2020 Regional Water Supply Plan

Heartland Planning Region

November 2020

Lake Hancock
Polk County

TECO Power Station
Polk County

Peace River
Hardee and Polk Counties

Jack Creek
Highlands County

Southwest Florida
Water Management District

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2020 Regional Water Supply Plan
Heartland Planning Region

Board Approved

November 2020

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Southwest Florida Water Management District

2020 Regional Water Supply Plan

This report is produced by the Southwest Florida Water Management District

November 2020

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Table of Contents

List of Figures

List of Tables

List of Appendices

These appendices are located on the District's website: *www.WaterMatters.org*

List of Abbreviations

AG	Agriculture
AMI	Advanced Metering Infrastructure
AMO	Atlantic Multidecadal Oscillations
AR	Aquifer Recharge
ASR	Aquifer Storage and Recovery
AWEP	Agriculture Water Enhancement Program
AWE	Alliance for Water Efficiency
AWS	Alternative Water Supply
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
CFWI	Central Florida Water Initiative
CHAMP℠	Conservation Hotel and Motel Program
CII	Commercial, Industrial, and Institutional
DBP	Disinfection by Products
DO	Dissolved Oxygen
DOH	Department of Health
DPCWUCA	Dover/Plant City Water Use Caution Area
DSS	Domestic Self Supply
DWRM	Districtwide Regulation Model
ECFT	East-Central Florida Transient groundwater model
ECFTX	East-Central Florida Transient groundwater model extended
EDR	Electro-Dialysis Reversal
ENSO	El Nino Southern Oscillations
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ERUSA	East Regional Utility Service Area
ET	Evapotranspiration
ETB	Eastern Tampa Bay
ETBWUCA	Eastern Tampa Bay Water Use Caution Area
EQIP	Environmental Quality Incentives Program
F.A.C.	Florida Administrative Code
FARMS	Facilitating Agricultural Resource Management Systems
FBCB	Florida Building Code, Building
FDACS	Florida Department of Agriculture and Consumer Services
FFL	Florida-Friendly Landscaping
FDEP	Florida Department of Environmental Protection
F.S.	Florida Statutes
FSAID	Florida Statewide Agricultural Irrigation Demand
FTMR	Focus Telescopic Mesh Refinement
FWS	Florida Water Star
FY	Fiscal Year
GAL	Gallons
GIS	Geographic Information System

GOES	Geostationary Operational Environmental Satellites
GPD	Gallons per Day
GPF	Gallons per Flush
GPM	Gallons per Minute
GRP	Gross Regional Product
HET	High Efficiency Toilets
HPR	Heartland Planning Region
HRWUCA	Highlands Ridge Water Use Caution Area
I-4	Interstate 4
I/C	Industrial/Commercial
IFAS	Institute of Food and Agricultural Sciences
IPCC	Intergovernmental Panel on Climate Change
IPE	Independent Performance Evaluation
L/R	Landscape/Recreation
LFA	Lower Floridan aquifer
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
NERUSA	Northeast Regional Utility Service Area
NGVD	National Geodetic Vertical Datum
NHARP	North Hillsborough Aquifer Recharge Program
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTB	Northern Tampa Bay
NTBWUCA	Northern Tampa Bay Water Use Caution Area
O&M	Operation and Maintenance
OFW	Outstanding Florida Water
PG	Power Generation
PRMRWSA	Peace River Manasota Regional Water Supply Authority
PRIM	Peace River Integrated Model
PRMRWSA	Peace River Manasota Regional Water Supply Authority
PRWC	Polk Regional Water Cooperative
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 and Monitor-well Program

RWSP	Regional Water Supply Plan
SERUSA	Southeast Regional Utility Service Area
SFWMD	South Florida Water Management District
SHARE	South Hillsborough Aquifer Recharge Expansion
SHARP	South Hillsborough Aquifer Recharge Program
SHP	Stormwater Harvesting Program
SJRWMD	St. Johns River Water Management District
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
WISE	Water Incentives Supporting Efficiency
WMD	Water Management District
WMIS	Water Management Information System
WMP	Watershed Management Program
WPSPTF	Water Protection and Sustainability Program Trust Fund
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 (SWFWMD or District) is an assessment of projected water demands and potential sources of water to meet these demands for the period from 2020 through 2040. The RWSP has been prepared in accordance with the Florida Department of Environmental Protection's (FDEP) 2019 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 2020 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, 2010, and 2015 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 a variety 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 a RWSP for areas where existing and reasonably anticipated sources of water were determined to be inadequate to meet future demand, based upon the results of the water supply assessment.

Regional water supply planning requirements were amended as a result of the passage of Senate Bill 444 during the 2005 legislative session. The bill substantially strengthened requirements for the identification and listing of WSD projects. In addition, the legislation intended to foster better communications among water planners, local government planners, and local utilities. Local governments are now 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.

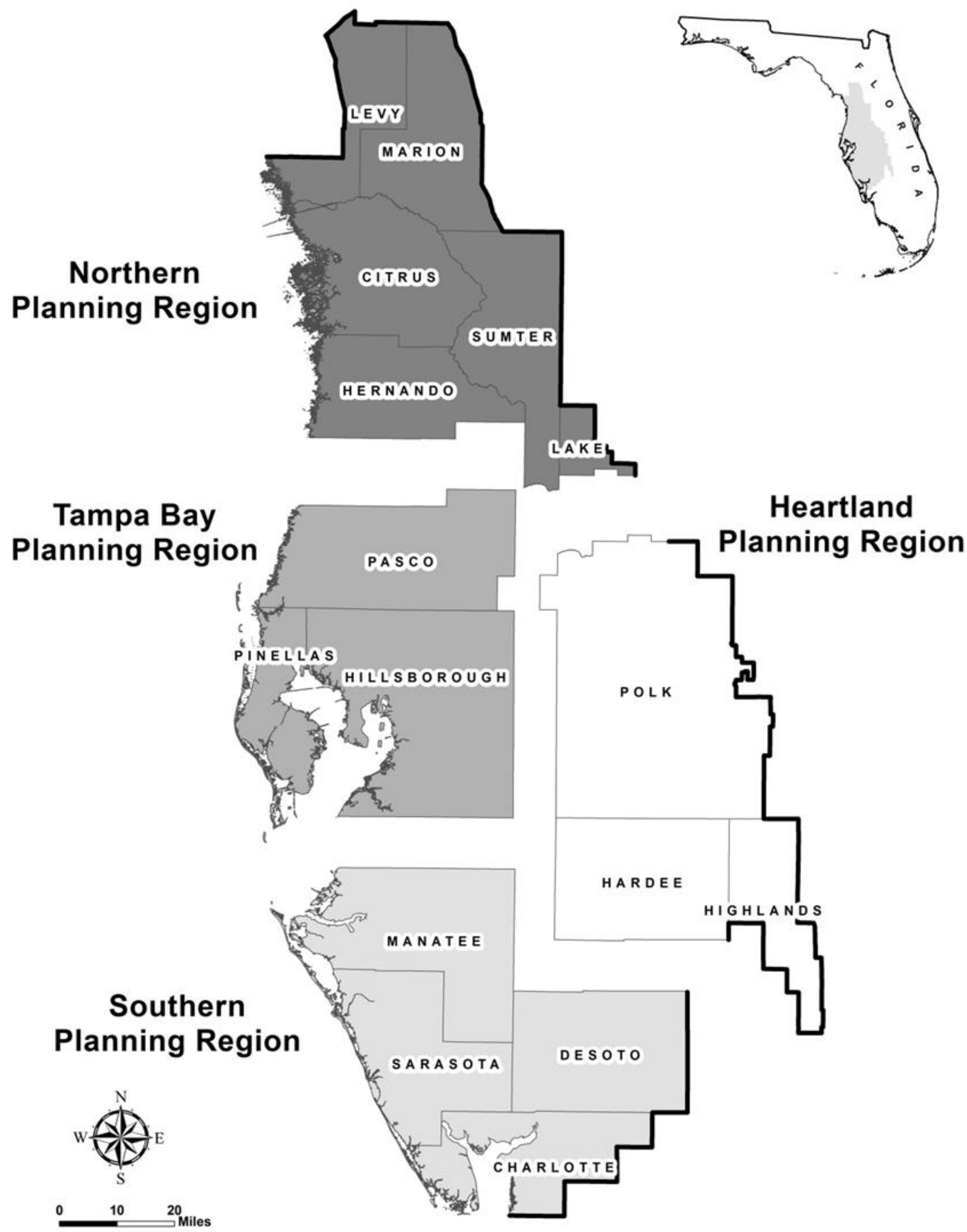


Figure 1-1. *Location of the four water supply planning regions within the District*

Part A. Introduction to the Heartland Planning Region Regional Water Supply Plan

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 2015 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 2040 for public supply, agricultural, industrial/commercial, mining/dewatering, power generation, 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 WSD projects that are currently under development and receiving District funding assistance. Chapter 7, Water Resource Development Component, is an inventory of the District's ongoing data collection and analysis activities and water resource projects that are classified as water resource development (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 2040 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 2015 Regional Water Supply Plan

This section is a summary of the District's major accomplishments in implementing the objectives of the RWSP in the planning region since the 2015 update was approved by the Governing Board in November 2015.

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

1.0 Alternative Water Supply

In 2016, Polk County and 16 of its municipalities formed the Polk Regional Water Cooperative (PRWC) to collaboratively plan and develop conservation efforts, system interconnections, and new alternative water supply (AWS) sources. The District is supporting the PRWC's efforts through resolutions that assure funding sources for future projects and incentivize a regional approach to WSD. The PRWC has four AWS projects currently in the conceptual or preliminary design phases: The Southeast Wellfield project (near Lake Wales), the West Polk County Lower

Aquifer Deep Wells project (near Lakeland), the Peace Creek Integrated Water Supply Project, and the Peace River/Land Use Transition Treatment Facility and Reservoir.

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, for fiscal years 2015-2019, this includes cooperatively-funded projects for toilet rebates, rain sensors, water-efficient landscape and irrigation evaluations, ET-based smart irrigation controllers, Florida Water Star℠ rebates, line looping to reduce flushing, advanced metering analytics customer portals, conservation kits, and demand management planning. The District has funded conservation projects undertaken by Polk County, the PRWC, the City of Winter Haven, and the Town of Lake Hamilton. In 2019, the District co-funded a Demand Management Plan with PRWC that will help assess available water conservation potential and articulate a long-term water conservation implementation strategy for PRWC. Additionally, it will provide an economic analysis of the potential beneficial delay in expensive AWS projects that becomes possible by extending existing supplies via conservation. Results from this effort will not be completed in time to be incorporated into the 2020 RWSP, but the 2025 update could include some of the information. The District also formed the Water Conservation Initiative to assist public supply utilities in achieving their water conservation goals.

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 194 operational projects Districtwide are providing a groundwater offset of more than 27 million gallons per day (mgd). An additional nine projects in the planning, design, or construction phase are expected to yield another 0.98 mgd of offset. Within the Heartland Planning Region, FARMS has funded 41 operational projects providing nearly 4 mgd of offset with another 3 projects under construction that are expected to yield an additional 0.37 mgd.

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 385 projects between Fiscal Year (FY) 1987 and FY2020 for the design and construction of transmission, distribution, recharge, natural system enhancement, storage and pumping facilities, metering, feasibility studies, reuse master plans, and research projects. As a consequence of District and utility cooperation, reuse projects were developed that will result in the 2025 Districtwide utilization of reclaimed water of more than 228 mgd and a water resource benefit of more than 137 mgd (FDEP 2015 beneficial reuse plus growth as projects currently under construction). Utilities are on their way to achieving the 2040 Districtwide goals of 353 mgd utilization (75 percent) and 269 mgd of water resource benefit (75 percent efficiency).

In 2015, utilities within the Heartland region were utilizing approximately 56 percent or 21 mgd of the 38 mgd of available wastewater treatment plant flows, resulting in an estimated 16 mgd of water resource benefits (78 percent efficiency). There are 10 reclaimed water supply projects under development and another six that are estimated to experience additional future supply growth. The projects will supply approximately 20 mgd of reclaimed water that will result in approximately 15 mgd of potable-quality water benefits at a total cost of more than $122 million.

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 and 2015 RWSPs and the District budgeted funds to cooperatively fund implementation of water supply projects identified in the plan. More recently, the District has supported the development of the Polk Regional Water Cooperative (PRWC) and funded PRWC alternative water supply projects designed to meet the future demands of member utilities in Polk County through 2040. These efforts reflect and 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 FDEP, 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 Minimum Flows and Levels

The MFLs established in the planning region during or since 2015 include new or reevaluated MFLs for lakes Aurora, Clinch, Crooked, Damon, Eagle, Easy, Eva, Hancock, Jackson, Letta, Little Lake Jackson, Lotela, Lowery, McLeod, Starr, and Wailes. The District continues to re-evaluate and establish new MFLs per the Priority List and Schedule for the Establishment of Minimum Flows, Minimum Water Levels, and Reservations (see Chapter 2, Part B, and Appendix 2-1).

2.0 Minimum Flows and Levels Recovery Initiatives

The District's Southern Water Use Caution Area (SWUCA) recovery strategy, approved in 2006 (SWFWMD 2006) with effective rules in 2007, relies on a variety of activities that are collectively aimed at achieving MFLs for all priority water resources in the SWUCA by 2025. Key areas of progress since 2015 include refinement in operation of 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 dry season flows and help achieve minimum low flows in the upper Peace River. The District anticipates monitoring the effectiveness of the Lake Hancock Lake Level Modification project on improving flows in the upper river during at least a five-year operating period prior to implementation of other projects that may be needed for river recovery. Resource monitoring is ongoing and a SWUCA progress report is provided to the Governing Board annually.

In 2018, the District completed its second five-year assessment of the SWUCA recovery strategy (SWFWMD, 2018). The purpose of the five-year assessment, which is required by rule, is to evaluate and assess the recovery in terms of resource trends, 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. Results from the second five-year assessment indicate the District continues to make progress toward recovery, but challenges remain to full recovery by 2025 . Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing WRD projects designed to augment or preserve existing flows and water levels.

The Dover/Plant City Water Use Caution Area (DPCWUCA) recovery strategy was established by Rule 40D-80.075, Florida Administrative Code (F.A.C.) in 2011. The objective of the DPCWUCA is to reduce groundwater withdrawals used for frost/freeze cold protection. Recovery activities have included both regulatory and non-regulatory approaches. Regulatory approaches, per water use permitting rules in Chapter 40D-2, F.A.C., have addressed groundwater withdrawal impacts, limitations on new groundwater withdrawals, development of alternative water supplies, implementation of frost/freeze cold protection methods, and resource recovery. Non-regulatory mechanisms have included assistance to agricultural entities in offsetting groundwater withdrawals for cold protection through the FARMS program, providing enhanced data for irrigation system management, and other means.

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

Since the 1970s, the Quality of Water Improvement Program (QWIP) has prevented waste and contamination of water resources (both groundwater and surface water) by reimbursing landowners for 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 reimburses approximately 200 well-pluggings per year and more than 6,800 have been reimbursed since inception. In the Heartland Planning Region, 734 well-pluggings have been reimbursed since the QWIP 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 85 wells as of September 2018, with 63 of these in the target watersheds. One well was completed in the Heartland Planning Region.

Section 5. Regulatory and Other Initiatives

Since 2011, the District has been working with public water supply utilities, the St. Johns River Water Management District (SJRWMD) and SFWMD, FDEP, 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 FDEP 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 2020 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 2040. Those efforts, which are reflected in this 2020 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.

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 729,124 in 2015 to 992,036 in 2040 (Appendix 3-3). This is a gain of approximately 262,912 new residents, a 36 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 (2017)*

Land-Use/Land Cover Type	Acres	Percent
Urban and Built-Up	252,216.74	15.3
Agriculture	515,575.55	31.3
Rangeland	71,312.17	4.3
Upland Forest	113,822.74	6.9
Water	96,533.61	5.9
Wetlands	349,982.38	21.3
Barren Land	1,862.97	0.1
Transportation, Communications, Utilities	19,608.05	1.2
Industrial and Mining	224,126.12	13.6
Total	**1,645,040.33**	**100.0**

Source: Southwest Florida Water Management District (SWFWMD) 2017 GIS LULC Layer (SWFWMD, 2019)

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. The region also contains the headwaters of the Hillsborough River, Withlacoochee River, and North and South Prongs of the Alafia River.

Peace River near Bartow in Polk County

2.0 Lakes

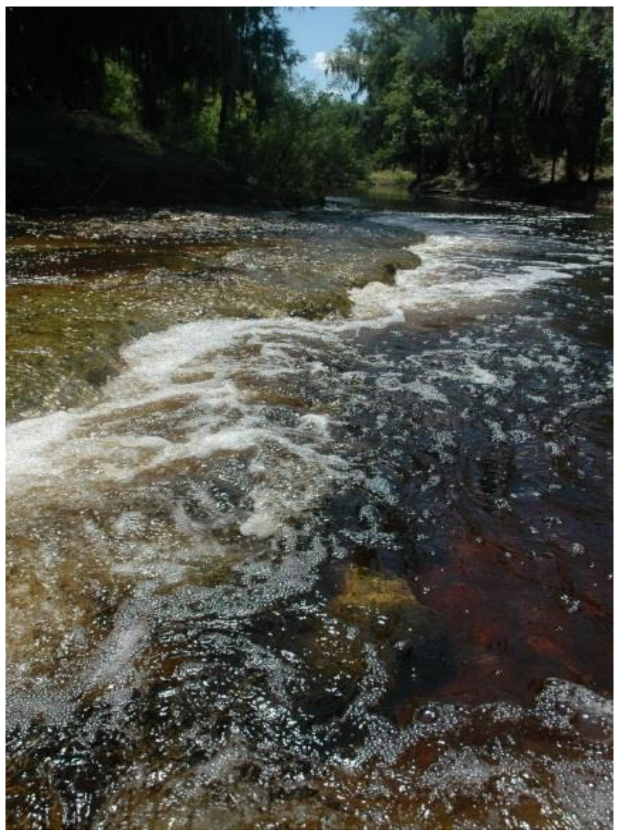
Nearly 200 lakes and ponds are located along the Lake Wales Ridge in the planning region. The lakes are most likely the result of ancient sinkholes formed by the dissolution of the underlying limestone. The lakes range in size from a few tens of acres to the more than 5,500 acres that comprise Crooked 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. Historically, 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 U.S. Geologic Survey (USGS) estimates that on average 17 cubic feet per second (cfs) (11 mgd) seeps down into the intermediate aquifer system and UFA from the river during typical dry season conditions (Metz and Lewelling, 2009).



Peace River near Wauchula in Hardee County

4.0 Wetlands

Prior to significant development, approximately 54 percent of Florida was covered by wetlands. However, due to drainage and development, only approximately 30 percent of the state currently remains covered by wetlands. Wetlands 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.

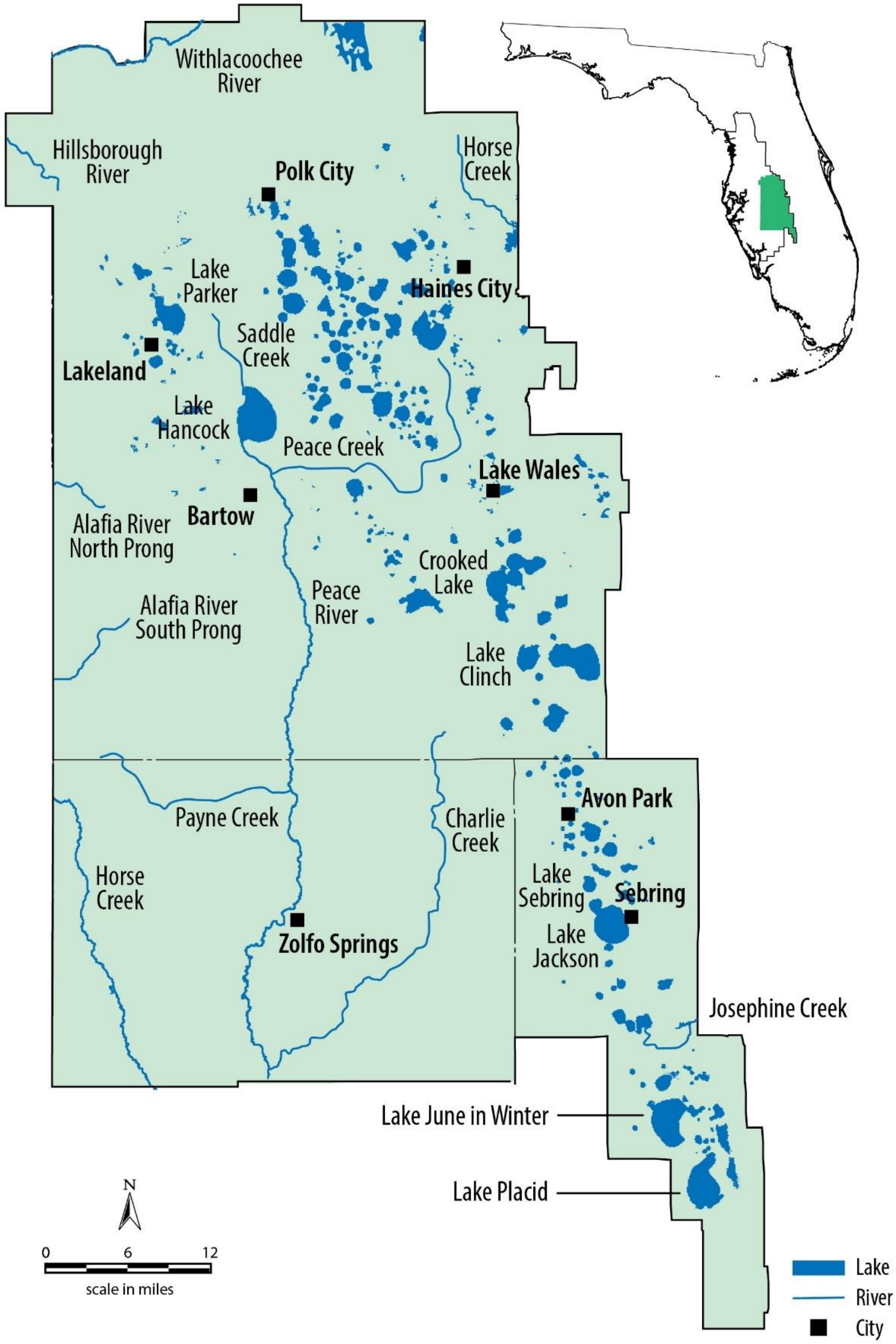


Figure 1-2. *Major hydrologic features in the Heartland Planning Region*

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 in Highlands County 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 II (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. Middle confining unit II (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 where the MCU II unit pinches out. In this area, MCU II is absent and the Lower Floridian aquifer (LFA) is present, which contains fresh water. This LFA on the eastern side of Polk County lies below another middle confining unit called middle confining unit I (MCU I) (Miller, 1986). It is located in the upper portion of the Avon Park Formation and is comprised of tight, dense, carbonate rock. Middle confining unit I (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).

