost
Frostproof: Frostproof WTP #2 Groundwater Blending	PS	0.05	1,730,000	34,600,000	6.53	Included in Unit Cost
Frostproof: Frostproof WTP #3 Groundwater Blending	PS	0.07	1,750,000	25,000,000	4.71	Included in Unit Cost
Haines City: WTP No #1 Groundwater Blending	PS	0.31	2,020,000	6,516,000	1.22	Included in Unit Cost
Haines City: WTP #2 Groundwater Blending	PS	0.35	2,120,000	6,057,000	1.15	Included in Unit Cost
Lake Alfred: Lake Alfred WTP Groundwater Blending	PS	0.18	1,830,000	10,167,000	1.92	Included in Unit Cost
Lake Hamilton: Lake Hamilton WTP Groundwater Blending	PS	0.06	1,740,000	29,000,000	5.47	Included in Unit Cost
Lake Wales: Grove Ave. WTP Groundwater Blending	PS	0.29	1,800,000	6,207,000	1.17	Included in Unit Cost
Lake Wales: High School WTP Groundwater Blending	PS	0.32	1,930,000	6,031,000	1.14	Included in Unit Cost
Lake Wales: Market Street WTP Groundwater Blending	PS	0.05	1,750,000	35,000,000	6.58	Included in Unit Cost

Description	User Group	Potential Quantity Available (mgd)	Capital Cost	Cost/mgd	Unit Cost ($/1,000 gal)	Annual O&M
Lakeland: C.W. Combee WTP Groundwater Blending	PS	1.2	4,300,000	3,580,000	0.67	Included in Unit Cost
Lakeland: T. B. Williams WTP Groundwater Blending	PS	3.03	6,900,000	2,277,000	0.42	Included in Unit Cost
Mulberry: Mulberry Plant #1 Groundwater Blending	PS	0.09	1,770,000	19,667,000	3.69	Included in Unit Cost
Polk City: Bougainvilla WTP Groundwater Blending	PS	0.05	1,750,000	35,000,000	6.58	Included in Unit Cost
Polk City: Commonwealth Plant Groundwater Blending	PS	0.01	1,740,000	174,000,000	3.25	Included in Unit Cost
Winter Haven Water Dept: Callen WTP Groundwater Blending	PS	0.11	1,780,000	16,182,000	3.05	Included in Unit Cost
Winter Haven Water Dept: 3rd Street WTP Groundwater Blending	PS	0.34	2,040,000	6,000,000	1.13	Included in Unit Cost
Winter Haven Water Dept: Cypresswood WTP Groundwater Blending	PS	0.05	1,750,000	35,000,000	6.58	Included in Unit Cost
Winter Haven Water Dept: Eloise Wood WTP Groundwater Blending	PS	0.07	1,760,000	25,143,000	4.72	Included in Unit Cost
Winter Haven Water Dept: Fairfax WTP Groundwater Blending	PS	0.74	2,510,000	3,392,000	0.64	Included in Unit Cost
Winter Haven Water Dept: Garden Grove WTP Groundwater Blending	PS	0.14	1,800,000	12,857,000	2.43	Included in Unit Cost
Winter Haven Water Dept: Inwood WTP Groundwater Blending	PS	0.15	1,810,000	12,067,000	2.27	Included in Unit Cost
Winter Haven Water Dept: Winterset Gardens WTP Groundwater Blending	PS	0.21	1,960,000	9,333,000	1.76	Included in Unit Cost
Winter Haven Water Dept: Winterset WTP Groundwater Blending	PS	0.17	1,820,000	10,706,000	2.02	Included in Unit Cost

Brackish Groundwater Option #2. Southeast Polk County Regional Wellfield.

- Entities Responsible for Implementation: Polk County regional entity, District, SFWMD

The Southeast Polk County Regional Wellfield Project is anticipated to supply up to 30 mgd of finished water to 10 municipal service areas — the cities of Auburndale, Davenport, Eagle Lake, Frostproof, Haines City, Lake Alfred, Lake Wales, Winter Haven, the Town of Dundee, and the Town of Lake Hamilton — and three Polk County Utilities service areas: East Regional Utility Service Area (ERUSA), Northeast Regional Utility Service Area (NERUSA), and Southeast Regional Utility Service Area (SERUSA). As part of the advancement of this project, the municipalities for these service areas and Polk County are forming a regional water supply entity. The project is the development of a centralized LFA brackish/nontraditional groundwater wellfield in southeast Polk County. The project includes the construction of a new WTP, wellfield and raw water transmission systems, concentrate disposal well(s), and the distribution water mains to facilitate water wheeling among the Polk County project partners. The project is expected to yield 30 mgd of finished water for the project partners. See Table 5-15, below.