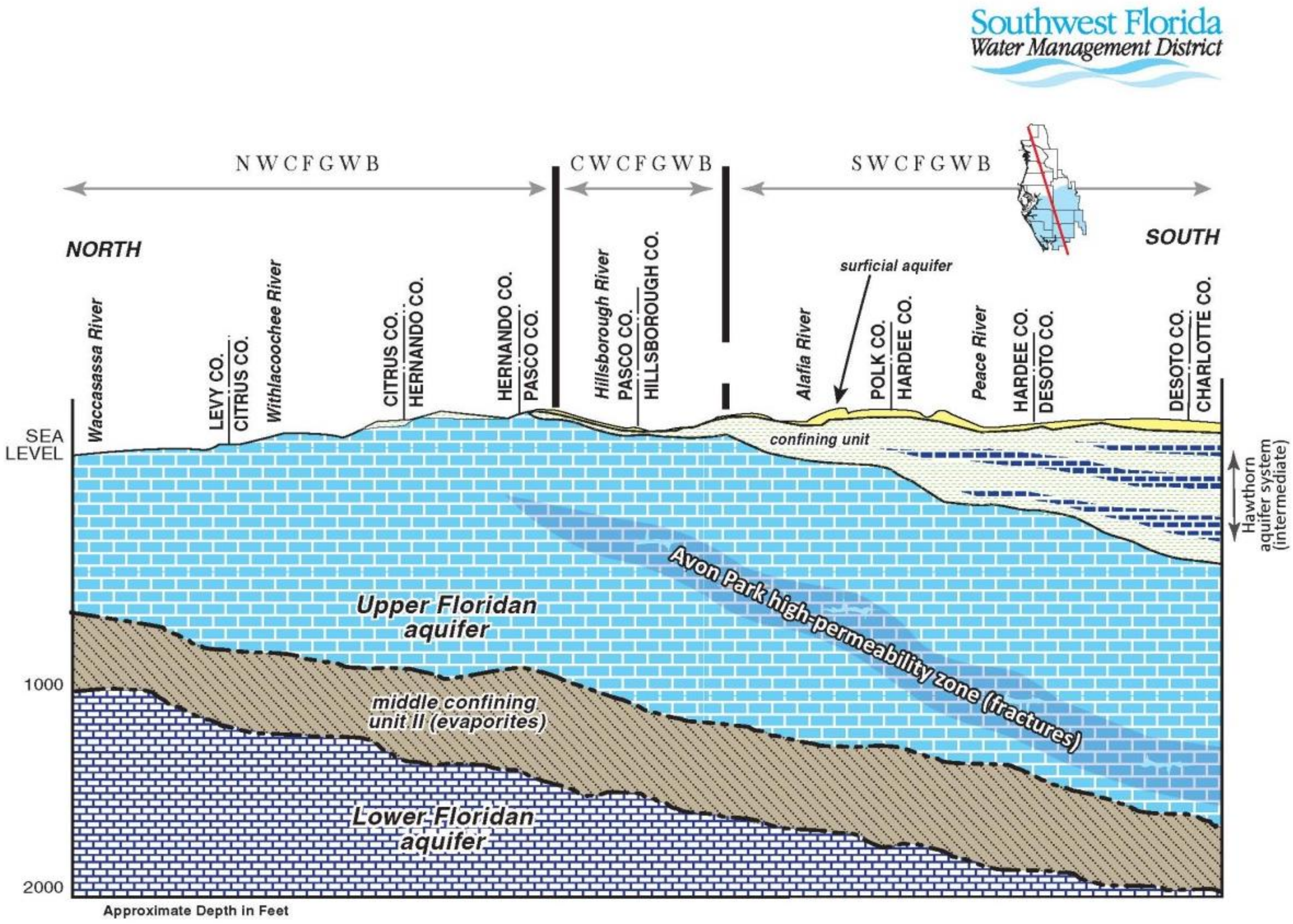


Figure 1-3. *Generalized north-south geologic cross section through the District*

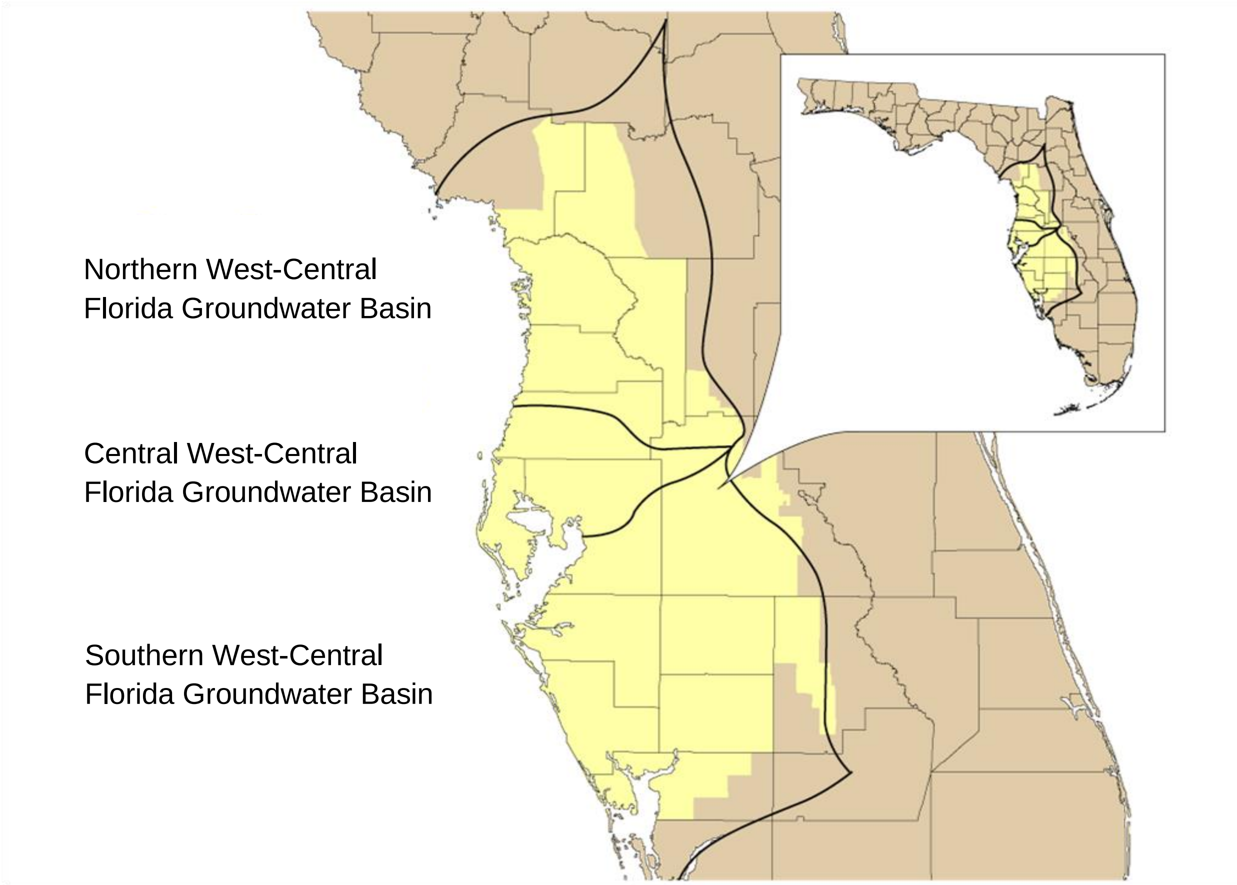


Figure 1-4. *The District and the West-Central Florida Groundwater Basins*

Part D. Previous Technical Investigations

The 2020 RWSP builds on a series of cornerstone technical investigations that were undertaken by the District and the 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), Management Plan (SWFWMD, 1990), 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 aquifer water levels and 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 to 2011 was completed in 2013 (SWFWMD, 2013), with the second five-year assessment for FY2012 to FY2016 completed in 2018 (SWFWMD, 2018). The District continues to work with key stakeholders and the public to the development and implementation of recovery options within the SWUCA.

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 FDEP 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. The 2020 CFWI RWSP details current work within the CFWI Planning Area focused on the development of water resources, water supply projects and regulatory components of the initiative necessary to meet projected water demands through 2040.

Section 2. United States Geologic Survey 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
	Optical Borehole Imaging Data Collection of Lower Floridan Aquifer Wells in Polk County
	Sources and Ages of Groundwater in the Lower Floridan Aquifer in Polk County
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 Northern Tampa Bay (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
	Statewide LiDAR Mapping
	Mapping Actual Evapotranspiration Over Florida Model Support
	Statewide Geostationary Operational Environmental Satellites (GOES) Evapotranspiration (ET) Project

Section 3. Water Supply Investigations

Water Supply investigations for the planning region were initiated in the 1960s as part of the U.S. 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 (Section 373.0361 F.S.). In response to the amended statutes, the District completed a Water Supply Assessment in 1998 that quantified water supply needs through the year 2020 and identified areas where future demand could not be met with traditional groundwater sources (SWFWMD, 1998). The District published its first RWSP in 2001 for the 10 counties located in the SWUCA and Northern Tampa Bay Water Use Caution Area (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 and 2015 RWSP updates extended the planning horizons to 2030 and 2035, respectively, and included four regional volumes covering all counties of the District. The Northern Planning Region RWSP concluded that the demand for water through 2035 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. For the three remaining planning regions, both the 2010 and 2015 RWSPs adopted several AWS options that were developed or are currently under development by the respective regional water supply authorities in those regions.

Section 4. Minimum Flows and Level Investigations

Extensive field-data collection and analysis is typically required to support MFLs development. These efforts include measurement of water levels and flows, assessment of aquatic and semi-aquatic plant and animal species or communities and their habitats, water quality characterization, and assessment of current and projected withdrawal-related impacts. Ultimately, ecological and hydrological information are linked using some combination of conceptual, statistical and numerical models to assess environmental changes associated with potential flow or level reductions. Goals for these analyses include identifying sensitive criteria that can be used to establish MFLs and prevent significant harm to a wide-range of human-use and natural system values.

USGS gauge site on river

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 East-Central Florida Transient (ECFT) groundwater model is a transient numerical model of the surficial aquifer, intermediate aquifer system, and Floridan aquifer system in east-central Florida (Sepulveda and others, 2012). The model encompasses the east-central portion of the State. The hydrogeology of east-central Florida was evaluated and used to develop and calibrate the groundwater-flow model that simulates the regional fresh groundwater-flow system. The model is used to simulate transient groundwater flow from 1995 to 2006 using monthly stress periods. The ECFT model footprint has recently been expanded and includes about 25,000 square miles from coast to coast across the Florida peninsula from southern Marion County in the north to the Charlotte-DeSoto County line in the south. This expanded ECFT model is named the ECFTX and has been constructed and calibrated by the SFWMD, SJRWMD, and the SWFWMD. The ECFTX model has been calibrated to 2003 steady-state conditions and a monthly transient period from 2004 through 2014. The focus of the model calibration was the CFWI area in the central part of the state.

The ECFTX model is fully three dimensional and is composed of 11 distinct layers. From top to bottom, the layers represent the surficial aquifer (model layer 1), the intermediate confining unit/Intermediate aquifer system (model layer 2), the Suwannee permeable zone (model layer 3), the Ocala low-permeable zone (model layer 4), the Avon Park permeable zone (model layer 5), the middle confining units I/II (model layers 6-8), and the Lower Floridan aquifer (model layers 9-11). Horizontally, the model area is divided into grid cells 1,250 by 1,250 feet in size.

The ECFTX model will increase the understanding of hydraulic connection between the surficial, UFA, and LFA. Most importantly, the model can be utilized by water-resource professionals to assess the effects of changes in groundwater withdrawals with regard to wetlands, lakes, spring flows, and potentiometric surfaces of the Upper and Lower Floridan aquifers. The model will be used to provide the technical framework for water-supply planning and decisions regarding the allocation of future groundwater withdrawals. The model also may be used for water use permit (WUP) evaluations in the model area. Other uses of the ECFTX model will include planning and regulatory impact assessments in the CFWI area.

The Districtwide Regulation Model (DWRM) was developed 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 withdrawal quantities in 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. 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 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. DWRM Version 3 simulates groundwater flow of the entire District using a quasi-3D conceptualization of the Modular finite Difference Groundwater Flow Model code (MODFLOW-2005). DWRM3 simulates groundwater flow in the surficial, intermediate, UFA, and LFA. DWRM3 supports current regulatory functions as a core business process addressed in the District's Strategic Plan (SWFWMD, 2014).

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 most impacted area (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 (including start-up period) 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.

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, Florida Statutes (F.S.), identify the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. If the existing flow or level of a water body is below, or is projected to fall below, the applicable minimum flow or level within 20 years, a recovery or prevention strategy must be implemented as part of the regional water supply plan (RWSP). Figure 2-1 depicts the location of the District's WUCAs. In order to determine whether an area should be declared a WUCA, the Governing Board must consider the following factors:

- 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 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

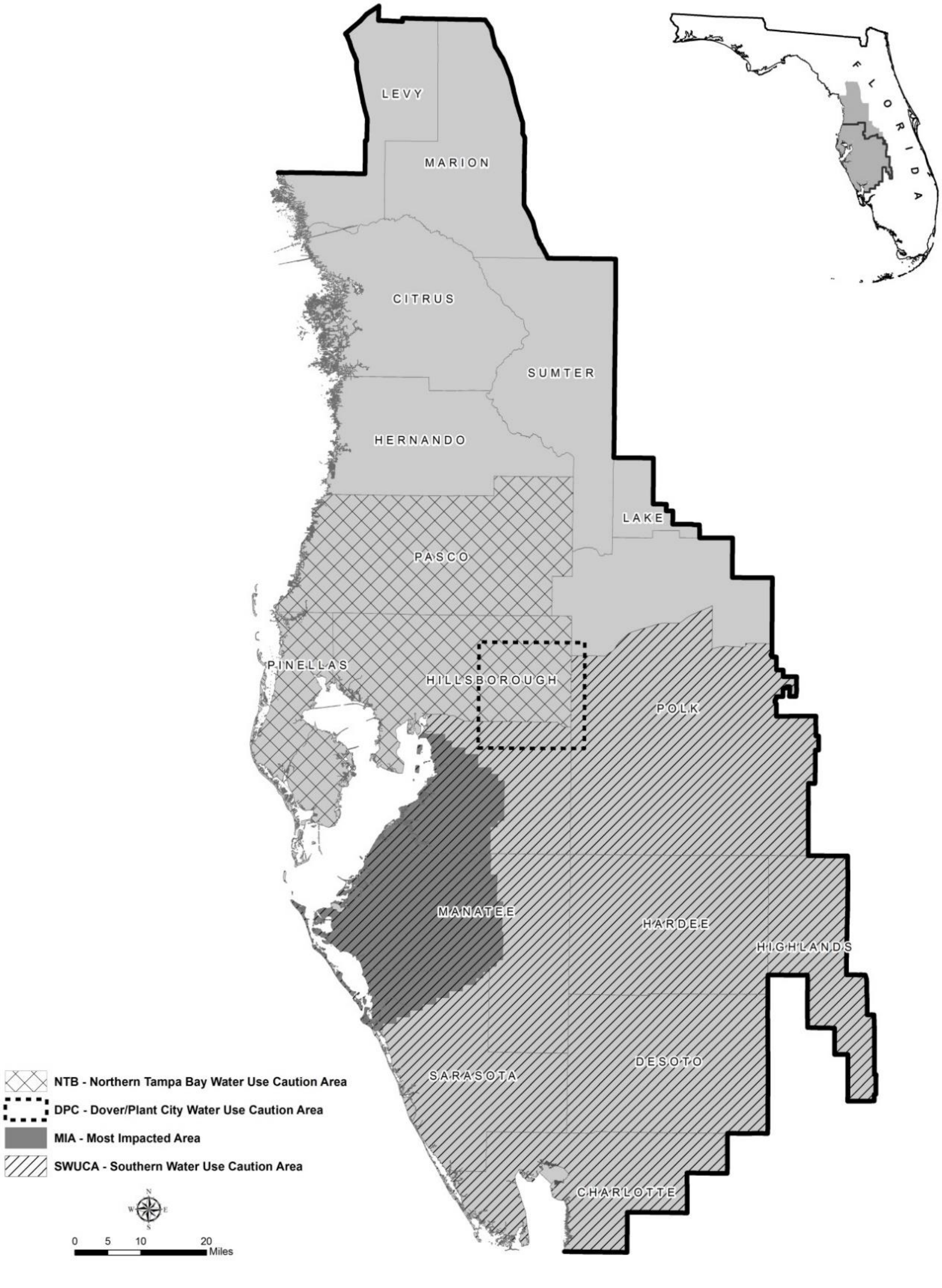


Figure 2-1. *Location of the District's water use caution areas and the MIA of the SWUCA*

1.0 Southern Water Use Caution Area

Since the early 1930s, 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 level. 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. The minimum aquifer level was withdrawn 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). 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 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 (SWFMWD 2013) that addressed the period from 2007 through 2011. 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 most impacted area (MIA) aquifer level all remained below adopted MFLs. 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.

Four meetings were held in 2015 to address issues associated with MFLs recovery in the MIA and in the ridge lakes area. Meeting participants represented all the major water use groups, a variety of environmental organizations, state agencies, and other interested parties. For the MIA, six options were identified to help meet the SWIMAL goal. The Governing Board voted to support five options (see below) and directed staff to gather more information on the exploration of aquifer recharge (AR) and aquifer storage and recovery (ASR). There was also subsequent approval of an increase to the District's cost share to 75 percent for Facilitating Agricultural Resource Management Systems (FARMS) projects in the MIA for a period of three years. This action was to encourage participation in the program.

MIA Options:

- Continue monitoring
- Update analytical tools
- Promote water conservation initiatives
- Expand FARMS
- Expand beneficial reuse

For the Ridge Lakes, three options were identified. The Board supported all three options.

Ridge Lakes Options:

- Continue monitoring
- Reevaluate established minimum lake levels
- Evaluate options for individual lakes

The second SWUCA Recovery Strategy Five-Year Assessment (SWFWMD 2018), addressing the period from 2012 through 2016 (SWFWMD 2018), evaluated and assessed recovery in terms of trends in water resources, permitted quantities, and the development of projects and initiatives that address issues within the SWUCA. An important conclusion of the second SWUCA Recovery Strategy Five-Year Assessment was that the District continues to make progress toward recovery, but challenges remain to achieving full recovery by 2025. Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing water resource development (WRD) projects designed to augment or preserve levels and flows.

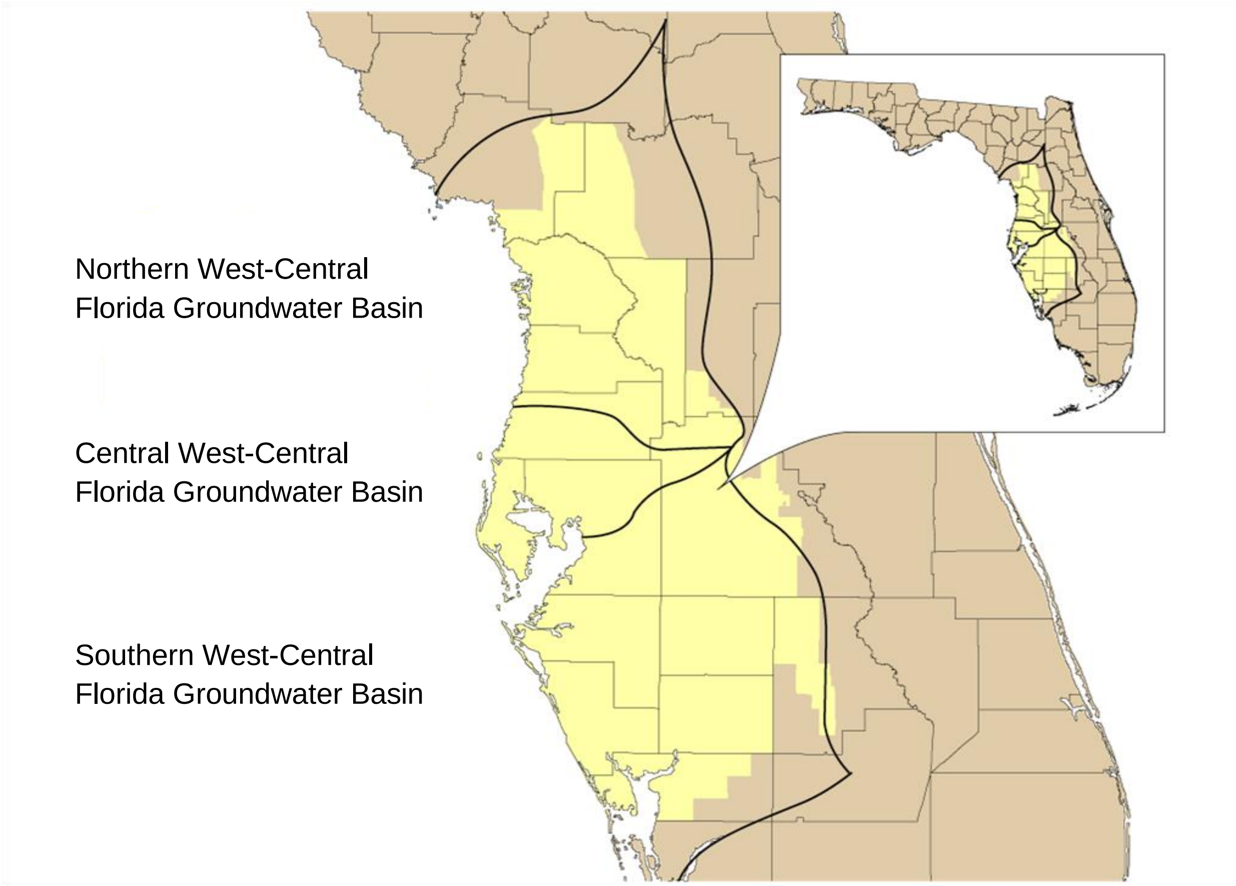


Figure 2-2. *Southwest Florida Water Management District and the West-Central Florida Groundwater Basins*

2.0 Dover/Plant City Water Use Caution Area

Groundwater withdrawals used for freeze protection of crops in the DPCWUCA 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 gallons per minute (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 DPCWUCA. This WUCA extends over a 256 square mile area in northeast Hillsborough County and eastern Polk County, within portions of the NTBWUCA and the SWUCA (see Figure 2-1). Concurrent with the establishment of the DPCWUCA, the District adopted the Minimum Aquifer Level (MAL), Minimum Aquifer Level Protection Zone (MALPZ), and recovery strategy for the DPCWUCA.

The objective of the recovery strategy established by Rule 40D-80.075, Florida Administrative Code (F.A.C.), for the DPCWUCA is to reduce groundwater withdrawals used for frost/freeze cold protection by 20 percent from the January 2010 withdrawal quantities by January 2020. 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. For the regulatory approach, water use permitting rules in Chapter 40D-2, F.A.C., and the Water Use Permit (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 of the Florida Water Resources Act of 1972 (Chapter 373, F.S.), directs the Florida Department of Environmental Protection (FDEP) or the water management districts (WMDs) to establish minimum flows or minimum water levels, i.e., MFLs, for priority water bodies using the best available information. The minimum flow for a given watercourse is defined by statute as the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. The minimum water level of an aquifer or surface waterbody is similarly defined by statute 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.

Minimum flows and levels (MFLs) are established and used by the District for water resource planning; as one of the criteria used for evaluating WUP applications; and for the design, construction, and use of surface water management systems. Water bodies with MFLs benefit from District funding of water resource and water supply development projects that are part of a recovery or prevention strategy identified for achieving an established MFL. The District's MFLs program addresses all MFLs-related requirements expressed in the Florida Water Resources Act and the Water Resource Implementation Rule (Chapter 62-40, F.A.C.).

Section 2. Priority Setting Process

In accordance with Sections 373.036(7) and 373.042(2), F.S., the District annually updates its priority list and schedule for the establishment of MFLs. As part of determining the priority list and schedule, which also identifies water bodies scheduled for development of reservations, 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 updated priority list and schedule is submitted to FDEP for approval by November 15th each year and, as required by statute, is published in the District's Consolidated Annual Report. The District's current priority list and schedule is also posted on the District website and is included in the Chapter 2 Appendix to this RWSP.

Section 3. Technical Approach to Minimum Flows and Levels Establishment

District methods used to establish MFLs for wetlands, lakes, rivers, springs, and aquifers are briefly summarized in the Chapter 2 Appendix to this RWSP. Additional details regarding MFLs methods are provided in District rules (Chapter 40D-8, F.A.C.) and within MFLs reports that are developed for individual priority water bodies and posted on the District website. Refinement and development of new MFLs methods and ongoing and new data collection efforts ensure that MFLs are established and reevaluated, as necessary, using the best available information.

The District's technical approach for MFLs development 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 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 includes water levels or flows that are lower or less than those of 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. MFLs established based on such a threshold hydrologic regime may therefore represent minimum acceptable, rather than historic or potentially optimal, hydrologic conditions.

1.0 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 establish MFLs. In addition, the District or FDEP may decide to voluntarily subject MFLs to independent scientific peer review, based on guidelines provided in Rule 62-40.473, F.A.C.

Currently, the District voluntarily seeks independent scientific peer review of methods used to develop MFLs for all water body types. Similarly, the District voluntarily seeks peer review of MFLs proposed for all flowing water bodies and aquifer systems, based on the unique characteristics of the data and analyses used for the supporting analyses.

Section 4. Established and Proposed Minimum Flows and Levels

Figure 2-3 depicts priority MFLs water resources as of October 22, 2019, that are in or 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 to this RWSP.

Water resources with established MFLs within or extending into the planning region include the:

- Alafia River (upper segment, which is partially located in the Tampa Bay Planning Region);
- Hillsborough River (upper segment, which is partially located in the Tampa Bay Planning Region);
- Myakka River (upper segment, which is partially located in the Southern Planning Region);
- Peace River (three upper segments and the middle segment, which is partially located in the Southern Planning Region);
- SWUCA Saltwater Intrusion MAL (which is located in the Southern Planning Region and the Tampa Bay Planning Region, but is affected by groundwater withdrawals in the Heartland Planning Region);
- Highlands County Lakes – Angelo, Anoka, Damon, Denton, Jackson, Little Jackson, June-In-Winter, Letta, Lotela, Placid, Tulane, and Verona; and
- Polk County Lakes – Annie, Aurora, Bonnie, Clinch, Crooked, Crystal, Dinner, Eagle, Easy, Eva, Hancock, Lee, Lowery, Mabel, McLeod, North Wales, Parker, Staff, Venus, and Wailes.

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

- Charlie Creek;
- Horse Creek (which is partially located in the Southern Planning Region);
- North Prong Alafia River (which is partially located in the Tampa Bay Planning Region);
- Peace River (three upper segments);
- South Prong Alafia River (which is partially located in the Tampa Bay Planning Region);
- Withlacoochee River (upper segment, which is partially located in the Tampa Bay Planning Region and the Northern Planning Region); and
- SWUCA Saltwater Intrusion MAL (which is located in the Southern Planning Region and the Tampa Bay Planning Region but is also affected by withdrawals in the Heartland Planning Region; reevaluation).

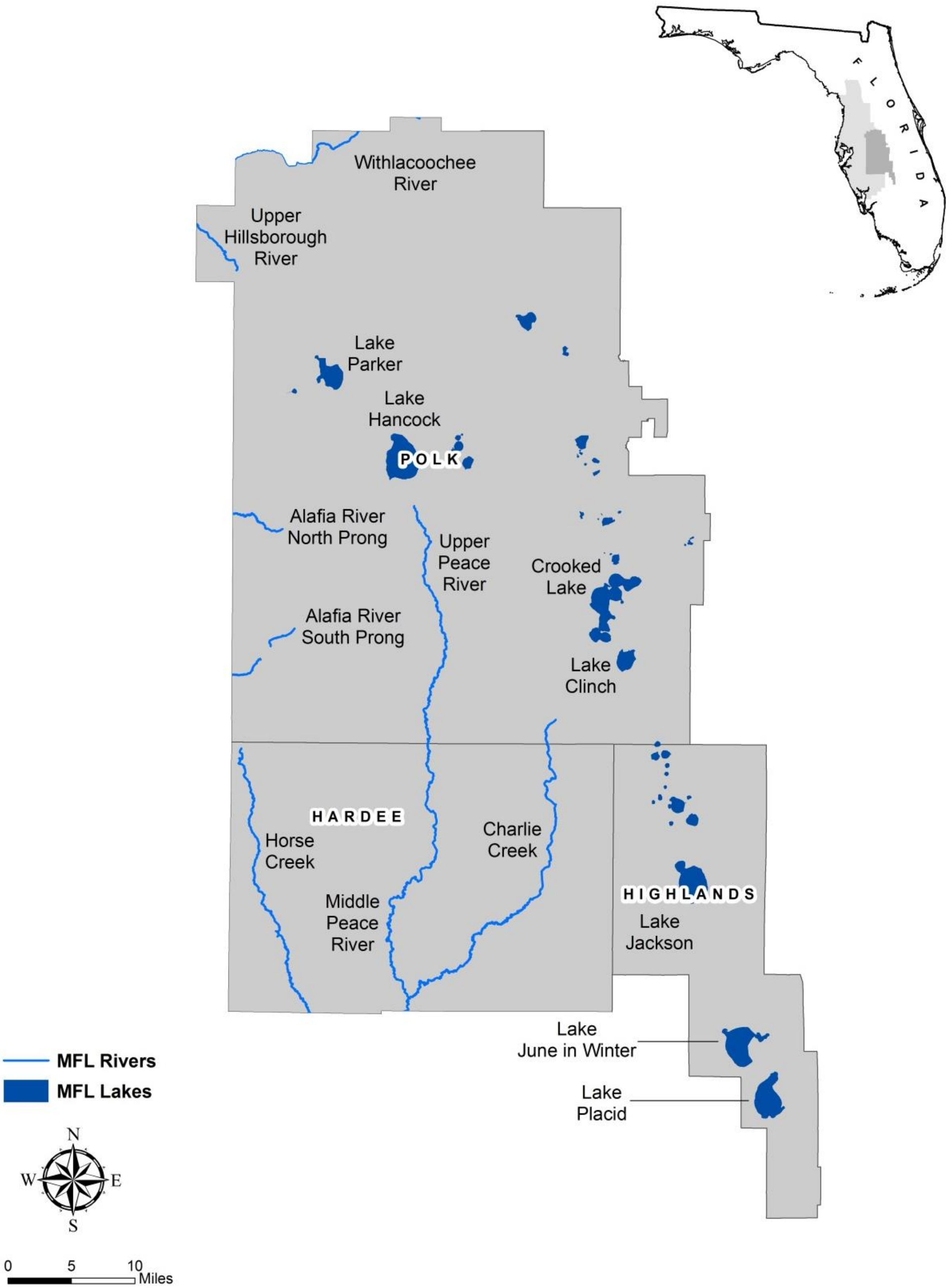


Figure 2-3. *MFL priority water resources in the Heartland Planning Region*

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 engaged in planning efforts that are coordinated with and complement those of the District. A goal of these efforts 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 DPCWUCA. 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 Southern Water Use Caution Area

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 achieve 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 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 implemented and considered.

The success of the SWUCA 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 assesses the cumulative impacts of factors affecting recovery. Information developed as part of these monitoring and assessment efforts is provided to the Governing Board on an annual and on a five-year basis. Results from two five-year assessments of the SWUCA recovery strategy (SWFWMD 2013, 2018), indicate the District continues to make progress toward recovery, but challenges to achieving full recovery by 2025 remain. Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing WRD projects designed to augment or preserve levels and flows.

2.0 Dover/Plant City Water Use Caution Area

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 DPCWUCA MAL (Figure 2-1), 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 DPCWUCA MAL is the 10- foot 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 goal of the recovery strategy is a 20 percent reduction in frost/freeze protection groundwater withdrawals in the DPCWUCA by January 2020, as compared to the estimated frost/freeze withdrawals used during the 2010 event. 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

Reservations of water are established by rule and authorized 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…” (Section 373.223(4), F. S.).

In accordance with Rule 62-40.474, F.A.C., as exemplified by Rule 40D-2.302, F.A.C. for the SWUCA, the District will consider establishing a reservation of water when a District WRD project will produce water needed to achieve an adopted MFL. The rule-making process associated with reservation adoption 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 established the Lake Hancock Reservation in 2020 to aid in the recovery of MFLs in the 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, which became operational in 2014, will provide an annual average flow of 2.7 out of the 5.0 mgd needed.

The District developed the reservation for water stored in Lake Hancock and released to Saddle Creek to support minimum flows achievement in the upper segments of the Peace River. Assessment of the benefits associated with implementation of the Lake Hancock Lake Level project is ongoing and will assist in refinement of operational guidelines for release from the lake. 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 continue to not be met with further project implementation, 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.

Rulemaking to support the recovery effort is scheduled for completion in 2020.

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 likely increased approximately 1.4 to 2.2°F from pre-industrial levels (IPCC, 2018). 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 resources and are developing vulnerability assessments, climate adaptation plans, and post-disaster redevelopment plans for member communities. The Florida Department of Environmental Protection's Community Resilience Initiative provides planning tools and promotes collaboration among RPCs and coastal communities. The WMDs and other agencies participate in focus groups organized by RPCs, Florid Sea Grant, and other entities 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 Florida Fish and Wildlife Conservation Commission, Department of Transportation, Department of Health, Department of Environmental Protection, and the Division of Emergency Management.

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 climate issues 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

Data from the National Oceanic and Atmospheric Administration (NOAA) tide gauge in St. Petersburg shows that monthly mean water levels have already increased 7.8 inches from the gauge's first reliable records in 1946 to 2019 (CSAP, 2019). The latest NOAA projections over this report's 20-year horizon (2020 through 2040) estimate that local sea levels will rise by 3.5 inches based a linear extrapolation, 4.3 inches by factoring the likely acceleration, and over 12 inches if accounting for potential polar ice sheet instabilities. With a 50-year horizon (2020 through 2070), a common lifecycle for infrastructure design, the NOAA projections range from 9 inches to over three feet (Sweet et al, 2017).

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. Aging municipal sewer systems can experience infiltration that reduces the quality of reclaimed water currently used to offset fresh water demands.

One positive aspect is that sea level rise is projected to occur relatively slowly, although persistently, which 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 compared to disaster recovery efforts.

2.0 Air Temperature Rise

The IPCC estimates that current green-house emission levels will cause mean global air temperatures to reach or stabilize at approximately 2.7°F above pre-industrial levels (1850-1900) by the end of this century, with greatest warming at inland and polar regions (IPCC, 2018). The impacts to southwest Florida will likely be more hot days and few cold days seasonally. 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 exacerbate algal blooms and declines in reservoir water quality that could raise treatment costs for potable water supply.

3.0 Precipitation Regimes and Storm Frequency

Increasing temperatures are expected to change global precipitation patterns, although changes will likely be more pronounced in the earth's tropical and temperate zones. Southwest Florida, being sub-tropical, has climatic precipitation patterns largely influenced by Atlantic multidecadal oscillations (AMO) of ocean sea surface temperatures, along with shorter-term El Nino southern oscillations (ENSO). The AMO warm periods tend to make the region's summer-fall seasons wetter, while strong ENSO phases, caused by warming in the eastern Pacific, make the region's winter and spring seasons wetter (Cameron, 2018). An AMO warm phase is currently in effect.

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. Hurricane activity near Southwest Florida is statistically more common during AMO warm periods. 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, ASR, AR, 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 dikes 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 AR 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

Section 1. Formation

The Central Florida Water Initiative (CFWI) focuses on the CFWI Planning Area, which includes Orange, Osceola, Seminole, Polk, and southern Lake counties (Figure 2-4). The CFWI was 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 SJRWMD, South Florida Water Management District (SFWMD), FDEP, Florida Department of Agriculture and Consumer Services (FDACS), regional public water supply utilities, and other stakeholders are collaborating on the initiative to develop a unified process to address current and long-term water supply needs in central Florida. The guiding principles of the CFWI are to:

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

Section 2. Central Florida Water Initiative Regional Water Supply Plan

The first ever multi-District RWSP was developed for the CFWI Planning Area in 2015. 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 WRD options that would meet future water supply needs in a manner that sustained water resources and related natural systems. For the 2015 CFWI RWSP, modeling results and groundwater availability assessments concluded that fresh groundwater resources alone could not 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 appeared to be more susceptible to the effects of groundwater withdrawals included 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 2015 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, FDEP, FDACS, public supply utilities, the agricultural industry, environmental groups, business representatives, and regional leaders used the 2015 CFWI RWSP to further develop specific water supply projects through partnerships with water users. The final work product of the Solutions Planning Team was the CFWI 2035 Water Resources Protection and Water Supply Strategies document, which addressed the necessary financing, cost estimates, potential sources, feasibility and permitting analyses, identification of governance structure options, and potential recovery needs of the CFWI Planning Area. The 2020 CFWI RWSP is currently under development, with ongoing coordination occurring to ensure consistency is maintained between the CFWI RWSP and the District's RWSP. Because Polk County is part of the CFWI Planning Area, the demands and many of the projects listed in this 2020 RWSP are also reflected in the 2020 CFWI RWSP.

Lake Lotela in Highlands County

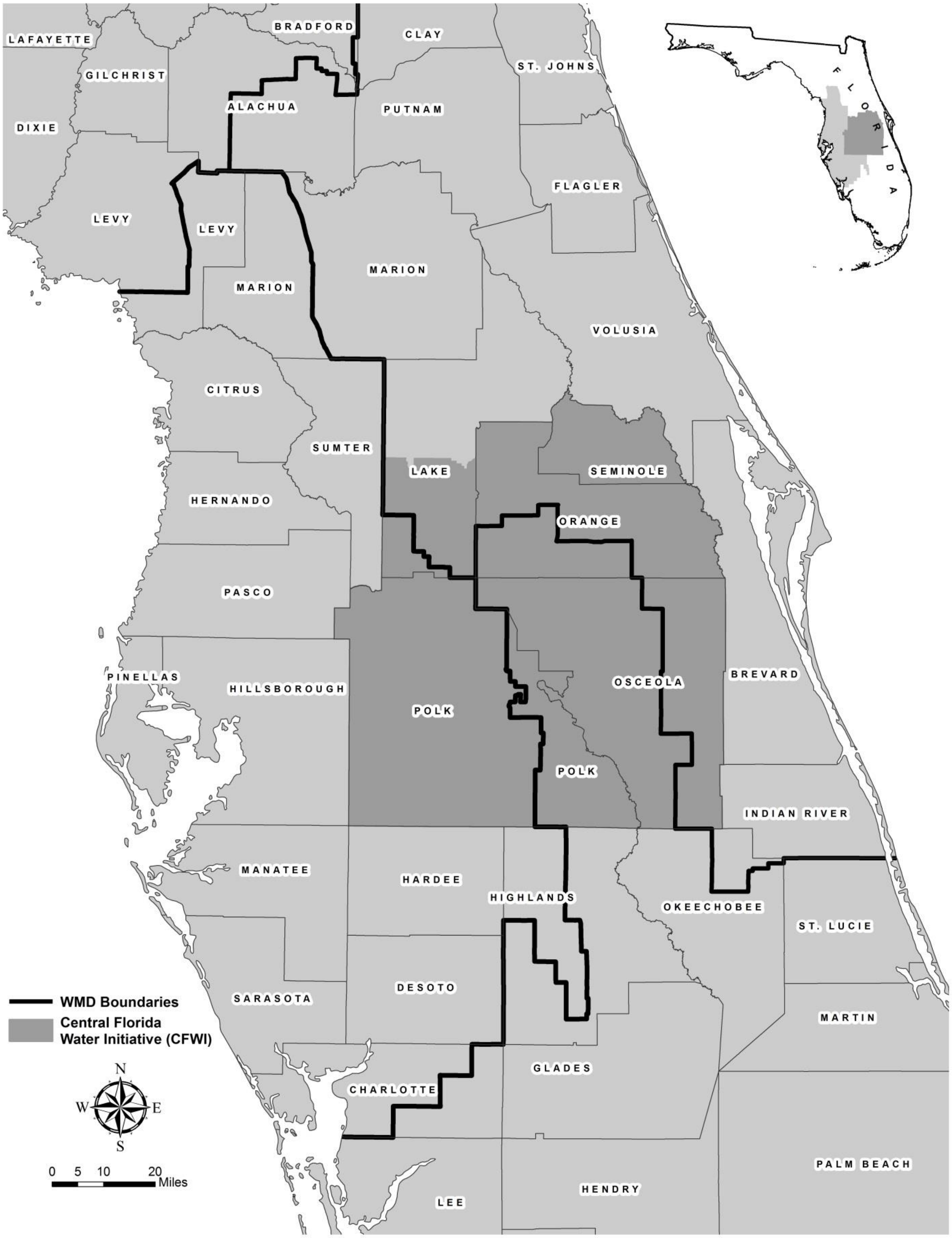


Figure 2-4. *Location of the Central Florida Water Initiative Area*

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Chapter 3. Demand Estimates and Projections

This chapter is a comprehensive analysis of the demand for water for all use categories in the Heartland Planning Region for the 2015-2040 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 (PS), agricultural (AG), industrial/commercial (I/C), mining/dewatering (M/D), power generation (PG), and landscape/recreation (L/R) sectors for each county in the planning region. 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 2040. The District determined 5-in-10 (average condition) and 1-in-10 (drought condition) demands for each five-year increment from 2015 to 2040 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 AG, I/C, M/D, and PG 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.

Key demand estimates and projection parameters include:

- Establishment of a base year: The year 2015 was agreed upon as a base year for the purpose of developing and reporting water demand projections. The data for the base year consist of reported and estimated usage for 2015; whereas, data for the years 2020 through 2040 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 I/C, M/D, and PG. 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 2040. 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) PS, (2) AG, (3) I/C, M/D, (4) PG, and (5) L/R. 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 sector PS 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 2015 would be the base year from which projections would be determined. The District calculated the 2015 population by extrapolating back from GIS Associates, Inc.'s 2016 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 University of Florida's 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 2015 Base Year Water Use and Per Capita Rate

3.1 Base Year Water Use

The 2015 PS base year water use for each large utility is derived by multiplying the average 2011–2015 unadjusted gross per capita rate by the 2015 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 2015 estimated population from the last issued permit. Domestic self-supply (DSS) base year is calculated by multiplying the 2015 DSS population for each county by the average 2011-2015 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 2020 to 2040. To develop the projections, the District used the 2011–2015 average per capita rate multiplied by the projected population for that increment. An additional component of public water supply demand is water derived from domestic wells for irrigation. These wells have a diameter of less than 6 inches, do not require a WUP and are used for irrigation at residences that receive potable water for indoor use from a utility.

4.2 Domestic Self-Supply

Domestic Self-Supply (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 presents the projected public supply water demand for the planning period. The table shows that public supply demand will increase by 33.17 mgd for the 5-in-10 condition and that 31.33 mgd, or 94 percent of the increase, will occur in Polk County.

Table 3-1. *Projected for PS, DSS, and private irrigation wells in the Heartland Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% 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	2.00	2.12	2.01	2.13	2.02	2.14	2.03	2.15	2.04	2.16	2.05	2.17	0.05	0.05	2.5%	2.4%
Highlands	12.45	13.20	12.99	13.77	13.42	14.22	13.77	14.59	14.03	14.88	14.24	15.09	1.79	1.89	14.4%	14.3%
Polk	67.48	71.53	77.06	81.68	83.58	88.60	88.98	94.32	94.14	99.79	98.81	104.74	31.33	33.21	46.4%	46.4%
Total	**81.93**	**86.85**	**92.06**	**97.58**	**99.02**	**104.96**	**104.78**	**111.06**	**110.21**	**116.83**	**115.10**	**122.00**	**33.17**	**35.15**	**40.5**	**40.5**

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-3 for source values. Additional Irrigation Demand was excluded from Polk County water demands for consistency with CFWI methodology.

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 (AG) represents the second largest sector of water use in the District after PS. 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 Regional Water Supply Plan (RWSP) for each of the following major categories of irrigated crops: (1) citrus, (2) field crops, (3) fruits (non-citrus), (4) greenhouse/nursery, (5) hay, (6) potatoes, (7) sod, and (8) fresh market vegetables. Most of these crop categories are self-explanatory, but some include several crops which are grouped together for reporting purposes by Florida Department of Agriculture and Consumer Services (FDACS). The fruits category includes several prominent crops in the District, such as strawberries, blueberries, and peaches, and the fresh market vegetables category includes tomato production along with cucumbers, peppers, and other vegetables. Water demands associated with non-irrigated AG such as aquaculture and livestock were also estimated and projected.

2.0 Water Demand Projection Methodology

Hardee County citrus

Demand projections for irrigated commodities were determined by multiplying projected irrigated acreage by the irrigation requirements of each commodity. Acreage projections were developed by the FDACS as part of the Florida Statewide Agricultural Irrigation Demand (FSAID5) projections through 2040. These projections were based on trends in historic National Agricultural Statistics Service irrigated acreage data. Irrigation requirements were adjusted from the FSAID5 demands and were based on permit-level metered water use data. Where possible, permit by permit water use rates were maintained, and in non-metered operations, average application rates were developed for each crop category by county. Per acre water use for each crop category was held constant, and changes in projected water demands are based on increases of decreases in irrigated acreages for each crop type. The methodologies are described, and data provided in more detail in Appendix 3-1.

Non-irrigation demand (e.g., aquaculture and livestock) was based on a combination of metered water use at the permit level and estimated demands from the FSAID5 geodatabase which were based primarily on livestock count data and water demands per head. The projected trends were based on the FSAID5 projections, and demands were held steady throughout the planning period, based on steady statewide livestock counts and lack of data upon which to make better projections. The methodologies are described, and data provided in more detail in Appendix 3-1.

In addition to the method developed by the District, which is based on the FSAID5 acreage projections and District metered water use rates, the FDACS has also developed a complete set of alternate water use projections through 2040. The District elected to use its modified FSAID5 approach to meet the statutory directive to use the best available data in developing AG water use projections. In this case, the District has extensive metered data on agricultural water use at the permit level, and the use of direct metered water use application rates will provide a more accurate assessment of local water use than a synthesized modeled water use rate. This allows the District projections to capture permit-level and regional variations in grower irrigation practices. This also means that the application rates in the projections will also be reflective of the progress made in agricultural conservation through the District's FARMS program and other regional efforts such as the SWUCA Recovery Strategy.

In addition to the methodology employed in the other regions of the District, the District also participated in the development of the CFWI Regional Water Supply Plan. In this joint planning effort, the FSAID4 water use projections were accepted by the CFWI stakeholders for use in that plan. Thus, the agricultural water use projections for Polk County are taken directly from the FSAID4 rather than using the typical method described above. The FSAID4 and FSAID5 acreages for Polk County are very similar, and only deviate by about 1,000 acres between the 2015 and 2016 baseline years and have very similar projected trends. Within this report, acreages reported for Polk County are based on the FSAID5 for consistency and to provide the most up to date data.

3.0 Water Demand Projections

Trends indicate that agricultural activities are expected to slowly decrease in the Heartland Planning Region during the planning period. Irrigated acreage is expected to decrease by about 12 percent, from 183,000 acreage in 2016 to 162,000 acres in 2040. This projection indicates a continuation of recent trends in acreage, which has experienced a steady decrease from peak levels in the early 2000s. Agriculture (AG) in the Heartland Planning Region is dominated by citrus production, and Polk and Highlands counties make up much of the core of the Central Ridge citrus production region. This area has been exhibited a reduction in active citrus production due to a variety of historical factors, including citrus canker, hurricanes, and most recently, citrus greening disease. Total agricultural water use in the Heartland Planning Region has fallen from well over 200 mgd annually in the late 1990s to about 150 mgd from 2014-2016.

Current average year demands are estimated at 155 mgd for 2015-2016 acreage levels. In 2040, the District projects that the projected decrease in acreage will result in a 7 percent decrease in water demands to about 144 mgd. Most of the decrease in acreage will be in citrus, and FDACS does not forecast a dramatic shift to alternative crops. Citrus represents the largest crop by acreage in each of these counties, and the long-term response of the industry to citrus greening disease will likely drive water use trends in the Heartland Planning Region. Additionally, northern

Polk County has been experiencing increased development pressure, particularly along the I-4 corridor, which may also impact long term citrus production in urbanizing areas. Table 3-2 displays projected combined agricultural irrigation and non-irrigation demands for the 5-in-10 (average) and 1-in-10 (drought) conditions for the planning period.

4.0 Stakeholder Review

District staff began presenting draft AG demand projections to the District's Agricultural and Green Industry Advisory Committee, permit evaluation staff, and FDACS staff in September 2018. The District additionally requested input from the Agricultural and Green Industry Advisory Committee on the FSAID5 water use projections and methodology as well as the adjusted FSAID 5 method developed by the District. The Committee wished to take time to consider the proposed methods and adjourned to solicit feedback from industry groups and other stakeholders. In October 2018, the Committee reconvened, and District staff provided an additional presentation on the potential AG projections methods and draft results. Stakeholders present included representatives from the Florida Turfgrass Association, Florida Citrus Mutual, the Florida Strawberry Growers Association, the Florida Nursery Growers and Landscape Association, and the University of Florida Institute of Food and Agricultural Sciences, among others. After discussion, the Agricultural and Green Industry Advisory Committee voted to support the District's updated Agricultural Water Demands Projections Methodology based on the FSAID5 projected acreages and adjustments to incorporated District metered water use data. The vote was passed unanimously. Additionally, the District consulted with staff from the FDACS Office of Agricultural Water Policy on the proposed method, and FDACS accented to the Districts' method based on FSAID5 acreage projections, and District metered water use data.

Table 3-2. *Projected total AG demand in the Heartland Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% 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	32.27	47.04	31.58	46.03	30.98	45.18	30.34	44.26	29.74	43.37	29.17	42.51	-3.10	-4.53	-9.6%	-9.6%
Highlands	41.64	61.96	39.95	59.44	38.01	56.57	35.92	53.45	35.46	52.76	33.01	49.1	-8.63	-12.86	-20.7%	-20.8%
Polk	81.83	119.94	80.83	118.48	80.36	117.79	80.67	118.24	81.36	119.25	81.61	119.62	-0.22	-0.32	-0.3%	-0.3%
Total	**155.74**	**228.94**	**152.36**	**223.95**	**149.35**	**219.54**	**146.93**	**215.95**	**146.56**	**215.38**	**143.79**	**211.23**	**-11.95**	**-17.71**	**-7.7%**	**-7.7%**

Notes: Polk County projections are derived from the 2020 CFWI RWSP, which is based on FSAID4 projections by FDACS. Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-1 for source values.

Section 3. Industrial/Commercial and Mining/Dewatering

1.0 Description of the Industrial/Commercial and Mining/Dewatering 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 AG commodities. Chemical manufacturing is associated with phosphate mining and consists mainly of phosphate processing. The 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 2020 RWSP were developed by multiplying the 2015 amount of water used for each I/C and M/D facility by a one-year growth rate based on Woods and Poole Economics' gross regional product (GRP) forecasts by county. For example, Cemex Construction Material, LLC (WUP# 7871) in Charlotte County reported using 0.006 mgd in 2015. This is a permit for a cement or concrete batch plant. Using the Charlotte County GRP-based growth factors, this permit's demand is projected to grow 2.88 percent from 2015 to 2020, and 3.00 percent from 2020 to 2025. Projected use for 2020 and 2025 were calculated as follows:

2020 projected use = 6,000 times 1.0288 = 6,173 gallons per day (0.00617 mgd)

2025 projected use = 6,420 times 1.03 = 6,613 gallons per day (0.00661 mgd)

Water use for 2015 is derived from the District's 2017 Water Use Well Package Database (WUWPD) (SWFWMD, 2017). This database includes metered use for individual/general permits and estimated use for small general permits. These quantities are for consumptive use of groundwater and fresh surface water.

This methodology was used for all institutional, I/C, and M/D permits with one exception. As with the 2015 RWSP, The District consulted with the Mosaic Company to develop projections of I/C and M/D water demands associated with each of its processing facilities and mining operations. The objective was to better reflect the movement of pumpage across counties as their mines and demands shifted locations during the RWSP 20-year period of analysis. 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 13.29 mgd, or 28.1 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 2015, 47.3 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 2019 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 2019).

Table 3-3. *Projected I/C and M/D demand in the Heartland Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Hardee	3.98	2.42	2.43	11.50	11.07	8.06	4.08	102.5%
Highlands	0.11	0.10	0.10	0.11	0.11	0.11	0.00	0.0%
Polk [2]	43.20	50.10	50.46	54.45	52.20	52.41	9.21	21.3%
Total	**47.29**	**52.62**	**52.99**	**66.06**	**63.38**	**60.58**	**13.29**	**28.1%**

Demand projections for the District's portion of Polk County are from Volume 2 of the 2020 CFWI RWSP . 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

1.0 Description of the Power Generation 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.

2.0 Demand Projection Methodology

Demand projections for the 2020 RWSP were developed using a combination of historic water use and the 2018 10-year site plans for each PG facility. These plans include historic number of customers and megawatt production. Using data for 2011-2015, a 5-year average water use per megawatt was calculated. This value is then applied to a projection of future megawatts by power generation facility. The 2018 10-year site plans for each power generation facility include projections of future customers and megawatts produced through 2027. The 20-year (2008-2027) average customer growth rate was used to extend the projections of customers through 2040. A calculation of megawatt use per customer is then applied to the projection of customers to arrive at a projection of megawatts by power generation facility. Future groundwater demand for 2020-2040 is calculated by applying the (2011-2015) average water use per megawatt to the projected megawatts specific to each power generation facility.