Table 5-15. *Southeast Polk County Regional Wellfield option quantity/costs*

Description	User Group	Potential Quantity Available (mgd)	Capital Cost	Cost/mgd	Unit Cost ($/1,000 gal)	Annual O&M
SE Polk County Wellfield	PS	30	320,000,000	10,667,000	1.52	Included in Unit Cost

Brackish Groundwater Option #3. Northeast Polk County Regional Wellfield.

- Entities Responsible for Implementation: Polk County regional entity, District, SFWMD

This project consists of two or more LFA wells in the northeast area of Polk County, membrane treatment and deep well injection for concentrate disposal, and transmission to utilities in northeastern Polk County. The project would be developed by Polk County Utilities or a new regional entity, and would create a new supply to meet regional demands. The cost information shown in Table 5-16, below, is from the CFWI RWSP.

Table 5-16. *Northeast Polk County Regional Wellfield option quantity/costs*

Description	User Group	Potential Quantity Available (mgd)	Capital Cost	Cost/mgd	Unit Cost ($/1,000 gal)	Annual O&M
NE Polk Co. LFAS Well	PS	4.0	28,400,000	7,100,000	1.76	Included in Unit Cost

Section 6. Seawater Options

Because of its inland locality, the District does not consider seawater desalination to be a viable water supply source for the planning region. However, Polk County and Tampa Bay Water (TBW) have previously discussed the potential for the County to partner with TBW to share a portion of the cost of a 25 mgd desalination plant expansion. In exchange for the funding commitment, TBW would supply a set quantity of water to the County through a regional interconnect from the Lakeland area to TBW's regional system in the Lithia area of Hillsborough County.

Chapter 6. Water Supply Projects Under Development

This chapter is an overview of water supply projects that are under development in the Heartland Planning Region. Projects under development are those the 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 68.52 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 22 percent of that demand (15.29 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. Fresh Groundwater

1.0 Polk County Partnership Funding For Regional Grid System

The formation of a regional water supply entity in Polk County will be a critical step in developing public water supply infrastructure that can enable permitted surplus water supplies to be transferred where needed in the short term, and allow future alternative supply delivery in the long term. As discussed in Chapter 5, the conceptual transmission grid system may loop through multiple cities and county service areas, and allow up to 6 mgd of surplus groundwater capacity to be imported to demand centers. The transmission system would eventually distribute 20 to 30 mgd of new water supply regionally from the proposed Southeast Wellfield and other future alternative supply projects. Beginning in FY2015, the District began securing funds to assist a regional entity in developing a regional water grid system. The initial allocation was $10 million, and over $140 million may be generated through the planning period. Future project costs are dependent on project performance and municipality involvement in the regional entity.

Section 2. Water Conservation

1.0 Non-Agricultural Conservation

1.1 Indoor Water Conservation Projects

Since 2010, the District has cooperatively funded the distribution of approximately 1,330 ultra low-flow or high-efficiency fixtures. These programs have cost the District and cooperating local governments a combined $161,856 and have yielded a potable water savings of approximately 31,983 gallons per day. Table 6-1 provides information on indoor water conservation projects that are under development.

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

Cooperator	Project Number	General Description	Savings (gpd)	Devices and Rebates	Total Cost[1]	District Cost	$/1,000 gal Saved
Lakeland	N112	Toilet Rebate	23,638	753	$143,702	$70,098	$1.67
Frostproof	N249	Toilet Rebate	540	20	$1,954	$977	$1.00
Lake Alfred	N314	Toilet Rebate	7,805	557	$16,200	$8,100	$0.57
Totals			**31,983**	**1,330**	**$161,856**	**$79,175**	**$1.39[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 573 rain sensor rebates and landscape and irrigation evaluations. These programs have cost the District and cooperating local governments a combined $101,059 and have yielded a potable water savings of approximately 94,528 gallons per day. Table 6-2 provides information on outdoor water conservation projects that are under development.