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 2.59 mgd, or 34.0 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 PG demand in the Heartland Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Hardee[1]	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]	7.62	9.94	10.00	10.07	10.13	10.21	2.59	34.0%
Total	**7.62**	**9.94**	**10.0**	**10.07**	**10.13**	**10.21**	**2.59**	**34.0%**

[1] Water demand projections for Seminole Electric Cooperative, Inc., facilities in Hardee County were developed and included as part of the totals reflected for the Industrial/Commercial water use category and are based on Industrial/Commercial methodology; using Power Generation methodology, projected demands for the Cooperative's facilities would range from 1.08 mgd in 2020 to 1.17 mgd in 2040.

[2] Demand projections for the District's portion of Polk County are from the 2020 CFWI RWSP 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 5. Landscape/Recreation

1.0 Description of the Landscape/Recreation 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. 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 2015 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 1.77 mgd for the 5-in-10 condition, an increase of 18.3 percent from the baseline 2015 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 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 counties 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 higher 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 County, 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 District's Agricultural and Green Industry Advisory Committee generally confirmed stable or decreasing water demands for golf as part of the L/R projections. Projections indicate a smaller percentage increase in demand from 2015 to 2040 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	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% 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	0.29	0.38	0.29	0.38	0.29	0.38	0.29	0.38	0.29	0.38	0.29	0.38	0.00	0.00	0.00%	0.0.00%
Highlands	2.17	2.80	2.18	2.82	2.20	2.84	2.21	2.86	2.22	2.87	2.22	2.88	0.05	0.08	2.30 %	2.86%
Polk	7.21	9.25	7.63	9.78	8.02	10.27	8.34	10.67	8.65	11.06	8.93	11.42	1.72	2.17	23.85%	23.46%
Total	**9.67**	**12.43**	**10.10**	**12.98**	**10.51**	**13.49**	**10.84**	**13.90**	**11.16**	**14.31**	**11.44**	**14.67**	**1.77**	**2.24**	**18.30%**	**18.02%**

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 6. Summary of Projected Change in Demand

Table 3-6 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. 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 3-6 shows that 38.87 mgd of additional water supply will need to be developed and/or existing use retired to meet demand in the planning region through 2040. Public supply water use will increase by 33.17 mgd over the planning period. Table 3-6 also shows an increase of 13.29 mgd in I/C and M/D water use, 2.59 mgd in PG water use, and 1.77 mgd in L/R water use. Agricultural water use is projected to decrease by 11.95 mgd over the planning period.

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

The agricultural sector includes cattle ranches and other farming operations

Table 3-6. *Summary of the Projected Demand in the Heartland Planning Region (5-in-10 and 1-in-10 (mgd)*

Water Use Category	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% 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
PS	81.93	86.85	92.06	97.58	99.02	104.96	104.78	111.07	110.21	116.82	115.10	122.01	33.17	35.16	40.5%	40.5%
AG	155.74	228.94	152.36	223.95	149.35	219.54	146.93	215.95	146.56	215.38	143.79	211.23	-11.95	-17.71	-7.7%	-7.7%
I/C & M/D	47.29	47.30	52.60	52.60	53.00	53.00	66.10	66.10	63.40	63.40	60.60	60.60	13.29	13.30	28.1%	28.1%
PG	7.62	7.62	9.94	9.94	10.00	10.00	10.07	10.07	10.13	10.13	10.21	10.21	2.59	2.59	34.0%	34.0%
L/R	9.67	12.43	10.10	12.98	10.51	13.49	10.84	13.90	11.16	14.31	11.44	14.67	1.77	2.24	18.3%	18.0%
Total	**302.25**	**383.14**	**317.06**	**397.05**	**321.88**	**400.99**	**338.72**	**417.09**	**341.46**	**420.04**	**341.14**	**418.72**	**38.87**	**35.58**	**12.9%**	**9.3%**

Notes: 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.

Table 3-7. *Summary of the Projected Demand for Counties in the Heartland Planning Region (5-in-10) (mgd)*

Water Use Category	Planning Period						Change 2015-2040	
	2015	2020	2025	2030	2035	2040	mgd	%
Hardee								
PS	2.00	2.01	2.02	2.03	2.04	2.05	0.05	2.5%
AG	32.27	31.58	30.98	30.34	29.74	29.17	-3.10	-9.6%
I/C & M/D	3.98	2.42	2.43	11.50	11.07	8.06	4.08	102.5%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	0.29	0.29	0.29	0.29	0.29	0.29	0.00	0.0%
Cumulative Total	38.54	36.30	35.72	44.16	43.14	39.57	1.03	2.7%
Highlands								
PS	12.45	12.99	13.42	13.77	14.03	14.24	1.79	14.4%
AG	41.64	39.95	38.01	35.92	35.46	33.01	-8.63	-20.7%
I/C & M/D	0.11	0.10	0.10	0.11	0.11	0.11	0.00	0.0%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	2.17	2.18	2.20	2.21	2.22	2.22	0.05	2.3%
Cumulative Total	**56.37**	**55.22**	**53.73**	**52.01**	**51.82**	**49.58**	**-6.79**	**-12.0%**
Polk								
PS	67.48	77.06	83.58	88.98	94.14	98.81	31.33	46.4%
Ag	81.83	80.83	80.36	80.67	81.36	81.61	-0.22	-0.3%
I/C & M/D	43.20	50.10	50.46	54.45	52.20	52.41	9.21	21.3%
PG	7.62	9.94	10.00	10.07	10.13	10.21	2.59	34.0%
L/R	7.21	7.63	8.02	8.34	8.65	8.93	1.72	23.9%
Cumulative Total	**207.34**	**225.56**	**232.42**	**242.51**	**246.48**	**251.97**	**44.63**	**21.5%**
Region Total	**302.25**	**317.08**	**321.87**	**338.68**	**341.44**	**341.12**	**38.87**	**12.9%**

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. Additional water quantities may be required over the planning period to address environmental restoration needs for water bodies discussed in Chapter 2.

Section 7. Comparison of Demands between the Regional Water Supply Plan 2015 and the 2020 Regional Water Supply Plan

There are significant differences between the 2015 and 2020 RWSP Heartland demand projections in the AG, PS, I/C, M/D, and PG water use categories. The 2015 base numbers are reduced in all sectors from the 2015 projected numbers used in the 2015 RWSP due to methodology changes, over-projections, and slower than anticipated population growth. Regarding the AG projections, the 2015 RWSP projected an increase of 4.43 mgd for the 2010–2035 planning period, while the 2020 RWSP projects a decrease of 11.95 mgd for the 2015-2040 planning period. Regarding the PS category, the 2015 RWSP projected an increase of 38.72 mgd for the 2010–2035 planning period, while the 2020 RWSP projects an increase of only 30.98 mgd from 2015–2040. For I/C, M/D, and PG categories the 2015 RWSP projected a net 6.18 mgd increase, while the 2020 RWSP projects a combined increase of 15.87 mgd. The 2015 RWSP projected a 9.18 mgd increase for the L/R water use category; however, a 1.78 mgd increase is projected for the 2020 RWSP.

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Chapter 4. Evaluation of Water Sources

This chapter presents the results of investigations by the Southwest Florida Water Management District (SWFWMD or District) to quantify the amount of water that is potentially available from all sources of water within the planning region to meet demands through 2040. 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 2040.

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 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 2017, approximately 95 percent (279 mgd) of the 292 mgd of water (including domestic self-supply) used in the planning region was from groundwater sources. Approximately 30 percent (82 mgd) of the fresh groundwater used was for public supply (PS) (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 UFAs 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 2014 was 13.5 mgd, with 93 percent (12.5 mgd) occurring in Highlands County and 7 percent (1.0 mgd) in Polk 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 4 mgd in Hardee, Highlands, and Polk counties in 2014.

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 2014 was 3.8 mgd, with 53 percent (2.0 mgd) occurring in Hardee County, 37 percent (1.4 mgd) occurring in Polk County, and 10 percent (0.4 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 1.6 mgd in Hardee, Highlands, and Polk counties in 2014. 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 1.6 mgd, with 0.8 mgd allocated to recreational use and 0.8 mgd to DSS indoor use/outdoor irrigation (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	0.0	0.0	0.0
Highlands	0.4	0.1	0.5
Polk	0.4[1]	0.7[1]	1.1
Total	**0.8**	**0.8**	**1.6**

[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 (AWSs) 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, 2018), 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 3-3, indicates a net demand increase of 13.29 mgd for industrial/commercial (I/C) and mining/dewatering (M/D). Chapter 3, Table 3-4, indicates a net demand increase of 2.59 mgd for, power generation (PG). There is a net decrease in demand of 11.95 mgd for agricultural (AG) irrigation by 2040, 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 AG 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 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 PS 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 PS water use permits in the planning region, approximately 53.7 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 AWSs.

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 milligrams per liter (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 significantly 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 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 AWS 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, which encourages water users to seek assistance by working with District staff when implementing water-saving and educational water conservation programs.

Water savings have been achieved in the Heartland Planning Region through a combination of regulatory and economic measures, as well as incentive-based outreach and technical assistance for the development and promotion of the most recent technologies and conservation activities. 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 by providing 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 (HET), low-flow faucet aerators, high-efficiency showerheads, smart irrigation controllers, rain sensors, and soil moisture sensors. Recognition programs, such as the District's Water Conservation Hotel and Motel Program (CHAMP℠) and Florida Water Star℠ (FWS), are also incentive programs that recognize homeowners and businesses for their environmental stewardship.

The District's Utilities Services Group provides guidance and technical expertise to PS water utilities and helps identify and reduce water loss. The non-regulatory assistance and educational components of the program maximize water conservation throughout the PS water use sector and improve both local utility system efficiency and regional water resource benefits. Among the services provided upon request are leak detection surveys, meter accuracy testing, and water audit guidance and evaluation. Since the program's inception, the leak detection team has conducted 155 leak detection surveys throughout the District, locating 1,554 leaks of various sizes and totaling an estimated 5.86 mgd. In the Heartland Planning Region, the leak detection team has conducted 48 leak detection surveys, locating 488 leaks totaling an estimated 1.80 mgd.

Repaired water main. The District performs leak detection surveys to reduce water loss.

For the past ten 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 conservation education programs accompanied with other effective conservation measures can be an effective supplement to a long-term water conservation strategy. On a Districtwide scale, water conservation efforts have contributed to declining unadjusted gross per capita use rates, from 115 gallons per day (gpd) per person in 2005 to 97 gpd per person in 2015. The per capita use rate for the District is the lowest of all five WMDs. The per capita trend for the Heartland Planning Region is also decreasing as shown in Figure 4-1.

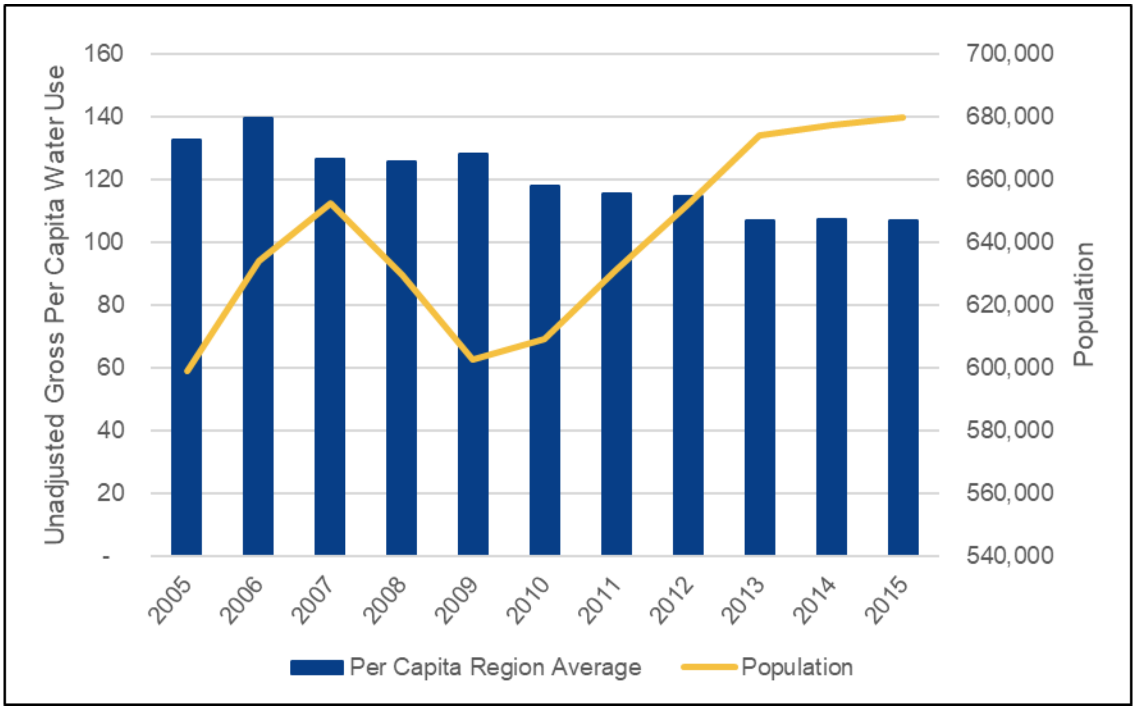

Figure 4-1. *Per capita water use rates in the Heartland Region, 2005-2015*

1.1 Public Supply

The PS sector includes all water users that receive water from public water systems and private water utilities. The PS sector may include non-residential customers such as hospitals and restaurants that are connected to a utility potable distribution system. Water conservation in the PS sector will continue to be the primary source of water savings in the District. Public supply (PS) systems lend themselves most easily to the administration of conservation programs since they measure each water customer's water use and can focus, evaluate, and adjust the program to maximize savings potential. The success of the District's water conservation programs for PS systems to date is demonstrated by the 15.8 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 PS category could be 8.69 mgd by 2040, if all water conservation programs presented below are implemented (Table 4-2).

1.1.1 Water Conservation Potential in the Heartland Planning Region

The draft 2020 Central Florida Water Initiative (CFWI) RWSP and the Water Conservation Tracking Tool (AWE Tool) (Alliance for Water Efficiency, 2019) were used to estimate water conservation potential in the Heartland Planning Region. The AWE Tool is built to assist utilities in determining the costs and benefits of passive and active conservation and was also used within the 2020 CFWI RWSP. It was chosen for use in measuring conservation due to its customizability and user friendliness given that it is based in Microsoft Excel.

1.1.2 Assessment Methodology

The 2020 CFWI RWSP calculated passive savings using the AWE tool, which was customized based on the region's stakeholder's feedback. The tool calculated savings on a county-by-county level, so Polk County figures were readily available. Refer to the 2020 CFWI RWSP Appendix B for information on the assumptions/customizations and more detailed methodology. Active conservation potential was also estimated from the CFWI RWSP, which was based on the Conservation Implementation Strategy that the CFWI Conservation Team developed in parallel with the RWSP chapters. The Conservation Implementation Strategy identified a range of water savings that were estimated to have occurred from 2010-2019. The average savings achieved each year was extrapolated into the future to span the 2040 planning horizon. This included slight increases proportional to population growth and resulted in projected water savings of 27 mgd for the CFWI region. Additional details on this effort can be found in the 2020 CFWI RWSP. The plan defined "High estimate" was chosen for use in this RWSP due to the heightened need for and attention to water conservation existing in Polk County. The regional figure was portioned out to Polk County by using the percentage of Polk County's demands compared to the region's demands. Specifically, 94.66 mgd demand within the SWFWMD potion of Polk County divided by 592.28 mgd CFWI 2040 demand = 16 percent. The percentage was then applied to the active conservation projection (16 percent X 27 mgd) to yield a conservation projection specific to Polk County of 4.32 mgd.

Polk County savings were refined further, to the conservation activity level, by again using information in the Conservation Implementation Strategy. Within that document, Table 9 contains the percentage of total savings that each of the cataloged conservation activities contributed toward the regional total. It is assumed that these savings will continue to be implemented at those proportions into the future. For example, percent of total savings 2010-2019 for high-efficiency showerheads is 21 percent, and so 21 percent X 4.32 mgd = 0.91 mgd of savings specific to high-efficiency showerheads in Polk County by 2040. It is acknowledged that active conservation programs could change in the future, however this is the best available information. CFWI documents did not have cost information, thus several of the activities for Polk County do not have cost information.

After extracting the water conservation savings specific to Polk County from the draft 2020 CFWI RWSP, they were combined with the savings for the 7 utilities that comprise approximately 92 percent of the total water use within Highlands and Hardee counties, the other two counties within the Heartland Planning Region. These 7 additional utilities included within this analysis are City of Sebring, City of Avon Park, Town of Lake Placid, City of Wauchula, Sun N Lake of Sebring, City of Bowling Green, and Lake Placid Holding Company.

<u>Passive Conservation</u>

Passive water conservation savings refer to water savings that result from users implementing water conservation measures in the absence of utility incentive programs. These are typically the result of building codes, manufacturing standards, and ordinances that require the installation of high-efficiency plumbing fixtures and appliances in new construction and renovations. Passive water conservation has been observed as a major contributor to decreasing per capita water use across the country. Projections were developed by combining the Polk County portion of passive savings from the 2020 CFWI RWSP with the passive savings estimated for the additional 7 utilities by the AWE Tool using information from property appraiser databases, Public Supply Annual Reports, and census data. The AWE Tool calculates passive water conservation savings for toilets, showerheads, clothes washers, and dishwashers. There are two components in the AWE Tool's passive water conservation savings calculation:

- Natural Replacement Savings: This accounts for water savings that occur as a result of the natural fixture and appliance replacements during the planning horizon. This occurs as older devices reach the end of their service lives or are otherwise replaced by newer, more efficient models. Passive replacement rates assumed by the AWE Tool can be found below in Table 4-2.
- Water Savings Adjustment Factor: Newer homes built over the planning horizon are more efficient in their indoor water use than existing older homes. When newer homes are combined with existing homes, the ratio of high-efficiency to low-efficiency fixtures and appliances will increase as compared to the ratio in the 2015 baseline from which demands were based.

Active Conservation

Active water conservation encompasses a variety of measures, practices, and programs sponsored or encouraged by utilities and municipal governments which result in water use reductions. By their nature, active water conservation programs are typically funded and administered by PS utilities or other regional entities. Active savings projections were developed by combining the Polk County-specific portion of active savings from the 2020 CFWI RWSP with the active savings estimated for the additional 7 utilities by the AWE Tool and other data from Public Supply Annual Reports, previously co-funded local conservation projects, "Determination of Landscape Irrigation Water Use in Southwest Florida" by Michael D. Dukes and Mackenzie J. Boyer (2018), and the *Handbook of Water Use and Conservation* by Amy Vickers (2010). The conservation potential and costs were estimated for the following conservation activities that utilities could implement:

- Residential High-efficiency Toilets
- Industrial/Commercial High-efficiency Toilets
- Residential Low-flow Showerheads
- Irrigation/Landscape Evaluations
- Rain Sensors
- Soil Moisture Sensors
- Residential Irrigation Controllers
- Irrigation Enforcement
- High-efficiency Faucets
- Advanced Metering Analytics
- Florida Water Star
- Other

The last 5 of these conservation activities were only evaluated for Polk County as a part of the 2020 CFWI RWSP and not the additional 7 utilities within Highlands and Hardee counties. For indoor activities, the AWE Tool estimates the number of older, inefficient fixtures available for replacement in a given year after factoring in passive replacement. A participation rate is applied to this number, and the result is divided over the number of years in the planning horizon to calculate the estimated annual number of replacements. Subsequently, the annual savings and costs are determined. A similar approach is taken for outdoor conservation activities. Rather than basing the annual number of replacements on the number of inefficient fixtures, it is based on a subset of the number of dwelling units within a given service area. This subset is the number of high users that are likely over-irrigating. The participation rate is then applied to the number of high users and divided by the number of years in the planning horizon to obtain the number of implementations for each outdoor activity. For additional input parameters used in the estimation of active savings for those utilities within Highlands and Hardee counties, see Table 4-2.

Table 4-2. *Input parameters used in AWE Tool conservation estimation for Highlands and Hardee counties*

Conservation Activities	Participation Rate[1]	Passive replacement rates
• Residential HET • Residential Irrigation Controllers • Industrial-Commercial-Institutional HET • Residential Low-Flow Showerheads • Irrigation/Landscape Evaluations • Rain Sensors • Soil Moisture Sensors	• 30% participation for all activities • For outdoor activities, participation rate taken is applied to a subset of users called “high users” [1] • High users considered to be 4% of residential customers, except for rain sensor activity[2]	• 4% per year for toilets (25-year life) • 12% per year for showerheads (8-year life) • 7.1% per year for clothes washers (14-year life) • 6.7% per year for dishwashers (15-year life)

[1] Participation rates for outdoor conservation activities were based in part on “Determination of Landscape Irrigation Water Use in Southwest Florida” by Michael D. Dukes and Mackenzie J. Boyer (2018).
[2] Percentage of high users was kept higher at 15 percent for rain sensors to reflect the fact that rain sensors are a low-cost outdoor conservation activity that can be more readily implemented.

1.1.3 Results

It is estimated that approximately 8.70 mgd of combined active and passive PS savings could be achieved in the planning region by 2040 (Table 4-3). This equates to an 8.4 percent reduction in projected 2040 public supply sector demand. This includes industrial and commercial entities that are connected to public supply utilities.

Savings are nearly evenly split between passive (4.16 mgd) and active (4.54 mgd) conservation, resulting in a 4.0 and 4.4 percent reduction in 2040 demand, respectively. The overall cost effectiveness for the active conservation programs analyzed in this RWSP is $0.90 per 1,000 gallons. This figure excludes the Polk-specific conservation activities (irrigation enforcement, high-efficiency faucets, advanced metering analytics, Florida Water Star, and other) for which no unit savings and unit cost information was available. The most impactful conservation activity identified was irrigation restriction enforcement. The total estimated cost for all 11 programs is approximately $8.1 million over the planning horizon. Figure 4-2 below depicts the change in demand over the planning horizon for the Heartland Planning Region due to passive and active conservation.

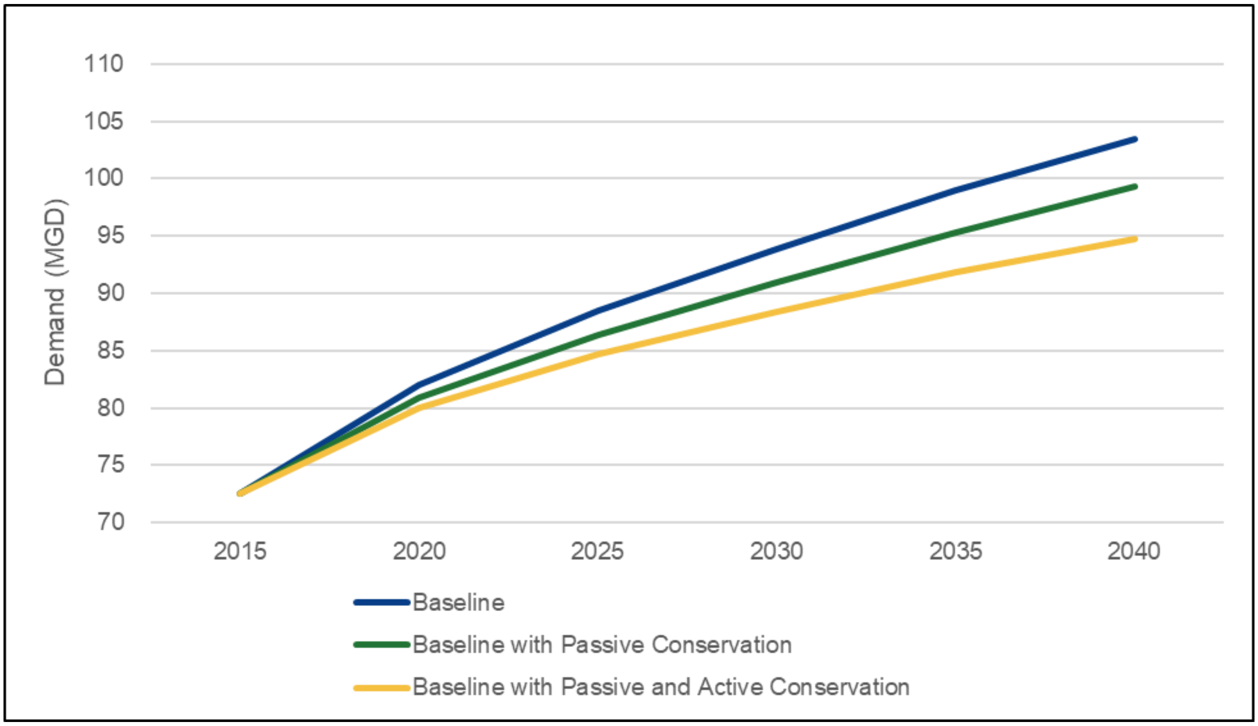

Figure 4-2. *Potential effects of conservation on projected PS demand*

1.1.4 Additional Considerations

Participation rates were kept low in the savings calculations for Hardee and Highlands County because it was unknown how many (if any) activities are truly occurring there. This results in a conservative estimate for those counties. Meanwhile, the high active conservation projections from the 2020 CFWI RWSP were used to derive the Polk County estimates since Polk County is a priority area for conservation with high future growth, limited existing supplies, and many ongoing conservation activities.

The active conservation analysis builds on the passive estimate as it considers only the inefficient stock not already replaced passively. However, it is not comprehensive as there are many other activities that could result in substantial water savings. Even for those activities that were modeled, higher participation rates could be achieved than those estimated here. It should be noted that for those items that have a short life expectancy (e.g., rain sensors), repetitive implementations and reoccurring costs are required just to maintain savings.

1.2 Domestic Self-Supply

The Domestic Self-Supply (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 commonly not metered and, therefore, changes in water use patterns are less measurable than those in the public supply sector. Only passive conservation was estimated for DSS systems in this RWSP. Within the region, it is estimated that passive savings for the DSS sector could be 0.25 mgd by 2040 (Table 4-3).