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

Cooperator	Project Number	General Description	Savings (gpd)	Sensors/ Audits	Total Cost[1]	District Cost	$/1,000 gal Saved
Highlands County SWCD	N165	Urban Mobile Irrigation Lab	5,400	40	$9,305	$6,545	$1.15
Winter Haven	N221	Smart Controller Pilot	21,483	12	$7,990	$3,950	$0.25
Polk County	N363	Landscape Irrigation Audit	35,045	299	$39,684	$19,842	$0.75
Polk County	N613	Landscape Irrigation Audit	32,600	222	$44,170	$22,085	$0.84
Totals			**94,528**	**573**	**$101,059**	**$52,422**	**$0.71**

[1] The total project cost may include variable project-specific costs including marketing, education and administration.

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 FARMS Program and the well back-plugging program, are not included in this section because the District classifies these programs as water resource development. Program details, 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. 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 8 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 Districtwide. 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.

Through IFAS, the District has funded a number of research and education projects to reduce agricultural water demand.

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 3. Reclaimed Water

1.0 Reclaimed Water Projects – Research, Monitoring and Education Projects

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 of the benefits and costs that have been or will be realized by the 11 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 use regardless of the water 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.

The ongoing TECO Reclaimed Water Interconnects project (H076) is projected to supply 10 mgd for industrial use.

Table 6-4. *Reclaimed water projects under development in the Heartland Planning Region*

Cooperator	General Project Description	Reuse (mgd)			Customer (#)		Costs		
		Produced	Benefit	Stored	Type	Total	Total	District[1]	$/1,000 gallons[2]
Highlands County									
Town of Lake Placid	Trans,Pump,Store L153	0.12	0.07	NA	Ag, Rec	4	$1,244,292	$845,154	$3.49
Polk County									
Polk County	Recharge study N304	NA	NA		NA	NA	$755,496	$377,748	NA
Polk County	Store,Pump H090	0.00	0.00	2.00	NA	NA	$3,032,920	$2,021,946	NA
Polk County	Pump/Store ASR N024	0.00	0.00	80.00	NA	NA	$5,226,045	$2,947,745	NA
Avon Park	Reuse Master Plan N455	NA	NA	NA	NA	NA	$25,000	$18,750	NA
City of Winter Haven	Feasibility study N286	NA	NA	NA	NA	NA	$200,000	$100,000	NA
City of Winter Haven	Trans, Pump, Store N339	0.30	0.15	5.00	Res, Com, GC	TBD	$5,500,000	$2,750,000	$7.22
City of Lake Wales	Trans,Pump,Store N335	0.35	0.26	0.00	GC	1	$846,500	$282,167	$0.64
City of Auburndale	Trans N536	0.65	0.49	NA	Com	1	$2,700,000	$747,393	$1.08
City of Haines City	Trans/Pump N065	0.60	0.49	0.00	Ind, Rec, Com	4	$3,548,222	$1,468,971	$1.42
Tampa Electric Company	Trans/ Pump H076	10.00	10.00	0.50	Ind	1	$97,960,725	$50,243,394	$1.93
Total	**11 Projects**	**12.02**	**11.46**	**87.5**		**11**	**$121,039,200**	**$61,803,268**	**$3.14**

[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. *Reclaimed water research, monitoring and education projects under development in the District*

Cooperator	General Project Description	Costs	
		Total[1]	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
TOTALS DISTRICTWIDE	**10 Projects**	**$3,214,100**	**$1,026,730**

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

Section 4. Brackish Groundwater

Polk County is pursuing the development of a wellfield in southeast Polk County that would withdraw up to 30 mgd from the Lower Floridan aquifer (LFA). While the wellfield would be located outside the District boundary, it would serve demands of multiple municipalities within the District. The District intends to assist with the regional transmission infrastructure necessary to deliver the supply to demand centers, and commenced budgeting for the projects in FY2015. Funds could potentially be applied to source development. The District is also currently conducting hydrogeologic investigations to determine the viability of the LFA below MCU II as an alternative water supply source in other portions of Polk County. At some sites where aquifer performance testing is being conducted, the test production wells may be constructed to standards allowing for their eventual conversion to supply wells by a new regional entity. It is anticipated that the entity would reimburse a share of the well construction costs, and provide an alternate location for the District well monitoring program. The ongoing hydrologic investigations are discussed in Chapter 7, Water Resource Development.

Section 5. Aquifer Storage and Recovery

There is one reclaimed water ASR project under development in the planning region. The project is located at Polk County's Northwest Regional Wastewater Treatment Facility and consists of a Lower Floridan ASR well. The ASR system is in the testing phase. Table 6-6 shows the ASR cost/share information.