1.2.1 Domestic Self-Supply Assessment Methodology

To calculate DSS passive savings, it was assumed that the DSS sector will experience the same percent savings as the public supply sector over the planning horizon. The percent of PS passive savings was therefore applied to the SWFWMD total DSS 2040 demand projection for the Heartland Planning Region to obtain the passive savings specific to the DSS sector. In other words, the DSS 2040 demand (6.16 mgd) was multiplied by the PS passive savings rate (4.02 percent) to yield the DSS passive savings estimate (0.25 mgd).

1.3 Industrial/Commercial

The Industrial/Commercial (I/C) water use sector includes factories and other industrial enterprises that obtain water directly from surface water and/or groundwater sources through a WUP. Businesses try to minimize water use to reduce 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 HET. 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 0.93 mgd by 2040 (Table 4-3).

1.3.1 Industrial/Commercial Assessment Methodology

The I/C savings estimate utilized the same methodology outlined in the 2020 CFWI RWSP. This methodology was based on a study by Dziegielewski et al. (2000) that examined the impact of water audits on improving water efficiency within this sector. The lower-bound savings determined in this study was 15 percent, and this number was used in lieu of the higher estimate to be more conservative. The 15 percent participation rate used in the 2020 CFWI RWSP was also assumed. Therefore, the self-supplied I/C 2040 demand (41.27 mgd) multiplied by both the savings and participation rates (15 percent for both) yields the estimated water savings over the planning horizon for the self-supplied I/C sector within the Heartland Planning Region (0.93 mgd).

1.4 Landscape/Recreation

The Landscape/Recreation (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 0.66 mgd by 2040 (Table 4-3).

1.4.1 Landscape/Recreation Assessment Methodology

As with the self-supplied I/C sector, the estimate of the water conservation potential of the L/R sector was derived using the methodology in the 2020 CFWI RWSP. Conservation in this sector primarily comes from updating inefficient sprinkler heads and the installation of smart irrigation controllers, such as soil moisture sensors or weather-based controllers. Based on two studies by the University of Florida, it was determined that the lower-bounds savings from retrofits and smart irrigation controllers are 10 percent and 20 percent, respectively. These values were used along with the 15 percent savings rate also assumed in the 2020 CFWI RWSP to estimate self-supplied L/R water conservation. In other words, the 2040 L/R demand (14.67 mgd) was multiplied by the participation rate (15 percent), and this product was multiplied by each of the savings rates (10 percent and 20 percent). The sum of these final two numbers (0.22 mgd and 0.44 mgd) equates to the total L/R savings over the planning horizon (0.66 mgd). The 1-in-10 2040 demand projections were used instead of the 5-in-10 projections in an effort to be more conservative in our calculations.

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

Table 4-3 summarizes the potential non-agricultural water conservation savings in the Heartland Planning Region. This table shows that, through the implementation of all conservation measures listed above for the public supply, DSS, I/C, and L/R water use sectors, it is anticipated that approximately 10.54 mgd could be saved by 2040 at a total projected cost of $8.1 million. This is a 6.37 percent reduction in total demand.

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

Sector	2040 Demand (mgd)	Savings (mgd)	Reduction in Demand (%)	Average Cost-Effectiveness ($/kgal)
Public Supply (PS Total)	103.49	8.70	8.41%	-
PS Passive	-	*4.16*	*4.02%*	-
PS Active	-	*4.54*	*4.38%*	*$0.90*[1]
DSS	6.16	0.25	4.06%	-
I/C	41.27	0.93	2.25%	-
L/R	14.67	0.66	4.50%	-
Total	**165.59**	**10.54**	**6.37%**	**-**

[1]Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost. It only takes into account the active conservation activities that were evaluated for Highlands and Hardee counties and excludes those evaluated only for Polk County (irrigation enforcement, high-efficiency faucets, advanced metering analytics, Florida Water Star, and other).

2.0 Agricultural Water Conservation

The Florida Department of Agriculture and Consumer Services (FDACS) develops conservation projections as part of the Florida Statewide Agricultural Irrigation Demand (FSAID5) projections. Those conservation projections were based on historical trends (1973-2013) in irrigation of water applied per acre per year. The historical trend of the ratio was used to predict future irrigation conservation through 2040. The trend accounts primarily for gains in irrigation system distribution uniformity. This methods limitation is that it does not completely account for existing regulatory constraints (SWUCA rules) that have resulted in increased water use efficiency thus limiting future water conservation savings potential. However, future savings could still come from developing new technology, sensor-based automation, and scheduling changes.

Agricultural irrigation project

This RWSP uses the trend as a percent reduction (approximately 13 percent) in 2040 demand. The county-by-county savings percentages derived from FSAID5 data were applied to the 2040 agricultural demands shown in Table 3-2 which are District-specific demand projections and lower than FSAID5 demands.

An effort was made to be consistent with CFWI estimates relative to Polk County. Polk County figures were calculated by determining the pace at which agricultural water conservation (gains in efficiency) have occurred in the past (2010-2017) to develop a historical trend. This only considers conservation projects funded by the Districts FARMS program and not AWS projects nor those happening without District funding. It is then assumed that the yearly rate, approximately 0.022 mgd per year of savings, continues through 2040 in a straight line. This method yields a result much lower than the afore described FSAID method. Of the 4.19 mgd in conservation that the 2020 CFWI RWSP estimates for the agriculture sector, approximately 0.49 mgd is attributable to Polk County. Results are shown below in Table 4-4.

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

County	Projected 2040 demand (mgd)	Savings as a percentage (derived from FSAID5)	Agricultural Conservation Potential by 2040 (mgd)
Hardee	28.77	12.65%	3.64
Highlands	32.95	11.92%	3.93
Polk[1]	80.61	0.61%	0.49[1]
Total	**142.33**		**8.06**

[1]Polk uses method consistent with CFWI

Polk County could have more conservation potential than the figures shown here with the consideration of the District's Mini-FARMS program. The program focuses on smaller agricultural operations (less than 100 acres) which are prevalent in the county. The small grants (up to $8,000) improve water use efficiency by helping pay for things like pump automation, weather stations, and soil moisture probes. Quantification of this program is ongoing.

These estimates should be considered potential conservation and should not be treated as "water supply" or directly removed from agricultural water demand estimates. Substantial investments will be necessary to realize these savings. District investment paired with other government assistance programs like FDACS and Natural Resources Conservation Service could accelerate the rate at which these savings occur. Water resource benefits from the Facilitating Agricultural Resource Management Systems (FARMS) Program are categorized as water resource development (WRD) or water conservation (gains in efficiency). Benefits associated with WRD (primarily tail water recovery) projects are estimated to be 9.6 mgd during the planning horizon. Additional information on the FARMS Program and its potential impact on water resources is located in Chapters 5 and 7.

Section 3. Reclaimed Water

Reclaimed water is defined by the Florida Department of Environmental Protection (FDEP) 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 reclaimed water infrastructure, utilization, and availability within the District in 2015, as well as planned utilization that is anticipated to occur by 2025 as a result of funded projects.

Existing and funded projects are expected to result in reclaimed water increases of 14 mgd, bringing utilization within the planning region to approximately 35 mgd by 2025. Appendix 4-1 contains anticipated 2025 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 “offline” 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 330 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 41 percent (330 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 75 percent utilization rate of all WWTP flows and benefit efficiency of all reclaimed water used of 75 percent by the year 2040. 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.

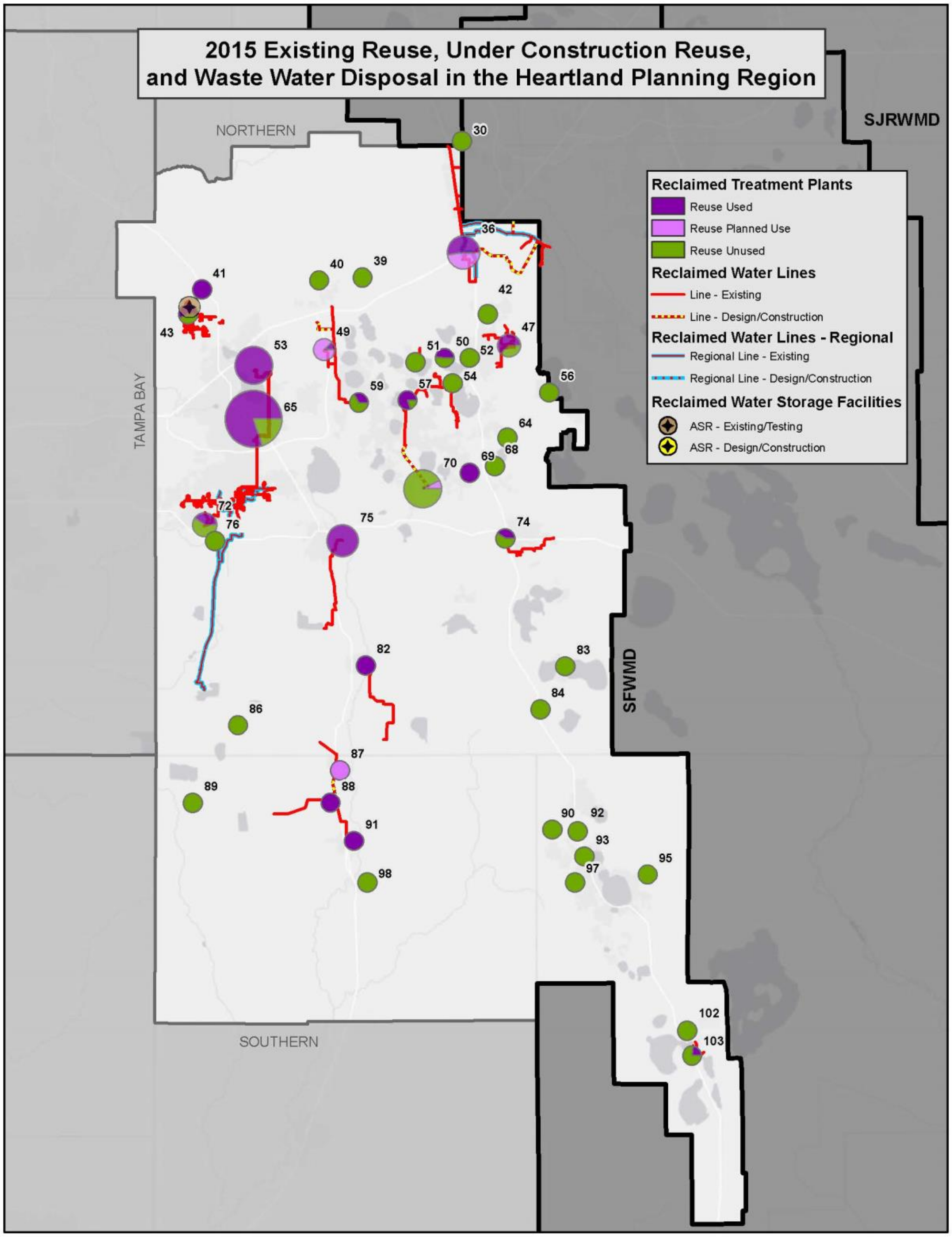

Figure 4-3. *Heartland Planning Region reclaimed water map (information on numbered facilities is available at http://www.swfwmd.state.fl.us/conservation/reclaimed/)*

1.0 Potential for Water Supply from Reclaimed Water

Table 4-5 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 2040. In 2015, there were 42 WWTPs in Polk, Hardee, and Highlands counties, which collectively produced 37.99 mgd of treated wastewater. Of that quantity, 21.12 mgd was used resulting in 16.47 mgd of benefits to traditional water supplies. Therefore, only approximately 45 percent of the wastewater produced in the planning region was utilized for irrigation, cooling, or other beneficial purposes. By 2040, it is expected that more than 75 percent of reclaimed water available in the planning region will be utilized, and that efficiency by the end user will average more than 75 percent through a combination of measures, such as customer selection metering, volume-based rates, and education. As a result, by 2040, it is estimated that nearly 48 mgd (more than 75 percent) of the 52 mgd of wastewater treated will be beneficially used. This will result in approximately 40 mgd of benefits, of which nearly 24 mgd are additional post-2015 (75 percent efficiency).

Table 4-5. *2015 Actual versus 2040 potential reclaimed water availability, utilization, and benefit (mgd) in the Heartland Planning Region*

County	2015 Availability, Utilization, and Benefit[1]				2015–2040 Potential Availability, Utilization, and Benefit[2]			
	Number of WWTPs in 2015	WWTP Flow in 2015	Utilization in 2015 (56%)	Potable-Quality Water Benefit in 2015 (78%)	2040 Total WWTP Flow	2040 Utilization (75%)[3]	2040 Potable-Quality Water Benefit (75%)[3]	Post 2015 Benefit
Polk	30	34.32	20.33	15.69	48.29	44.55	37.64	21.95
Hardee	5	1.21	0.77	0.77	1.25	0.94	0.94	0.17
Highlands	7	2.46	0.02	0.01	2.96	2.21	1.66	1.65
Total	**42**	**37.99**	**21.12**	**16.47**	**52.50**	**47.70**	**40.24**	**23.77**

[1] Estimated at 78 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 this methodology is included 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 1975 through 2018. Adjusted annual flow was 762.7 mgd (1,180.6 cfs). The PRMRWSA is permitted to supply an annual average of 101.6 mgd from the river.

Projects have been 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 4-6.

All available surface water in the Peace River is allocated to the Southern Planning Region in Table 4-6 because more water is physically present and available downstream; however, future withdrawals from the river in the Heartland Planning Region are being explored by the Polk Regional Water Cooperative. 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 2.3 mgd of water supply is potentially available from the lower 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 43.1 mgd (67 cfs). Annual average withdrawals of 0.46 mgd are permitted from the creek. Average annual diversions from 1996 to 2018 were 0.46 mgd. Based on the planning level minimum flow criteria, an additional 4.2 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 4-6 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 is approximately 4.2 mgd. 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 4-6. *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	43.1	4.3	0.46	0.46	4.2	310	148	366
TOTAL		**43.1**	**4.3**	**0.46**	**0.46**	**4.2**			

[1] Mean flow based on recorded U.S. Geologic Survey flow plus reported WUP withdrawals added back in when applicable. Maximum period of record used for rivers in the region is 1980–2018.
[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 2007–2018.
[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 suitable for water supply is available from two general sources within the District; in the UFA and intermediate aquifer system along coastal areas, and inland at greater depths within the LFA below middle confining unit II (MCU II). The coastal brackish groundwater is found 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 milligrams per liter (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 of the District.

Outside of the immediate coastal zone, brackish water sources in the LFA originate from mixing with relic seawater or contact with evaporitic and organic-rich strata. Recent hydrogeologic investigations in Polk County have found groundwater below MCU II to be mildly brackish, and also reasonably confined from the UFA, to suggest development of the source may be feasible. At greater depths the groundwater is saline, so future projects must address potential upwelling of saline groundwater to supply wells that could deteriorate water quality over time.

Brackish groundwater is defined as groundwater having impurity concentrations greater than drinking water standards (i.e., TDS concentration greater than 500 mg/L), but less than seawater (SWFWMD, 2001). Seawater has a TDS concentration of approximately 35,000 mg/L. Brackish water treatment facilities typically use source water that slightly or moderately exceeds potable water standards. Raw water with TDS values less than 6,000 mg/L is preferable for treatment due to recovery efficiency and energy costs. Groundwater with TDS greater than 10,000 mg/L generally exceeds feasibility because treatment would require high-pressure pumps and reverse osmosis (RO) membranes that are more costly to operate. Many treatment facilities will blend fresher water or recirculate some RO permeate to maintain a consistent raw water quality for efficient operation. Pure RO permeate can have very low TDS and may be corrosive to pipe metals and prior mineral deposits, so bypass blending of some raw water into the RO permeate is common for buffering, and also increasing the total yield.

While RO is the most common brackish water treatment technology, electro-dialysis reversal (EDR) systems may also be viable and are in use within the District at the T Mabry Carlton facility in Sarasota County. The EDR method uses an electrical current to pull ionic minerals outward from water flowing through a gel membrane, and the electrical current is frequently reversed to prevent buildup in the membrane. It's recommended that both RO and EDR systems be considered in brackish water supply project conceptualization and feasibility studies.

Both RO and EDR treatment systems generate 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 Pollutant Discharge Elimination System (NPDES) permit and may be restrained by TMDL limitations. In some cases, brackish water treatment facilities have been required to run below their potential efficiencies to reduce the strength of the concentrate. Because of these environmental considerations, deep-well injection is becoming more prevalent. Deep-well injection may not be permittable in some areas with unsuitable geologic conditions. An additional but costly disposal option is zero liquid discharge (ZLD). Zero liquid discharge (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 might have economic value for various industrial processes.

The Florida Legislature declared brackish groundwater an AWS 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 hydrologic 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, recognizing brackish groundwater as an AWS and allowing for assistance with construction projects. Since then, the District has assisted constructing five brackish groundwater treatment projects in the cities of North Port, Oldsmar, Tarpon Springs, Clearwater, and Punta Gorda. Each city has a regionally interconnected water supply system. The District is also co-funding two additional brackish groundwater projects for the Polk Regional Water Cooperative that are under design. The funding is intended to incentivize the development of integrated, robust, multijurisdictional systems that are reliable, sustainable, and utilize diverse water sources. While the District's regional water supply development processes have traditionally been based on meeting increasing demand projections, several brackish groundwater projects have been pursued for other needs: to blend permeate with treated surface water in order to meet finished water quality standards, to maintain viability of existing wellfields with deteriorating water quality, and to provide seasonal source substitution to meet an MFL. Future projects might also incorporate indirect potable reuse. 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. A phased approach to brackish groundwater development is recommended that includes hydrogeologic evaluations to determine project viability, design phases that help refine the economic and permitting feasibility, and construction procured through a competitive bidding process.

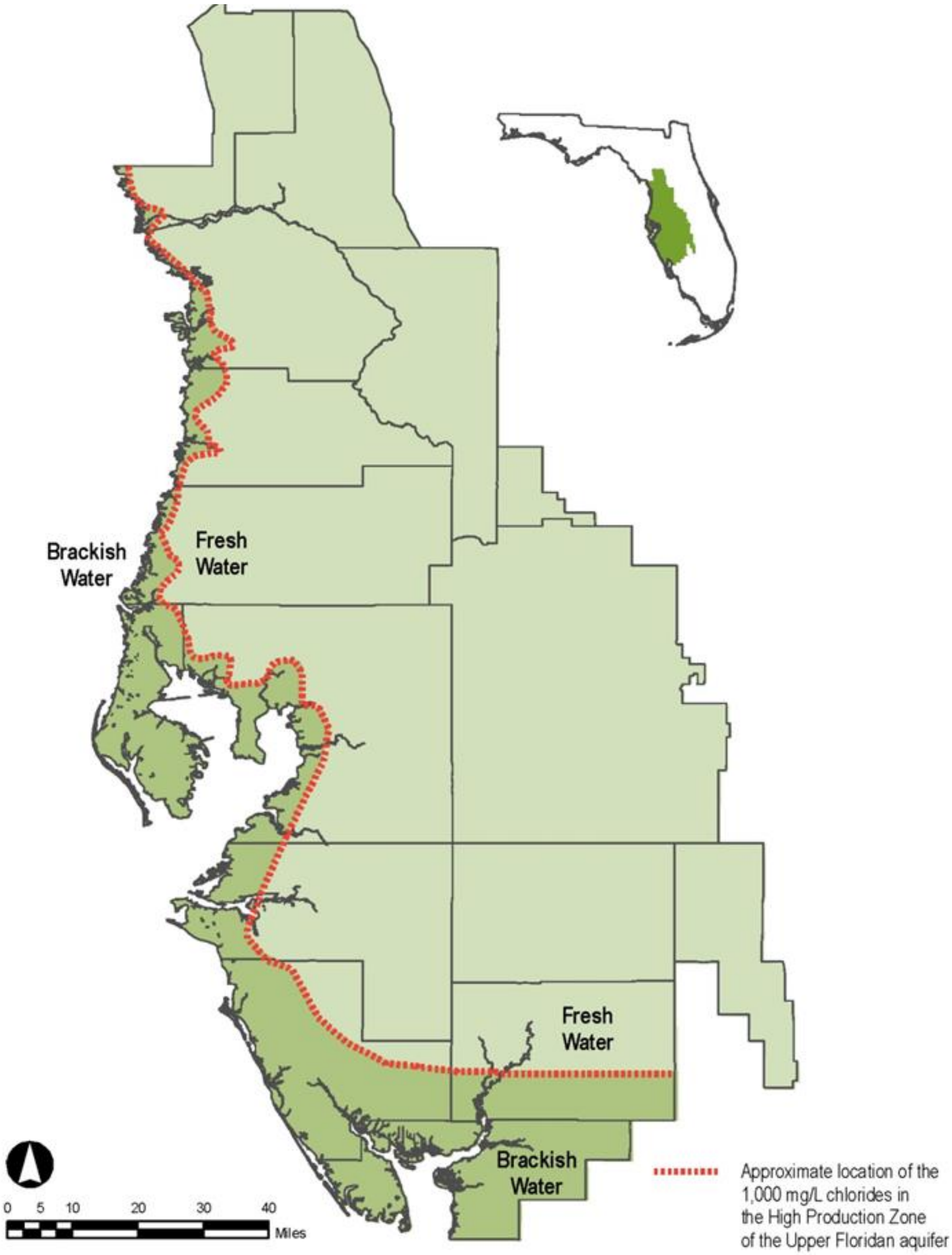

Figure 4-4. *Generalized location of the freshwater/saltwater interface in the District*

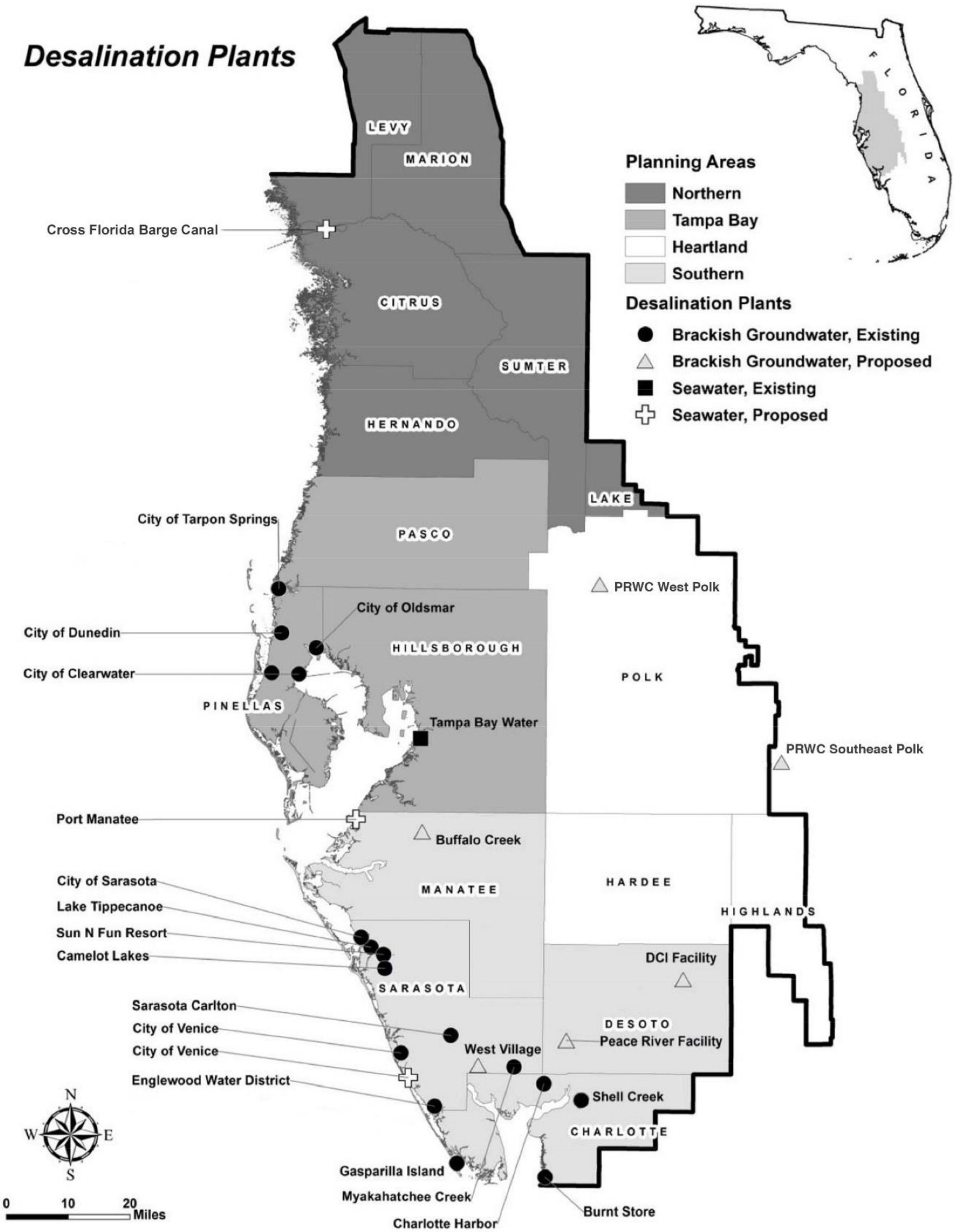

Figure 4-5. *Location of existing and potential seawater and brackish groundwater desalination facilities in the District*

1.0 Potential for Water Supply from Brackish Groundwater

Brackish groundwater from the LFA, defined as an alternative or non-traditional source, 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 system in the planning region is divided into Upper and Lower Floridan aquifers (UFA and LFA), separated by partially overlapping middle confining units I and II (MCU I and MCU II) (Miller, 1986). In east central Florida, the Lower Floridan aquifer is very productive with mostly freshwater 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 and less permeable 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 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 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 WRD planning efforts. The projects will help improve understanding of water quality and productivity in the LFA, as well as its degree of confinement from the UFA and the potential of future withdrawals to degrade existing water resources. The projects will also expand the District's regional monitor-well network and provide valuable data for groundwater modeling efforts.

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. 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. Additional exploration is underway to explore the injection of concentrate in the lower portions of the LFA.

The quantity of brackish groundwater supply available for future needs in the Heartland Planning Region has yet to be fully defined, but investigations of the water resources of the LFA is ongoing and preliminary information is available in selected areas of the region. The availability of this 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. Aquifer storage and recovery (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 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.

Aquifer storage and recovery 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. Aquifer storage and recovery 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.

Aquifer storage and recovery 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.

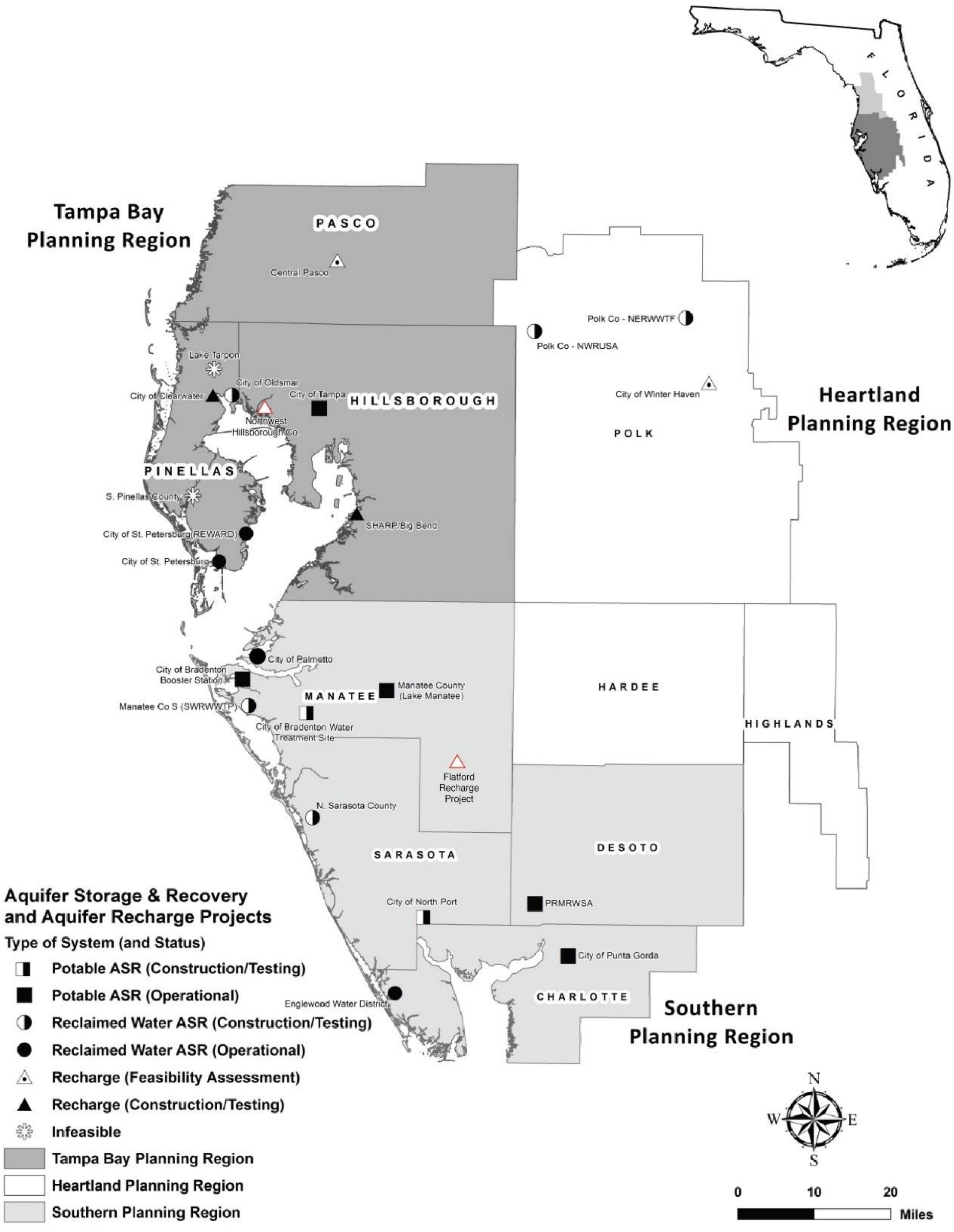

Figure 4-6. *Location of aquifer storage and recovery and aquifer recharge projects in the District that are operational or under development*

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) have been completed since the year 2010 and are included to report on the status of implementation since the previous RWSP.

1.0 Aquifer Storage and Recovery 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 radionuclides 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 radionuclides 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 Aquifer Storage and Recovery Permitting

Permits to develop ASR systems must be obtained from the District, the FDEP, 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 FDEP 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 FDEP 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 FDEP is now considering on a case by case basis handling other parameters, such as disinfection byproducts (DBP) and coliform bacteria, in a similar manner to arsenic, and including reclaimed water ASR and recharge projects.

3.0 Aquifer Storage and Recovery and Arsenic

When the last RWSP was under development in 2015, 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. Dissolved oxygen (DO) control offers one method of achieving an operation permit for ASR and recharge facilities. Dissolved oxygen (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. Aquifer recharge (AR) is the process of beneficially using excess water to directly or indirectly recharge aquifers. Aquifer recharge (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. Aquifer recharge (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. A total volume of 738 mgd of reclaimed water was used Statewide in 2015 (DEP, 2015), for water uses including residential, industrial, recreational (golf courses), water treatment plants, rapid infiltration basins, and spray field applications.

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 FDEP 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 FDEP 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. Aquifer recharge (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 spray fields, recharge wetlands, large-scale drain fields, and RIBs. This recharge approach is used in areas where there is a good connection between the surface and source aquifer for water supply. Water applied to the surface must meet minimum water quality standards approved by the FDEP. 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 20 mgd of available reclaimed water (Districtwide) was being applied through RIBs for indirect AR as of 2015 (DEP, 2015).

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: (1) an intake structure to acquire the source water, (2) pretreatment to remove organic matter and suspended solids, (3) RO desalination to remove dissolved minerals and microscopic constituents, (4) post-treatment to stabilize and buffer product water and prepare it for transmission, and (5) 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 pounds per square inch (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 FDEP 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 toward 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 SHP. 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 SHP 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, the following is a list of areas of opportunity for stormwater harvesting now and in the future:

- Dispersed Water Management & Dispersed Water Storage
- AG 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 AR

Section 10. Summary of Potentially Available Water Supply

Table 4-7 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 2040. The table shows that the total quantity available could be as high as 77.22 mgd.

Part B. Determination of Water Supply Deficits/Surpluses

Future water supply deficits/surpluses were calculated as the difference between projected demands for 2040 and demands for the 2015 base year (Table 3-7). The projected additional water demand for the planning period is approximately 38.87 mgd. As shown in Table 4-7, up to 77.22 mgd is potentially available from sources in the planning region to meet this demand. Based on a comparison of projected demands and identified supplies, it is concluded that sufficient sources of water are generally available in the planning region to meet demands through 2040. It should be noted, however, that resource constraints within the planning region may limit the availability of permitted unused groundwater quantities.

Peace River in Hardee County

Table 4-7. *Potential additional water availability in the Heartland Planning Region through 2040 (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	PS	AG	
Polk	-	-	21.95	-	-	1.1	27.76	7.97	0.49	59.27
Hardee	-	-	0.17	-	-	0.0	0.46	0.65	3.64	4.92
Highlands	0.46	4.20	1.65	-	-	0.5	2.21	0.08	3.93	13.03
Total	**0.46**	**4.20**	**23.77**	**NA**	**TBD**	**1.6**	**30.43**	**8.70**	**8.06**	**77.22**

[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 2018 Estimated Water Use (SWFWMD, 2019).

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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 (SWFWMD) (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 (AR), 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 CFWI RWSP and the 2020 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 MIA of the SWUCA 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.

Section 2. Water Conservation Options

1.0 Non-Agricultural Water Conservation

The District identified a series of conservation activities that are appropriate for implementation by the public supply (PS) sector. However, while this analysis only estimates active conservation savings and costs for public supply, some of these activities can also be implemented by the domestic self-supply (DSS), industrial/commercial (I/C), and landscape/recreation (L/R) water use sectors. A complete description of the criteria used in selecting these activities and the methodology for determining the water savings potential for each activity are described in detail in Chapter 4.

Some readily applicable conservation activities are not addressed due to the wide variance in implementation costs and the site-specific nature of their implementation. One such measure is water-conserving rate structures, 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 water use permit (WUP) application or renewal. Below is a description of each non-agricultural water conservation option. Savings and costs for each conservation activity evaluated in the 2020 RWSP are also summarized in Table 5-1 below.

The types of activities implemented in this region are expected to be similar to CFWI as most PS demands in the region are part of CFWI. Figure 5-1 below depicts which activities will produce what portion of the projected savings. It is understood that over time the breakout will change, but this is considered to be the best available information.

Table 5-1. *Conservation activity options for PS sector*

Conservation Activity	2040 PS Savings (mgd)	Average Cost Effectiveness ($/kgal)	Total Cost
Region-wide Activities[2]			
High-efficiency Toilets (Residential)	0.22	$2.27	$1,828,249
High-efficiency Toilets (I/C)	0.03	$1.74	$195,575
High-efficiency Showerheads	0.93	$0.66	$4,155,059
Smart Irrigation Controllers	0.03	$0.89	$156,176
Rain Sensors	0.01	$1.26	$111,884
Soil Moisture Sensors	0.03	$0.89	$156,176
Landscape and Irrigation Evaluations/Audits	0.29	$0.71	$1,500,076
Polk County-exclusive Activities			
Irrigation Restriction Enforcement	1.04	-	-
High-efficiency Faucet Aerators	0.39	-	-
Advanced Metering Infrastructure	0.43	-	-
Florida Water Star	0.35	-	-
Other[3]	0.78	-	-
Total Public Supply	**4.53**	**$0.90[1]**	**$8,103,195**

[1]Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.
[2]The following activities include Polk County: High-Efficiency Toilets (HET), High- Efficiency showerheads, landscape and irrigation evaluations
[3]Other includes savings specific to Polk County for activities like rain sensors, soil moisture sensors, smart irrigation controllers, and line flushing reduction to name a few.

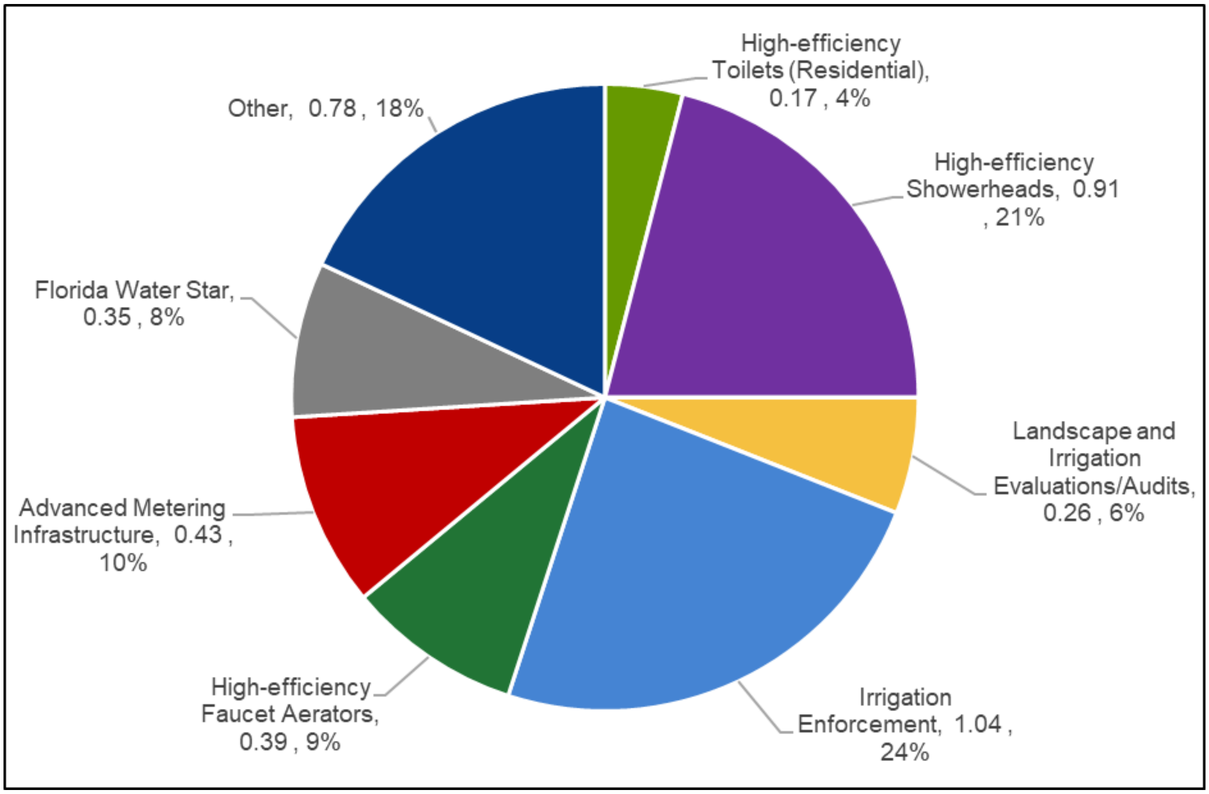

Figure 5-1. *Total 2040 active water savings (mgd) in Polk County, by conservation activity*

1.1 Description of Non-Agricultural Water Conservation Options

1.1.1 High-Efficiency Showerheads

This practice involves installing Environmental Protection Agency (EPA) WaterSense®-labeled, high-efficiency showerheads. This is a low-cost conservation option that is easy to implement for both residential and I/C users. Savings occur when showerheads are upgraded from higher flow models (4 gallons per minute (gpm) through 2.5 gpm) to a WaterSense®-labeled version (2.0 gpm or less).

High-Efficiency showerheads were identified as a major potential source of water conservation.

1.1.2 High-Efficiency Toilets Rebates (Residential)

High-efficiency toilet (HET) rebate programs offer $100 rebates as an incentive for replacement of inefficient high-flow toilets with more water-efficient models. High-efficiency toilets (HET) use 1.28 gallons per flush (gpf) as opposed to older, less-efficient models that could use 3.5 gpf or more, depending on the age of the fixture. Savings estimated in this plan are based on converting 3.5 gpf to a 1.28 gpf model. High-efficiency toilets (HET) and dual-flush toilets are WaterSense® labeled by the EPA. Also, gradually becoming more popular on the marketplace are 0.8 gpf models, which offer a 50 percent savings compared to 1.6 gpf models that are currently required by building code.

1.1.3 Landscape and Irrigation Evaluations/Audits

Water-efficient landscape and irrigation evaluations (evaluations) generate water savings by evaluating individual irrigation systems, providing expert tips on opportunities to increase water efficiency, optimizing run times, pointing out broken heads and leaks, and sometimes offering targeted rebates or incentives based on those recommendations. Evaluations can focus on three areas: operation, repair, and design. They are normally only available to high-use accounts that have inground irrigation systems and are likely over-watering

1.1.4 Rain Sensors

Section 373.62, Florida Statues (F.S.), requires all new automatic landscape irrigation systems to be fitted with properly installed automatic shutoff devices. This is typically a rain sensor. As with showerheads, rain sensors are an easily implemented, low cost conservation option. They are often paired with a landscape and irrigation evaluation/audit but can also be given away to homeowners with irrigation systems.

1.1.5 Smart Irrigation Controllers

Smart irrigation controllers go a step further than rain sensors. This technology automatically adjusts irrigation runtimes according to the needs of the local landscape. It is often based on temperature, climate, rainfall, soil moisture, rain, wind, slope, soil, plant type, and more. This data is obtained by an on-site evapotranspiration (ET) sensor or through the internet. Some units can be operated by smart phone and can incorporate a weather forecast to anticipate coming rain. As an example, winter season run times may be automatically dialed down 30 percent from summer run times.

1.1.6 Soil Moisture Sensors

Soil moisture sensors have been available on the market for approximately 10 years, and costs have come down considerably since they were first released. These devices override (prevent) scheduled irrigation events when enough moisture is present at the site, thus reducing water usage by skipping irrigation cycles.

1.1.7 Irrigation Restriction Enforcement

The District has year-round irrigation restrictions in effect except where there are stricter measures imposed by local governments. These restrictions limit the number of days (usually 1 or 2 days per week) and limit the time of day (before 10 a.m. and after 4 p.m.) irrigation that can be applied to lawns. Proper enforcement of these regulations can result in significant water savings for both residential and commercial users.

1.1.8 High-Efficiency Faucet Aerators

These programs install EPA WaterSense®-labeled high-efficiency kitchen and bathroom faucet aerators. The efficient flow rates are 1.5 gpm or less for bathroom faucets and 2.5 gpm for kitchen faucets. This is a low-cost conservation option for both the residential and I/C water use sectors.

Irrigation restriction enforcement was identified as a major potential source of water conservation.

1.1.9 Advanced Metering Analytics

Advanced metering infrastructure (AMI) can be installed on residential and commercial properties to track water use at a more granular level, often hourly or daily. This technology can assist users in understanding their water use. In order to be relevant for conservation, the data collected by the AMI system needs to be analyzed and communicated to the customer. A software system, Advanced Metering Analytics, and an online customer portal allows this communication to occur and can alert the customer to suspected leaks, high usage, and non-compliance irrigation events.

1.1.10 High-Efficiency Toilets (Industrial/Commercial)

Similar to the residential HET retrofit programs, a non-residential fixture replacement program provides financial incentives to water customers to encourage conversion of higher flush volume toilets to HET models. These measures apply to office buildings, sports arenas, hospitals, schools, dormitories, and other commercial facilities.

1.1.11 Florida Water Star℠

Florida Water Star℠ (FWS) is a certification program for both residential and commercial buildings. Certified buildings uphold higher standards for water conservation and efficiency, both indoors and outdoors. Many of the conservation activities discussed here are implemented within FWS properties, and the primary water saving feature of FWS is the limit on high volume irrigation (maximum of 60 percent of the irrigable area).

1.1.12 Other

The "Other" category is adopted from CFWI and is comprised of some of the same activities already described in this chapter, including: Advanced ET irrigation controllers, soil moisture sensors, Waterwise Florida; Commercial, Industrial, and Institutional (CII) facility water audits; pre rinse spray valves; clothes washers; rain sensors; Florida Building Code, Building (FBCB) requirements; Florida friendly landscaping; line flushing reduction; and combination programs where several activities are implemented at the same time.

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 2015 to 2040, 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 2040. 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 200 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.

2.1 Facilitation of Agricultural Resource Management Systems

The District, in cooperation with the Florida Department of Agriculture and Consumer Services (FDACS), initiated the Facilitation of Agricultural Resource Management Systems (FARMS) Program in 2003. The FARMS Program provides cost-share reimbursement for the implementation of agricultural best management practices (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 within the SWUCA.

2.2 Facilitation of Agricultural Resource Management Systems Conservation Potential

Districtwide, as of September 2019, FARMS has funded more than 200 projects with agricultural cooperators, for a total estimated reduction in groundwater use of more than 28 mgd. In the Heartland Planning Region, there are 44 projects with an estimated reduction in groundwater use of more than 4.3 mgd. Facilitation of Agricultural Resource Management Systems (FARMS) has achieved these reductions through two main types of projects, alternative water supply and conservation through precision irrigation. These types of projects will be discussed below. During the current planning horizon, from Fiscal Year (FY) 2015 through FY 2040, if the current trends in agriculture and District cooperation continue, the FARMS program has the potential to reduce groundwater use by nearly 24 mgd through development of alternative water supplies and nearly 1.7 mgd through precision irrigation or other groundwater conservation BMPs. Within the Heartland Planning Region, the District projects that FARMS alternative water supplies could save nearly 9.6 mgd and conservation BMPs could save nearly 0.5 mgd over the same planning horizon of FY 2015 through FY 2040.

Table 5-2. *FARMS conservation potential within Heartland Planning Region*

Project type	Potential resource benefit (mgd)	Estimated costs	Cost Benefit (cost per 1000 gallons saved)
Alternative water supply (tailwater recovery)	9.6	$34,880,000	$1.84
Conservation	0.49	$950,000	$0.98

Typical FARMS Project #1. Tailwater Recovery

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 appurtenances 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 Twenty-Twenty Grove Charlie Creek Farms project located in Hardee County is an example of a tailwater recovery system in the Heartland Planning Region that was developed through the FARMS Program. Twenty-Twenty Groves is an 1,885-acre citrus farm located in south-central Hardee County. The project offsets groundwater withdrawals through use of a tailwater recovery reservoir located on the downgradient side of the property. The project includes four surface water pump stations, filtration, and a pipeline to connect the reservoir to the existing irrigation system. This project is permitted for an annual average groundwater withdrawal of 1.7 mgd. Actual water use is approximately 1.2 mgd, which is offset nearly 70 percent by the use of tailwater.

Typical FARMS Project #2. Precision Irrigation Systems

Precision irrigation systems allow for the automatic remote control of irrigation pumps based upon information derived from soil moisture sensors that measure and monitor discrete sub-surface 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.

An example of precision irrigation in the Heartland Planning Region is Lykes, Camp Mack Grove. The farm is a 1,023-acre citrus grove just north of Lake Wales. It is permitted for 1.448 mgd for supplemental irrigation. The FARMS program funded a precision irrigation project that included automated pump control, weather stations with soil moisture sensors, for four groundwater wells, and automated valve control. Estimated groundwater use reduction is approximately five percent or about 0.068 mgd.

Because the District classifies FARMS projects as water resource development, additional information pertaining to the program, status of project implementation and water savings achieved to date is provided in Chapter 7.

2.3 Mobile Irrigation Laboratory

The mobile irrigation lab program is a cooperative initiative between the District and the U.S. 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 has recommended management strategies and/or irrigation system adjustments.

2.4 Best Management Practices

Best Management Practices (BMPs) are individual agricultural practices or combinations of practices that, based on research, field testing, and expert review, have been determined to be the most effective and practical means for maintaining or improving the water quality of surface and groundwaters and conserving groundwater resources. BMPs typically are implemented in combination to prevent, reduce, or treat pollutant discharges off-site. BMPs must be based on sound science, be technically feasible, and be economically viable. In Florida, agricultural BMPs are detailed in crop-specific BMP manuals developed by the FDACS in cooperation with a wide spectrum of stakeholders within the community specific to that crop. BMP manuals are available on the FDACS website and are used to evaluate a farm's intent to implement practices that conserve groundwater, protect water quality, reduce nutrient impacts, control erosion, and implement integrated pest management to reduce environmental impacts.

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 wastewater treatment plants (WWTPs) for 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. The following 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, or groundwater) into the reclaimed water system to expand available supply
- **ASR:** 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 and 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, and 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 WWTPs 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.

Reclaimed water pipes

The District developed five reclaimed water project options (Table 5-3) for the planning region through coordination with utilities and other interested parties in concert with the CFWI and the Heartland Planning 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 2040 at a utilization rate of 75 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 5-3.

Flow and capital cost data for the 39 funded reclaimed water construction projects identified as being under development (FY2015-2020) 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 shows that for projects anticipated to come online between 2015 and 2025, the average capital cost is approximately $10.27 million for each 1 mgd supplied. This figure was used in cost calculations for individual reclaimed water options unless specific cost data were available.

Table 5-3. *Reclaimed water options for the Heartland Planning Region*

Option Name and Entity	County	Type	Supply (mgd)	Benefit (mgd)	Capital Cost (Millions $)
Avon Park/Polk Co. Nucor Steel Mill Reuse	*Polk, Highlands*	*System Expansion*	*0.37-0.67*	*0.37-0.67*	*$2.74-$5.47*
Polk Co. to Haines City Reuse Interconnect	*Polk*	*Interconnection*	*0.50*	*0.50*	*$3.40*
Lake Wales MFL Reuse	*Polk*	*Natural System Enhancement*	*0.19*	*0.19*	*$1.40*
Winter Haven Reclaimed Recharge	*Polk*	*Natural System Enhancement*	*0.50*	*0.50*	*$5.14*
Tampa Electric Company (TECO)-Lakeland Power RO Expansion	*Polk*	*System Expansion*	*7.00*	*7.00*	*$53.00*
Total 5 Options			***8.86***	***8.86***	***$68.41***

The use of italics denotes SWFWMD estimations.
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.

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, and the Alafia River and Peace Creek in Polk County. 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. Two water supply development projects on the Peace River and Peace Creek are in the feasibility stage and are discussed as ongoing projects in Chapter 6. Additional river supply options listed above are discussed in this section.

The surface water/stormwater options presented in this section are based on work that was prepared for the 2020 CFWI RWSP. Table 5-4 is an updated list of options developed by the District.

Table 5-4. *Surface water/stormwater options for the Heartland Planning Region (District and CFWI)*

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
Highlands County (District)							
Josephine Creek Highlands County and/or others [1]	Ag, PS, I/C	3.2	6,077	2.27	960	AR	Aquifer conveyance to AG, PS, and I/C
Polk County (PRWC)							
Alafia River (confluence of North and South Prongs)	PS	10.0	26,340	5.30	TBD	ASR/reservoir	Transmission lines

[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.