Table 6-6. *Polk County Lower Floridan ASR Well project cost/share*

Quantity Produced (mgy)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
TBD	$5,226,045	$2,613,022	TBD	TBD

Section 6. Aquifer Recharge

The City of Winter Haven has completed a desktop feasibility investigation and is preparing for indirect aquifer recharge (AR) site testing, design and construction at the Tilden Groves site in the central Winter Haven area. The City of Winter Haven hopes to recharge up to 1.7 mgd in an effort to achieve measurable improvements in SWUCA aquifer levels.

There are a number of existing indirect AR Rapid Infiltration Basin (RIB) sites located along the Lake Wales Ridge where the surficial aquifer is thick and the water table is well below land surface. This ridge, along with portions of the Winter Haven Ridge, Lake Henry Ridge, and the Lakeland Ridge, are areas where indirect AR projects may have a better chance for success, provided site-specific hydrogeologic conditions are favorable.

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, 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 is 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 wall 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, 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 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 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 (SPJC) watersheds; (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 37 within the Heartland Planning Region. These projects are projected to have a cumulative groundwater offset of 3.70 mgd.

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.

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

Project Description	District budget FY2011-15	Benefit (mgd)	Priority Area
Ark Industries, Inc.	$21,904	0.010	SWUCA
Ben Hill Griffin, Inc - Section 16 and 17 Grove	$171,726	0.156	SWUCA
Blue Fields USA, LLC	$255,868	0.056	SWUCA
Classic Caladiums, LLC	$28,679	0.186	SWUCA
Clear Springs Enterprises, LLC	$670,105	0.520	SWUCA
Evans Ranch	$90,174	0.030	NA
Five Star Family Growers, LLC	$200,000	0.090	SWUCA
Heartland Farming, LLC	$44,962	0.019	NA
Jeremy Scott Blueberries	$34,611	0.010	SPJC
Luna Berry Farms, LLC	$266,980	0.112	SWUCA
Mary McTeer	$23,000	0.010	SWUCA
Mixon Family Farms, Phase 2	$64,740	0.034	SWUCA
Oak Creek Farms, LLC	$348,750	0.060	SWUCA
Orange and Blue Groves	$8,730	0.011	SWUCA
Polkdale Farms - Wind Machines	$30,479	0.000	NA
San Juan Citrus	$18,846	0.030	SWUCA
Sunshine Foliage World, Ltd.	$72,000	0.145	SWUCA
Sweetwater Preserve, LLC	$281,500	0.185	SWUCA
Sweetwater Preserve, LLC - Phase 2	$231,886	0.176	SWUCA
The Doc Applications	$32,500	0.041	SWUCA
Twenty-Twenty Groves, Inc.	$199,800	0.177	SWUCA
Twenty-Twenty Groves, Inc. - Phase 2	$1,615,823	0.710	SWUCA
Wheeler Farms, Inc	$116,548	0.059	SWUCA
Windmill Farms Nurseries, Inc.	$175,000	0.429	SWUCA
Windmill Farms Phase 2	$205,400	0.445	SWUCA
Total	**$5,210,000**	**3.701**	

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.

2.3 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, 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 Tampa Bypass Canal 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 Tampa Bypass Canal 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 Tampa Bypass Canal 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 Tampa Bypass Canal to the LHR in accordance with adopted MFL requirements (as described above). The diversion is achieved through two temporary pump stations located on the Tampa Bypass Canal 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 Tampa Bypass Canal. Pump operation is expected to continue until the City of Tampa completes new permanent pumping facilities.

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/ground-water 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.


P-11 outfall structure

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 staff.

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 storm water 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


Lake Jackson in Highlands County

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.

Lake Jackson near Sebring

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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 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.

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). 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. A significant portion of water demand in the Northern Planning Region will be met with fresh groundwater available to the region.

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, 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 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 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 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 receiving Springs Initiative funding have been 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 alternative water supplies Districtwide.

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. An 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. The 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 to the SWUCA. 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 $600 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 WSRD 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 the CFI and District Initiatives 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 (WPSTF)	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 that have been proposed by the PRMRWSA, Tampa Bay Water, Tampa Electric Company, and Polk County that will produce up to 49 mgd of water supply within the 2035 planning horizon Districtwide. 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. In other planning regions, additional new demands will be met through the development of alternative water source and conservation projects chosen by users. The potential water supply project options are discussed in Chapter 5 for each planning region.

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. 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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