Section 5. Brackish Groundwater Options

As discussed in Chapter 4, the Upper Floridan aquifer (UFA) and Lower Floridan aquifer (LFA) are divided within the planning region by two partially overlapping confining units, middle confining unit I (MCU I) and middle confining unit II (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.

Two projects currently in the preliminary design phases for development of brackish water supplies include the Polk Regional Water Cooperative's Southeast Wellfield and West Polk Wellfield projects. These AWS projects, which can address projected water demands and assist in the recovery of the region's stressed MFL water resources, are described in Chapter 6.

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 FY2019, or (3) have been completed since the year 2015 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 38.9 mgd of new water supply will need to be developed during the 2020–2040 planning period to meet demand for all use sectors in the planning region. As of 2019, it is estimated that at approximately 171 percent of that demand (66.6 mgd) will be met by projects that meet the above definition of being “under development.” These projects may assist in offsetting the need for additional water supplies proposed for development by various entities in the planning region outside of the District’s funding programs.

Section 1. Fresh Groundwater

1.0 Polk Regional Water Cooperative – Virtual Pipelines Concept

The Polk Regional Water Cooperative (PRWC) is designing regional transmission systems as part of the scopes for the Southeast Wellfield and West Polk Wellfield projects, further described in Section 5. To economically meet growing demands of PRWC members, the concept of “Virtual Pipelines” is included as a design alternative to reduce the number of transmission mains to be developed. The Virtual Pipeline concept would allow a PRWC member who receives new Alternative Water Supply (AWS) and reduces their traditional groundwater withdrawals to share the unused permitted groundwater capacity with another member. The permitted Upper Florida aquifer (UFA) allocations would not increase over the region. Virtual Pipelines may become a viable interim solution for remote customers like Fort Meade or the Polk Southeast Regional Service Area that would otherwise need lengthy, costly pipeline segments to supply relatively small AWS quantities. The PRWC would likely serve as a broker of the groundwater allocations. The District has yet to thoroughly evaluate the regulatory approach or hydrologic effects of the Virtual Pipeline concept.

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 $398,550 and have yielded a potable water savings of approximately 179,370 gallons per day (gpd). Table 6-1 provides information on indoor water conservation projects that are under development.

1.2 Outdoor/Other Water Conservation Projects

Since 2015, 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 $2,098,240 and have yielded a potable water savings of approximately 420,548 gpd. Table 6-1 provides information on outdoor water conservation projects that are under development.

Table 6-1. *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
Indoor Projects							
Polk Regional Water Cooperative	P921	Indoor Conservation Incentives	87,370	3,135	$242,550	$121,275[2]	$0.48
Polk Regional Water Cooperative	N948	Indoor Conservation Incentives	92,000	3,520	$156,000	$78,000	$0.65
Indoor Total			179,370	6,655	$398,550	$199,275	
Outdoor/Other Projects							
Polk County Utilities	N613	Irrigation System Evaluation	19,198	88	$18,420	$8,922	$0.63
Polk County Utilities	N714	Irrigation System Evaluation	36,863	167	$36,370	$18,185	$0.66
Polk County Utilities	N716	Advanced Metering Analytics	13,468	353	$20,000	$10,000	$0.06
Polk County Utilities	N820	Irrigation System Evaluation	42,000	300	$82,800	$41,400	$0.52
Polk Regional Water Cooperative	P920	Outdoor Best Management Practices	52,300		$332,150	$166,075[2]	$1.80
Polk Regional Water Cooperative	P922	Florida Water Star	66,165	500	$350,000	$350,000[2]	$2.02
Polk County Utilities	N846	Irrigation System Evaluation	42,000	300	$85,000	$42,500	$1.39
Town of Lake Hamilton	N996	Line-Looping	19,554	NA[4]	$521,000	$124,610	$6.43
Polk Regional Water Cooperative	N971	Outdoor Best Management Practices	113,000	872	$192,500	$96,250	$0.87
City of Winter Haven	N973	Advanced Metering Analytics	16,000		$120,000	$60,000	$5.00

Cooperator	Project Number	General Description	Savings (gpd)	Devices and Rebates	Total Cost[1]	District Cost	$/1,000 gal Saved
Polk Regional Water Cooperative	Q023	Water Demand Management Plan	NA[5]	NA	$340,000	$170,000	NA
Outdoor/Other Total			420,548		$2,098,240	$1,087,942	
Totals			**599,918**		**$2,496,790**	**$1,287,217**	

[1]The total project cost may include variable project-specific costs including marketing, education and administration.
[2]Funded by Florida Department of Environmental Protection Grant
[3]Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.
[4] This is a construction project that includes the removal of auto flushers and installation of a new pipeline.
[5]This project involves the development of a demand management plan, rather than the provision of water-conserving fixtures.

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 Facilitation of Agricultural Resource Management Systems (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.

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

3.0 Institute of Food and Agricultural Sciences Research and Education Projects

The District provides funding for Institute of Food and Agricultural Sciences (IFAS) to investigate a variety of agriculture/urban 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, frost/freeze protection, residential irrigation, and urban water use. Institute of Food and Agricultural Sciences (IFAS) conducts the research and then promotes the results to the agricultural community. 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 58 research projects, 48 have been completed. Completed projects include 10 projects dealing with urban landscape issues and 38 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 10 ongoing projects are described in Table 6-2.

Table 6-2. *Water conservation research projects*

Project	Total Project Cost + District Cooperator	Total Project and Land Cost	Funding Source	Planning Region(s)[1]
Leaching Fraction-Adjusted Irrigation Impact on Nutrient Load and Plant Water Use	$81,320	$81,320	District	All
Florida Automated Weather Network Data Dissemination and Education	$100,000	$100,000	District	All
Blueberry Water Allocation and Irrigation Scheduling Using Evapotranspiration-based Methods	$ 210,000	$ 210,000	District	All
Reduction of Water Use for Citrus Cold Protection	$21,000	$21,000	District	All
Effect of Water Scheduling and Amounts on Growth of Young Citrus Trees in High Density Plantings	$168,623	$168,623	District	All
New Practical Method for Managing Irrigation in Container Nurseries	$165,310	$165,310	District	All
Effect of Composting at Animal Stock Facilities on Nutrients in Groundwater	$175,000	$175,000	District	All
Evaluating Fertigation with Center Pivot Irrigation for Water Conservation on Commercial Potato Production	$400,000	$400,000	District	All
Evaluation of Water Use & Water Quality Effects of Amending Soils & Lawns with Compost Material	$60,000	$60,000	District	All
Evaluation of Nitrogen leaching from reclaimed water applied to lawns, spray fields, and rapid infiltration basins.	$294,000	$294,000	District	All
Total	**$1,675,253**	**$1,675,253**		

[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 6-3 is a list of the benefits and costs that have been or will be realized by the 10 reclaimed water projects currently under development and another 6 are estimated to experience additional future supply growth. It is anticipated that these projects will be online by 2025. Table 6-4 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 Geographic Information System (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 Tampa Electric Company (TECO) Reclaimed Water Interconnects project (H076) is projected to supply 10 mgd for industrial use.

Table 6-3. *Reclaimed water supply projects under development in the Heartland Planning Region*

Cooperator	General Project Description	Reuse (mgd)			Customer (#)		Costs	
		Produced	Benefit	Stored	Type	Total	Total	District[1]
Wauchula	Wauchula Growth Increase to Mine	0.01	0.01	NA	Ind	1	Prior	Prior
Wauchula Hills	Wauchula Hills Growth Increase to Mine	0.01	0.01	NA	Ind	1	Prior	Prior
Bowling Green	Trans Q022	0.14	0.14	NA	Ind	1	$1,111,000	$833,250
Polk County	Trans N772	0.35	0.28	NA	Res	915	$2,505,000	$1,252,500
Polk County	Trans N862	0.38	0.32	NA	Res	1060	$869,500	$434,750
Polk County	Trans N868	0.41	0.33	NA	Res	1,100	$2,113,000	$1,056,500
Polk County	Trans N918	0.14	0.12	NA	Res	400	$1,696,000	$848,000
Polk County	Trans Q066	0.18	0.17	NA	Res	1025	$525,500	$262,750
Polk County	Trans Q067	0.52	0.52	NA	Res	1365	$4,373,500	$2,186,750
City of Winter Haven	Trans, Pump, Store N339	0.30	0.15	5.00	Res, Com, GC	TBD	$9,466,000	$2,750,000
City of Auburndale	Trans N536	1.50	1/13	NA	Com	1	$3,000,000	$1,500,000
Tampa Electric Company	Trans/ Pump H076	10.00	10.00	0.50	Ind	1	$97,960,725	$49,203,020
Streamsong	Streamsong Growth to Golf Course	0.01	0.01	NA	GC	1	Prior	NA
Cypress Lakes	Cypress Lakes Growth to Golf Course	0.01	0.01	NA	GC	1	Prior	NA
Ft Meade	Ft. Meade Growth to Mine	0.14	0.14	NA	Ind	1	Prior	Prior
Bartow	Bartow Growth to Power Plant	0.62	0.62	NA	Ind	1	Prior	Prior
Total	**16 Projects**	**14.72**	**12.91**	**5.50**		**5,874**	**$122,620,225**	**$60,327,520**

[1] Costs include all revenue sources budgeted by the District.

Table 6-4. *Reclaimed water research, monitoring, and education projects co-funded 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
Total (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. Surface Water/Stormwater

<u>Surface Water/Stormwater Project #1. Polk County Regional Cooperative Peace River/Land Use Transition Treatment Facility and Reservoir</u>

- Entities Responsible for Implementation: Polk Regional Water Cooperative, District

The project includes developing an alternative water supply source from the upper Peace River in southern Polk County. A feasibility study is underway to develop a conceptual potable water supply plan that will identify potential capacity, treatment, storage, and permitability. Conceptual estimates are initially at 11 mgd of surface water from the upper Peace River within the boundaries of Polk County, although quantities may be revised based on ongoing modeling. The project also includes a Land Use Transition evaluation, to identify industrial or agricultural WUPs on lands in the vicinity that may have retired uses in the future, presenting an opportunity to transfer the permitted quantities to public supply. See Table 6-5 for a summary of this option's potential yield and costs.

Table 6-5. *Polk Regional Cooperative Peace River Basin/Land Use Transition Treatment Facility and Reservoir Project yield/costs*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
11.0	$150,200,000	$75,100,000	$13.65	TBD

Surface Water/Stormwater Project #2. Peace Creek Integrated Water Supply Plan

- Entities Responsible for Implementation: Polk County Regional Water Cooperative, District

This project includes the development of a water supply or recharge project utilizing water from the Peace Creek. A feasibility study is underway to determine viable options to increase water supply. The study will look at several potential AR and water storage sites to increase groundwater recharge. Conceptual estimates are initially at 10 mgd of surface water from the Peace Creek in Polk County, although quantities may be revised based on ongoing modeling.

Table 6-6. *Polk Regional Cooperative Peace Creek Integrated Water Supply Plan Project yield/costs*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
10.0	$120,200,000	$260,100,000	$12.02	TBD

Section 5. Brackish Groundwater

Brackish Groundwater Project #1. PRWC Southeast Wellfield

The PRWC is conducting the conceptual and preliminary design phases of the Southeast Wellfield Project. The project consists of a brackish water treatment facility located approximately 10 miles east of Lake Wales, a wellfield located over the District border and permitted by the SFWMD, and a regional transmission system to deliver AWS to multiple PRWC members along the US-27 and SR-60 corridors. The project is anticipated to produce 7.5 mgd of AWS in its implemental phase and 30 mgd at full development. The wellfield will withdraw water from the Lower Floridan aquifer (LFA) below middle confining unit II (MCU II). The District commenced budgeting for the project via a funding resolution in Fiscal Year (FY) 2015 as an incentive for the formation of the PRWC, and the project commenced in FY2017 with conceptual design and hydrogeologic testing at the planned facility site. Additional funds for future developmental phases are being reserved annually through resolutions that require specific milestones for PRWC projects. The costs below are based on the conceptual design estimates at full development. The project is anticipated to be operational by 2023.

Table 6-7. *Southeast Wellfield Water Treatment Plant and Regional Transmission System Costs at estimated Build-out*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
30.0	$447,600,000	$223,800,000	$14.92	$3.60

Brackish Groundwater Project #2. PRWC West Polk Wellfield

The PRWC is conducting the conceptual and preliminary design phases of the West Polk Wellfield Project. The project consists of a brackish water treatment facility located in Lakeland adjacent to the City's UFA wellfield and distribution systems. The project includes a wellfield, a brackish water treatment facility, and a regional transmission system. The project is anticipated to produce 5 mgd of AWS in its implemental phase and 15 mgd at full development. The wellfield will withdraw water from the LFA below MCU II. The District commenced budgeting for the project via a funding resolution in FY2015 as an incentive for the formation of the PRWC, and the project commenced in FY2017 with conceptual design and hydrogeologic testing at the planned facility site. Additional funding for future developmental phases is being reserved annually through resolutions that require specific milestones for PRWC projects. The costs below are based on the conceptual design estimates for the project at full development. The project is anticipated to be operational by 2027.

Table 6-8. *West Polk Wellfield Water Treatment Plant and Regional Transmission System Costs at Build-out*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
15.0	$179,100,000	$89,550,000	$11.94	$2.88

Section 6. Aquifer Storage and Recovery

There are currently no Aquifer Storage and Recovery (ASR) projects under development in the planning region.

Section 7. Aquifer Recharge Projects

There are a number of existing indirect aquifer recharge (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.

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Chapter 7. Water Resource Development Component

This chapter addresses the legislatively required water resource development (WRD) activities and projects that are conducted primarily by the District. The intent of WRD projects is to enhance the amount of water available for regional-beneficial uses and for natural systems. Section 373.019, Florida Statutes (F.S.), defines WRD as: *"…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 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 WRD 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 WRD data collection and analysis activities, which support the health of natural systems and water supply development. Table 7-1 displays the Fiscal Year (FY) 2020 budget and anticipated five-year funding levels for Districtwide data collection and analysis activities. Approximately $40.8 million will be allocated toward these activities annually for a five-year total of approximately $204 million. Because budgets for the years beyond FY2020 have not yet been developed, but are projected to be fairly constant, future funding estimates for activities are set equal to FY2020 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 U.S. Geological Survey (USGS). The activities listed in Table 7-1 are described in subsections 1.0 through 5.0, below.

Table 7-1. *WRD data collection and analysis activities (Districtwide)*

WRD Data Collection and Analysis Activities		FY2020 Funding	Anticipated 5-Year Funding	Funding Partners
1.0	**Hydrologic Data Collection**			SWFWMD, other WMDs, USGS, FDEP, FWC
1.1	Surface Water Flows and Levels	$2,715,842	$13,579,210	
1.2	Geohydrologic Data Well Network (includes ROMP)	$3,149,091	$15,745,455	
1.3	Meteorological Data	$278,408	$1,392,040	
1.4	Water Quality Data	$1,003,524	$5,017,620	
1.5	Groundwater Levels	$891,391	$4,456,955	
1.6	Biologic Data	$1,502,627	$7,513,135	
1.7	Data Support	$3,776,719	$18,883,595	
2.0	**Minimum Flows and Levels Program**			SWFWMD
2.1	Technical Support	$1,718,986	$8,594,930	
2.2	Establishment	$678,495	$3,392,475	
3.0	**Watershed Management Planning**	$7,456,686	$37,283,430	SWFWMD, Local Cooperators
4.0	**Quality of Water Improvement Program**	$743,025	$3,715,125	SWFWMD
5.0	**Stormwater Improvements: Implementation of Storage and Conveyance BMPs**	$16,927,435	$84,637,175	SWFWMD, USGS
TOTAL		**$40,842,229**	**$204,211,145**	

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 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 808 surface water level gauging sites, and cooperative funding with the USGS for discharge and water-level data collection at 129 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 (CFWI), Water Resource Assessment Projects (WRAPs), Water Use Caution Areas (WUCA), recovery strategies, 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 at 171 rain gauges, most of which provide near real-time data. Annual funding is for costs associated with measurement of rainfall, including sensors, maintenance, repair, and replacement of equipment. Funding allows for the operation of one District evapotranspiration (ET) station for reference near Lake Hancock, and for District participation in a cooperative effort between the USGS and all five Florida water management districts to map statewide potential and reference ET using data measured from the Geostationary Operational Environmental Satellites (GOES). The program also includes a collaborative effort between the five the water management districts (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 380 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 1,618 monitor wells in the data collection network, including 856 wells that are instrumented with data loggers that record water levels once per hour, and 762 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 150 wetlands and a five-year assessment of over 400 wetlands to document changes in wetland health and assess level of recovery in impacted wetlands. Funding also supports an effort to map the estuarine hard bottom of Tampa Bay, as well as SWIM program efforts for mapping 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 LoggerNet data acquisition system.

2.0 Minimum Flows and Levels (MFLs) Program

Minimum flow and water levels are ecologically based, hydrologic standards that are used for permitting and planning decisions concerning how much water may be withdrawn from or near a water body without causing significant harm to water resources or ecology of the area. Chapter 373.042, F.S., requires the state water management districts or the Florida Department of Environmental Protection (FDEP) to establish MFLs for aquifers, surface watercourses, and other surface water bodies to identify the limit or level at which further withdrawals would be significantly harmful. Rivers, streams, estuaries, and springs require minimum flows; while minimum levels are developed for lakes, wetlands, and aquifers. Minimum flows and levels (MFLs) are adopted into District rules, Chapter 40D-8, Florida Administrative Code (F.A.C.), and are used in the District's WUP and water supply planning programs.

Reservations are rules that reserve water from use by permit applications, as necessary for the protection of fish and wildlife or public health and safety. Reservations are adopted into District rules, Chapter 40D-2, F.A.C., pursuant to Chapter 272.223, F.S., and are also used for water use permitting and water supply planning.

The District's processes for establishing MFLs and reservations include opportunities for interested stakeholders to review and comment on proposed MFLs or reservations and participate in public meetings. An independent scientific peer review process is used for establishing MFLs for flowing water bodies, MFLs for all water body types that are based on methods that have not previously been subjected to peer review, and for establishing reservations. Stakeholder input and peer review findings are considered by the Governing Board when deciding whether to adopt proposed MFLs and reservations. District monitoring programs provide data for evaluating compliance with the adopted MFLs and reservations, determining the need for MFLs recovery or prevention strategies and assessing the recovery of water bodies where significant harm has occurred.

The District has planned to monitor and assess the status of 210 adopted MFLs, including MFLs for 23 river segments, 10 springs or spring groups, 127 lakes, 41 wetlands, 7 wells in the NTBWUCA, and the Upper Floridan aquifer (UFA) in the MIA of the SWUCA, and in the DPCWUCA. The District is scheduling the establishment or reevaluation of 96 additional MFLs and one reservation through FY2029. The District's annual MFL Priority List and Schedule and Reservations List and Schedule is approved by the Governing Board in October, submitted to FDEP for review in November, and subsequently published in the Consolidated Annual Report. The approved and proposed priority lists and schedules are also posted on the District's Minimum Flows and Levels Documents and Reports webpage at: https://www.swfwmd.state.fl.us/projects/mfl/documents-and-reports

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

The Quality of Water Improvement Program (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 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 Best Management Practices (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 (FDOT), or state funding. As stormwater is a primary contributor of water quality degradation in older urban areas, the District seeks opportunities to retrofit or improve these systems to reduce impacts to receiving waters. FY2020 funding includes new storage and conveyance projects in the Tampa Bay area, particularly in Hillsborough and Pasco County, as well as several continuing Tampa Bay projects.

Section 2. Water Resource Development Projects

As of FY2020, the District has 20 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 $150 million and a minimum of 78 mgd of additional water supply will be produced or conserved.

These projects include feasibility and research projects for new alternative water supply (AWS), 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. 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 FY2019	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	South Hillsborough Aquifer Recharge Program (SHARP) (N287)	$1,382,500	$2,765,000	SWFWMD, Hillsborough County	2 mgd	TBPR
1.2	Bradenton Aquifer Protection Recharge Well (N842)	$1,500,000	$5,050,000	District, City of Bradenton	5 mgd	TBPR
1.3	PRMRWSA Partially Treated Water ASR (N854)	$495,500	$8,300,000	District, PRMRWSA	0 mgd	SPR
1.4	Southern Hillsborough Aquifer Recharge Project (SHARP) Phase 2 (N855)	$4,500,000	$9,700,000	District, Hillsborough County	4 mgd	TBPR
1.5	Braden River Utilities ASR Feasibility (N912)	$2,736,250	$5,995,000	District, Braden River Utilities	TBD	SPR
1.6	Hydrogeologic Investigation of Lower Floridan Aquifer in Polk County (P280)	$11,375,000	$12,000,000	SWFWMD	TBD	HPR
1.7	Optical Borehole Imaging Data Collection from LFA Wells (P925)	$100,200	$167,000	District, USGS	NA	HPR
1.8	Sources/Ages of Groundwater in LFA Wells (P926)	$368,300	$555,800	District, USGS	NA	HPR
1.9	City of Venice Reclaimed Water Aquifer Storage Recovery (Q050)	$0	$5,065,000	District, City of Venice	0.17 mgd	SPR
1.10	Direct Aquifer Recharge-North Hillsborough Aquifer Recharge Program Phase 2 (Q064)	$0	$1,500,000	District, Hillsborough County	TBD	TBPR
1.11	Direct Aquifer Recharge-South Hillsborough Aquifer Recharge Program Phase 3 (Q088)	$0	$13,000,000	District, Hillsborough County	6 mgd	TBPR

2) Facilitating Agricultural Resource Management Systems (FARMS)						
2.1	FARMS Projects	$40,780,456	$71,791,225	SWFWMD, FDACS, State of FL, private farms	29 mgd	All
2.2	Mini-FARMS Program	$616,237	$150,000 (annual)	SWFWMD	2 mgd	All
3) Environmental Restoration and Minimum Flows and Levels (MFL) Recovery						
3.1	Lower Hillsborough River (LHR) Recovery Strategy (H400)	$5,464,712	$10,857,462	SWFWMD, City of Tampa	3.1 mgd	TBPR
3.2	Lower Hillsborough River (LHR) Pumping Facilities	$394,512	$4,850,044	SWFWMD, City of Tampa	TBD	TBPR
3.3	Pump Stations on Tampa Bypass Canal (H404)	$486,428	$1,236,428	SWFWMD	3.9 mgd	TBPR
3.4	Haines City Reclaimed Water MFL Recharge & Advanced Treatment Feasibility Study (N888)	$225,000	$357,710	SWFWMD, Haines City	0.7 mgd	HPR
3.5	Lake Hancock Lake Level Modification (H008)	$9,989,166	$10,428,490	SWFWMD, State of FL, Federal	TBD	HPR, SPR
3.6	Aquifer Recharge for SWIMAL Recovery at Flatford Swamp with Natural Systems Enhancement(H089)	$5,044,012	$31,000,000	SWFWMD	10.0 mgd	SPR, HPR

Note: Tampa Bay Planning Region (TBPR); Southern Planning Region (SPR); Heartland Planning Region (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 South Hillsborough Aquifer Recharge Program (SHARP) (N287)

This is an aquifer recharge (AR) pilot testing project that will design, permit, construct, and test a 2 mgd reclaimed water UFA recharge well in the MIA of the SWUCA. The project will beneficially use reclaimed water and improve aquifer levels in the MIA to help meet the SWIMAL defined in the SWUCA Recovery Strategy.

1.2 Bradenton Aquifer Protection Recharge Well (N842)

The project is for design, permitting, construction, and testing of one recharge well in the Avon Park production zone of the UFA and associated facilities to help prevent nutrient loading to the Manatee River and Tampa Bay and to replenish groundwater in the MIA. The third-party review will provide necessary information to support District funding past the 30 percent design to final design, permitting, and construction.

1.3 PRMRWSA Partially Treated Water ASR (N854)

The project consists of site feasibility testing, 30 percent design, and third-party review of a partially treated water Aquifer Storage and Recovery (ASR) project located at the PRMRWSA ASR facility. Feasibility pilot testing will be implemented using partially treated surface water pumped from Reservoir No. 1 to recharge the UFA at two existing ASR wells and subsequently delivered back to the raw water reservoir system. The third-party review will provide the necessary information on construction costs and project benefits to support District funding in future years to complete design, permitting, and construction.

1.4 Southern Hillsborough Aquifer Recharge Project (SHARP) Phase 2 (N855)

This project is for a third-party review of the County's 30 percent design, completion of design and permitting, and the initiation of construction for Phase 2 of the SHARP. Pending third-party review and approval, the project will construct 9,500 feet of transmission mains, two reclaimed water recharge wells (2 mgd each), eight monitoring wells, and associated appurtenances. The SHARP expands upon the county's current recharge project (N287).

1.5 Braden River Utilities ASR Feasibility (N912)

This project will perform a third-party review for reclaimed water ASR feasibility studies at two sites. Pending the review, the project may include the construction of an ASR well at each site, monitoring wells, and partial infrastructure necessary to sufficiently and cost-effectively perform two cycle tests in accordance FDEP permit requirements.

1.6 Hydrogeologic Investigation of LFA 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 Lower Floridan characteristics and groundwater quality. Three sites have been identified. At each site, if the tests on the initial exploration monitor well drilled are positive, a test production well may be constructed to conduct an aquifer performance test to obtain transmissivity and leakance information and to determine the quality of the formation water. The data gathered from the wells will improve the District's understanding of this potential alternative water supply (AWS) source, enhance groundwater modeling of the LFA, and determine the practicality of developing the LFA as an AWS source in areas facing future water supply deficits. Data from this project will also add to the geologic inputs in the Districtwide Regulation Model (DWRM) for the LFA to assess potential withdrawal-related impacts to water resources in the District. If the tests prove that the water quality and quantity are suitable, the water may be used by the regional entity established in Polk County as an additional source of public water supply.

1.7 Optical Borehole Imaging Data Collection from LFA Wells (P925)

This project collects optical borehole imaging data from LFA wells in Polk County. This data will aid in understanding the aquifer characteristics and groundwater quality in Polk County. The USGS is testing and providing the processed data to the District. Currently, nine LFA well sites have been identified for testing.

1.8 Sources/Ages of Groundwater in LFA Wells (P926)

This project collects isotope data from LFA wells from various sites in Polk County. The groundwater analysis will determine the sources and ages of the water from productive zones within the LFA and lower portions of the UFA. This data will aid in understanding the LFA characteristics (including flow paths) and groundwater quality in Polk County. The USGS is testing and providing the processed data to the District. Currently, six LFA well sites have been identified for testing.

1.9 City of Venice Reclaimed Water Aquifer Storage Recovery (ASR) (Q050)

This project is for the 30 percent design and third-party review of an ASR system to store and recover at least 25 million gallons per year of reclaimed water on-site at the City's Eastside Water Reclamation Facility, an advanced wastewater treatment plant. If constructed, ASR would let the City store excess reclaimed water in the wet season, to be used in the dry season when demand exceeds plant flow. The City has self-funded a feasibility study for FY2019, which will clarify project requirements, but its planning level study expects two production wells (1 mgd capacity each).

1.10 Direct Aquifer Recharge-North Hillsborough Aquifer Recharge Program Phase 2 (Q064)

This project includes completion of a direct AR feasibility study, which includes the construction and testing of three exploratory wells necessary to evaluate recharge locations for the North Hillsborough Aquifer Recharge Program (NHARP). If approved, the study will aid in the determination of the hydrogeological characteristics and water quality of the targeted Avon Park

Formation of the UFA and the approximate depth of the base of the underground source of drinking water in the general vicinity of NHARP.

1.11 Direct Aquifer Recharge-South Hillsborough Aquifer Recharge Program Phase 3 (Q088)

This project is for the third-party review of the County's 30 percent design, completion of design, permitting, construction, testing, and Independent Performance Evaluation (IPE) for SHARP Phase 3. The Phase 3 project, if approved, will design, permit, construct, and test three recharge wells (2 mgd each) and design and construct well heads, appurtenances, monitoring wells, and approximately 4,000 feet (ft) of pipelines to connect the recharge wells to existing reclaimed water transmission mains. This project expands upon the County's current recharge projects resulting in six recharge sites anticipated to recharge approximately 14 mgd collectively.

2.0 Facilitating Agricultural Resource Management Systems 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, (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) reduce UFA groundwater use and nutrient loading impacts in the Springs Coast, and (5) reduce frost-freeze pumpage by 20 percent within the DPCWUCA. These goals are critical in the District's overall strategy to manage water resources.

2.1 FARMS Cost-Share Projects

Facilitating Agricultural Resource Management Systems (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. Facilitating Agricultural Resource Management Systems (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 have been board approved since FY 2020 is provided in Table 7-3.

As of September 2019, there were 208 approved FARMS projects including 44 within the Heartland Planning Region. These projects are projected to have a cumulative groundwater offset of 4.36 mgd.

Table 7-3. *Specific FARMS cost-share projects within the Heartland Planning Region funded post-FY 2015*

Project Description	District Budget FY2015-2019	Benefit (mgd)
Dean Evans Phase 2	$17,744	0.006
Windmill Farms - Phase 2	$156,974	0.043
ALICO - POLK CO	$54,702	0.020
Tamiami Citrus - Bee Branch Grove	$250,645	0.084
Keith Davis	$95,400	0.025
KLM Farms, LLC AWS	$221,938	0.043
Pebbledale Farms, INC.	$553,799	0.184
Reynolds Farms, Inc - Annes Block	$99,749	0.033
Total	**$1,450,951**	**0.44**

Notes: Projects were selected by funds budgeted in years FY2015 to FY2019, meeting District RWSP definition of "projects under development." The benefit is based on projected offset., Sources: 2017 – 2018 Biennial FARMS Report.

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, DPCWUCA 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 $8,000 per agricultural operation per year, and the maximum cost-share rate is 75 percent of project costs.

From FY2006 through FY2018, the District's portion of the Mini-FARMS Program has reimbursed 159 water conservation BMP projects. The total cost of the Mini-FARMS projects was $ 856,086 and the District's reimbursement was $ 597,256. The Mini-FARMS Program continues to receive a strong demand from growers within the District, and it is projected that at least $150,000 will be budgeted for projects annually.

2.3 FARMS Irrigation Well Back-Plugging Program

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

A total of 85 wells have been back plugged in the SWUCA through FY2014, with 63 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 Minimum Flows and Levels Recovery Projects

As of FY2020, the District has six ongoing ER and MFL recovery projects that benefit water resources. The Lower Hillsborough River Recovery Strategy, Lower Hillsborough River Pumping Facilities, and Pump Stations on the Tampa Bypass Canal (TBC) projects are in the Tampa Bay Planning Region. The Haines City Reclaimed Water MFL Recharge and Advanced Treatment Feasibility Study and the Lake Hancock Lake Level Modification projects are in the Heartland Planning Region. The Upper Myakka/Flatford Swamp Hydrologic Restoration and Implementation project is in the Southern Planning Region.

3.1 Lower Hillsborough River Recovery Strategy (H400)

The District established revised MFLs for the Lower Hillsborough River in 2007. Because the MFLs were not being met, the District incorporated a recovery strategy for the river into Rule 40D-80.073(8), F.A.C. As part of the recovery strategy, the District entered into a joint funding agreement and additional project-specific agreements with the City of Tampa to assess and implement projects associated with diversion of water from various sources to meet minimum flow requirements in the river.

3.2 Lower Hillsborough River Pumping Facilities and
3.3 Pump Stations on the Tampa Bypass Canal

In accordance with the recovery strategy, the City has diverted water from Sulphur Springs to the base of the Hillsborough River Reservoir Dam, as necessary to support river recovery. In addition, the District and more recently the City have diverted water from the Tampa Bypass Canal to the Hillsborough River Reservoir for subsequent diversion to the lower river. The City assumed responsibility for these diversions from the canal through the reservoir in 2018, with transfers of water from the reservoir to the lower river made using a newly constructed sluice gate in the dam that was cooperatively funded by the District and the City. In 2017, the City, with support from the District, completed the Blue Sink Project, which facilitates diversion of water from Blue Sink to the base of the dam for minimum flow recovery, and use of the sink as a recovery source was initiated in 2018. A project between the District and City associated with investigation of storage or additional supply options was completed in 2018 and identified the proposed Tampa Augmentation Project as a potential source for additional water that may be needed for recovery of the lower river. Permitting, design and permit-required monitoring associated with a project involving potential diversion of water from Morris Bridge Sink for river recovery have also been completed, although project implementation is contingent upon future recovery need assessments.

3.4 Haines City Reclaimed Water MFL Recharge and Advanced Treatment Feasibility Study (N888)

This project is for the evaluation of reclaimed water recharge sites, components, and advanced treatment necessary to assist in meeting MFLs on Lake Eva in the “Ridge Lakes” area of the CFWI.

3.5 Lake Hancock Lake Level Modification (H008)

This project is part of the recovery strategy to restore minimum flows in the upper Peace River, which is one of the four goals defined in the SWUCA Recovery Strategy. The project involved raising the control elevation of the existing outflow structure on Lake Hancock in order to slowly release the water during the dry season to help meet the minimum flow requirements in the upper Peace River between Bartow and Zolfo Springs. Increasing the operating level also helps restore wetland function for several hundred acres of contiguous lands to Lake Hancock and provide recharge to the UFA through exposed sinks along the upper Peace River. Construction is complete and the project is currently in the monitoring phase.

3.6 Aquifer Recharge for SWIMAL Recovery at Flatford Swamp with Natural Systems Enhancement (H089)

Hydrologic alterations and excess runoff have adversely impacted the Flatford Swamp in the upper Myakka watershed, and quantities of water should be removed from the swamp and surrounding areas to restore hydroperiods close to historic levels. The District has conducted evaluations to explore potential beneficial uses of water. In 2016, evaluations began on an injection recharge option that would use excess flow affecting the swamp to recharge the UFA in the vicinity of the MIA of the SWUCA to slow saltwater intrusion. The recharge system would assist with the SWUCA Recovery Strategy’s goal of meeting the SWIMAL to help recover and protect groundwater resources in/near the MIA. The ongoing evaluation includes construction of test recharge wells in the Flatford Swamp and the design and permitting of diversion infrastructure for source water.

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 2040 and restore minimum flows and levels (MFLs) to impacted natural systems.

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 209.7 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 2015 to 2040*

Planning Region	Projected Demand Increase
Heartland	38.9
Northern	50.4
Southern	44.4
Tampa Bay	76.0
Total	**209.7**

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 water supply development (WSD) projects (Table 8-2). The District anticipates that a large portion of the remaining demand will be met through projects that users will select from the water supply options listed in Chapter 5 of this RWSP.

The amount of funding that will likely be generated through 2040 by the various utility, District, state, and federal funding mechanisms is compared to the capital cost of the potential large-scale projects. This comparison allows an evaluation of funding adequacy for support of projects necessary to meet water demands.

Part A. Statutory Responsibility for Funding

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

Water supply development 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 variety 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. Community development districts (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 (TBW), 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.

While some utility 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 ratepayers 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 (WRAP), the state's Florida Forever Program, the District's Facilitating Agricultural Resource Management Systems (FARMS) Program, and Florida Department of Environmental Protection (FDEP) funding for the Springs Initiative.

1.0 Cooperative Funding Initiative

The primary funding mechanism is the District's CFI, which includes funding for major regional water supply and WRD 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, this highly successful program has resulted in a combined investment (District and cooperators) of approximately $3.3 billion for a variety of water projects addressing the District's four areas of responsibility: (1) water supply, (2) natural systems, (3) flood protection, and (4) water quality. From Fiscal Year (FY)2016 through FY2020, the District's adopted budget included an average of $56.8 million in ad valorem tax dollars for the CFI program, of which $30 million (53 percent) was for WRD and water supply assistance.

2.0 District Initiatives

Projects funded through the District Initiatives program are 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 Utilities Services Group to conserve water by assisting utilities in controlling their water loss, (3) data collection and analysis to support major District initiatives such as the MFL program, (4) the FARMS program, and other various agricultural research projects designed to increase the water-use efficiency of agricultural operations, (5) water resource development investigations and MFL Recovery projects which may not have local cooperators, and (6) the Water Incentives Supporting Efficiency (WISE) program launched in 2019 offers cost-share funding for a wide variety of water conservation projects (max of $20,000 per project) to non-agricultural entities. From FY2016 through FY2020, the District's adopted budget included an average of $24.5 million in ad valorem tax dollars for District Initiatives, of which $9 million (37 percent) was for WRD and WSD assistance.

The average total commitment from FY2016 through FY2020 for CFI and District Initiatives was approximately $81.3 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 its 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 FDEP 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, to reduce groundwater withdrawals and nutrient loading within first-magnitude springsheds, and to improve the water quality and quantity of spring discharges. Projects include the reestablishment of aquatic and shoreline vegetation near spring vents, construction of infrastructure necessary to convey wastewater currently treated in septic systems or package plants to a centralized wastewater treatment facility and may increase reclaimed water production and implementation of other best management practices (BMPs) within springshed basins.

The first year of the appropriation was FY2014, when the District received $1.35 million from FDEP to allocate for springs restoration. To date, the District has been allocated over $55.2 million in Springs Restoration funding from FDEP, including $19.25 million for FY2020, of which $7 million will be budgeted in future years. This funding has provided for reclaimed water projects that will provide approximately 4 mgd in additional reuse flows and 5 mg in reclaimed water storage. Projects receiving Springs Initiative funding have primarily 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

Large areas of Florida do not have sufficient traditional water resources to meet the future needs of the state's growing population and the needs of the environment, agriculture, and industry. The state's Water Protection and Sustainability Program Trust Fund (WPSPTF) was created in the 2005 legislative session through Senate Bill 444 to accelerate the development of alternative water sources (AWSs) and later recreated in Chapter 373, F.S., as part of the 2009 legislative session. Legislation focused on encouraging cooperation in the development of (AWSs) and improving the linkage between local governments' land use plans and water management districts' RWSPs. The program provides matching funds to the District for alternative WSD assistance. From FY2006 through FY2009, the District received a total of $53.75 million in legislative allocations through the program for WSD projects. Annual WPSPTF funding resumed in FY2020 with $250,000 allocated to the District.

Program funds are applied toward a maximum of 20 percent of eligible project construction costs. In addition, the Legislature 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. The legislation also requires that a minimum of 80 percent of the WPSPTF funding must be related to projects identified in a district water supply plan. The District's RWSP is utilized in the identification of the majority of WPSPTF-eligible projects.

Projects are evaluated for funding based on consideration of the 12 factors described in Subsections 373.707(8)(f) and (g), F.S., and additional District evaluation factors as appropriate. If the Legislature continues to fund the state's Water Protection and Sustainability Program, it could serve as a significant source of matching funds to assist in the development of AWSs and regional supply infrastructure in the region.

3.0 The Florida Forever Program

The Florida Forever Act, as originally passed by the Florida Legislature in 1999, established the 10-year $3 billion statewide Florida Forever Program. The Program was extended by the Legislature during the 2008 legislative session, allowing the Program to continue for 10 more years at $300 million annually. 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., 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 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 FY2016 through FY2020.

5.0 West-Central Florida Water Restoration Action Plan

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 SWUCA. 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, however, no new funding has been provided via state appropriation since that time.

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 FDEP, 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 AWS 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 STAG projects for several years, so future funding for individual projects through this mechanism is uncertain. Congressional authorization through the Water Resources 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 FDEP, the United States Army Corps of Engineers (USACE), and the members of the Florida Congressional Delegation to secure federal funding.

1.0 U.S. Department of Agriculture Natural Resources Conservation Service programs

The Natural Resources Conservation Service's (NRCS) 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 FY2018, 41 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: (1) competition and economies of scale enjoyed by regional or national construction/operation firms or teams that 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, TBW 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. One example of this structure is the Polk Regional Water Cooperative, formed in 2016 to address the development and provision of alternative water supply sources to its member local governments. 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.

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

Below is a summary of projected resources that could be generated by the District and state funding programs for WRD and water supply development projects. An explanation follows as to how the funding amounts are derived.

1.0 Cooperative Funding Initiative

With the Governing Board's direction for a continued investment in vital projects to protect the region's water resource needs, the District's most recent long-range funding plan estimated $1.33 billion in ad valorem tax dollars would be allocated for the CFI from 2021 through 2040. Assuming these funds are used for projects that would be matched by a partner on an equal cost-share basis, this would collectively result in $2.66 billion generated through this program. If the funding allocation summary of the program remains consistent with the previous five years, approximately $1.41 billion (53 percent) could potentially be utilized for water source development and water supply development assistance. However, the allocation of resources is typically driven by new requests submitted through the CFI program each year, which could significantly influence this funding projection, as the Governing Board may direct more funding for the District's other areas of responsibility (i.e., flood protection, water quality, and natural systems). It is important to note that funding does not include state or federal funds, which the District and its partners continue to seek.

2.0 District Initiatives

Also consistent with the District's most recent long-range funding plan, an estimated $579 million in ad valorem tax dollars would be allocated for District Initiatives from 2021 through 2040. If the funding allocation of the program remains consistent with the previous five years, approximately $214 million (37 percent) could potential be utilized for water source development and water supply development assistance. However, the allocation of resources is typically driven by strategic priorities which could significantly influence this funding projection, as the Governing Board may direct more funding for the District's other areas of responsibility (i.e., flood protection, water quality, and natural systems.) It is important to note that funding does not include state, federal, or local funds, which the District continues to seek.

3.0 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.

4.0 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.

5.0 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.

If funding allocations remain consistent with the previous five years, approximately $1.62 billion could potentially be generated or made available to fund the CFI and District Initiatives projects necessary to meet the water supply demand through 2040 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.

Section 2. Evaluation of Project Costs to Meet Projected Demand

Of the 209.7 mgd of Districtwide projected demand increases during the 2015–2040 planning period to meet the demand for all users and to restore MFLs for impacted natural systems, it is estimated that 46 mgd, or 22 percent of the demand, has either been met or will be met by reclaimed water and conservation projects that are under development. The total District share of cost for the projects currently under development including regional transmission, ASR, and brackish groundwater treatment systems is $490 million.

To develop an estimate of the capital cost of projects necessary to meet demand, the District compiled a list of large-scale WSD projects proposed for development within the 2040 planning horizon. Projects proposed by the PRMRWSA, TBW, and the Polk Regional Water Cooperative could produce up to 105 mgd of water supply. Estimated costs and the quantity of water these projects will produce are listed in Table 8-2. 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 100 to 105 mgd of water supply that will be produced by these projects is up to $1.81 billion.

The Polk Regional Water Cooperative's (PRWC) Annual Comprehensive Water Resources Report FY2020-2021 contains several AWS projects, many of which would be eligible for co-funding by the District. The PRWC's priority projects would provide for up to 45 mgd in additional AWS capacity with a capital cost estimate of approximately $650 million.

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.

Table 8-2. *Proposed large-scale water supply and WRD projects by 2040 (millions of $)*

Project	Entity to Implement	Quantities (mgd)	Capital Costs
Peace River Facility Surface Water System Expansion and Regional Reservoir	PRMRWSA	15	$332
Phase II Capacity Expansion, New RO Water Treatment Plant, and Regional Loop System	PRMRWSA	10	$365
Aquifer Recharge for SWIMAL Recovery at Flatford Swamp with Natural Systems Enhancement	TBD	10	$31
Southeast Wellfield and West Polk County Lower Aquifer Deep Wells	PRWC	45	$650
Big Bend Desalination	Tampa Bay Water	10-12.5	$244
Enhanced Surface Water Expansion from Alafia River	Tampa Bay Water	10-12.5	$88
New Regional Feed Line to Balm Area	Tampa Bay Water	N/A	$76-97
Subtotal Southern Planning Region		**35**	**$728**
Subtotal Heartland Planning Region		**45**	**$650**
Subtotal Tampa Bay Planning Region		**20-25**	**$408-429**
Total – Districtwide		**100-105**	**$1,786-1,807**

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

The conservative estimate of $2.66 billion in cooperator and District financial resources that will be generated through 2040 for funding is sufficient to meet the projected $1.79 to $1.81 billion total cost of the large-scale projects listed in Table 8-2. State and federal funding sources may also assist with any remaining and/or 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.

References (Listed by Chapter)

Chapter 1

Barcelo, M.D. and R.J. Basso, 1993. *Computer model of ground-water flow in the Eastern Tampa Bay Water Use Caution Area*. Southwest Florida Water Management District, Resource Projects Department, Resources Evaluation Section, Brooksville, FL.

Beach, M. and Chan, D., 2003. *Southern District Ground-Water Flow Model: Version 1.0. Southwest Florida Water Management District, Hydrologic Evaluation Section*. Brooksville, FL.

Beach, M, 2006. *Southern District Ground-Water Flow Model: Version 2.0, A Southwest Florida Water Management District Technical Report, Resource Conservation and Development Department, Hydrologic Evaluation Section*. August 2006.

Environmental Simulations, Inc., 2004. *Development of the Districtwide Regulation Model for Southwest Florida Water Management District*. Consultant's report submitted to the Southwest Florida Water Management District. Brooksville, FL.

Environmental Simulations, Inc., 2007. *Refinement of the Districtwide Regulation Model for Southwest Florida Water Management District*. Consultant's report submitted to the Southwest Florida Water Management District. Brooksville, FL.

Environmental Simulations, Inc., 2011. *Technical Memorandum: Modifications Made to DWRM Version 2.1*, 14 pp.

Environmental Simulations, Inc., 2014. *Development and Calibration of the District Wide Regulations Model Version 3 for Southwest Florida Water Management District.* Consultant's report submitted to the Southwest Florida Water Management District. Brooksville, FL.

HydroGeoLogic, Inc.1993. SIMLAS: *Saltwater Intrusion Model for Layered Aquifer Systems; Version 1.3; Code Documentation and Users Guide*; HydroGeoLogic, Inc.; Herndon, VA.

HydroGeoLogic, Inc.1994; *Modeling assessment of the Regional Freshwater-Saltwater Interface in the Eastern Tampa Bay Water Use Caution Area*, prepared for Southwest Florida Water Management District; HydroGeoLogic, Inc.; Herndon, VA, for the Southwest Florida Water Management District. HydroGeoLogic, Inc., 2002.

HydroGeoLogic, Inc., 2002. *Numerical Modeling of Saltwater Intrusion in the Southern District. Consultant's Report submitted to the Southwest Florida Water Management District*. Brooksville, FL.

HydroGeoLogic, Inc., 2011, *Computer Flow and Saltwater Intrusion Model for the Northern District Water Resources Assessment Project*, Version 3.0.

Menke, C.G., Meredith, E.W., and Wetterhall, W.S., 1961. *Water resources of Hillsborough County, FL: Florida Geological Survey Report of Investigations No. 25*, 101 pp.

Metz, P.A., and Lewelling, B.R., 2009, *Hydrologic Conditions that Influence Streamflow Losses in a Karst Region of the Upper Peace River, Polk County, Florida: U.S. Geological Survey Scientific Investigations Report 2009-5140*, 82 pp.

Miller, J.A. 1986. *Hydrogeologic framework of the Floridan aquifer system in Florida and in parts of Georgia, Alabama, and South Carolina: U.S. Geological Survey Water-Resources Investigations Report 84-4135*, 69 pp.

Sepulveda, N., 2002. *Simulation of Ground-Water Flow in the Intermediate and Floridan Aquifer Systems in Peninsular Florida, U.S. Geological Survey Water Resources Investigations Report 02-4009.*

SWFWMD, 1989. *DRAFT: Highlands Ridge Work Group Report*. Brooksville, FL.

SWFWMD, 1990. *DRAFT: Eastern Tampa Bay Work Group Report*. Brooksville, FL.

SWFWMD, 1992. DRAFT: Water Supply Needs & Sources: 1990-2020. Brooksville, FL.

SWFWMD, 1993. *Surficial Aquifer Yield Assessment – SWUCA EIS, SWFWMD Technical Memorandum.*

SWFWMD, 1998. *Southwest Florida Water Management District Water Supply Assessment*, Brooksville, FL.

SWFWMD, 2001. *Southwest Florida Water Management District 2000 Regional Water Supply Plan.* Brooksville, FL.

SWFWMD. 2006a. *Southern Water Use Caution Area Recovery Strategy*. March 2006 Final Report. Southwest Florida Water Management District, Brooksville, FL, 305 pp.

SWFWMD, 2006b. *Southwest Florida Water Management District 2006 Regional Water Supply Plan*. Brooksville, FL.

SWFWMD. 2013. *Southern Water Use Caution Area Recovery Strategy: Five Year Assessment for FY2007-2011. November 2013 Final Report*. Southwest Florida Water Management District, Brooksville, Florida, 31 pp.

SWFWMD. 2018. Southern Water Use Caution Area Recovery Strategy Five-Year Assessment for FY2012-2016. Brooksville, Florida.

Wolansky, R.M., 1983. *Hydrogeology of the Sarasota-Port Charlotte Area, Florida: U.S.G.S. Water Resources Investigation 82-4089*, 48 pp.

Yobbi, D.K., 1996. *Analysis and simulation of ground-water flow in Lake Wales Ridge and adjacent areas of central Florida. U.S. Geological Survey Water Resources Investigation Report* 94-4254, 82 pp.

Chapter 2

Bates BC, Kundzewicz ZW, Wu S, Palutikof JP, Eds. 2008. *Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change*, IPCC Secretariat, Geneva. 210 pp.

Butler, William et al, 2013. *Sea Level Rise Projection Needs Capacities and Alternative Approaches*. Florida Planning and Development Lab, Department of Urban and Regional Planning, Florida State University. Prepared for the Florida Department of Economic Opportunity.

Cameron, C, M. Kelly, and R. Basso. 2018. *Summary Statistics of Rainfall Data for Sites in West-Central Florida.* Southwest Florida Water Management District.

Climate Science Advisory Panel (CSAP). 2019. *Recommended Projections of Sea Level Rise for the Tampa Bay Region (Update)*. 14 pp.

Groisman PY, Knight RW, Easterline DR, Karl TR, Hegerl GC, Razuvaev VN. 2005. *Trends in Intense Precipitation in the Climate Record*, *Journal of Climate, Volume 18*, 1326 – 1350.

IPCC, 2018. Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

Sweet, W.V., R.E. Kopp, C.P. Weaver, J. Obeysekera, R.M. Horton, E.R. Thieler, and C. Zervas. 2017. *Global and Regional Sea Level Rise Scenarios for the United States.* NOAA.

SWFWMD. 2006. *Southern Water Use Caution Area Recovery Strategy*. March 2006 Final Report. Southwest Florida Water Management District, Brooksville, Florida, 305 pp.

SWFWMD. 2013. *Southern Water Use Caution Area Recovery Strategy: Five Year Assessment for FY2007-2011*. November 2013 Final Report. Southwest Florida Water Management District, Brooksville, Florida, 31 pp.

USACE, 2014. *Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation*. Technical Letter No. 1100-2-1, June 30, 2014. Department of the Army. Washington D.C. Numerical projections for St. Petersburg were calculated using the USACE online calculator, Accessed Sept. 25, 2014: http://www.corpsclimate.us/ccaceslcurves.cfm.

Chapter 3

D.L. Smith and Associates, 2004. *Southwest Florida Water Management District Irrigation Well Inventory, Consultant's report submitted to the Southwest Florida Water Management District*, Brooksville, FL.

FDEP et al., 2019. *Format and Guidelines for Regional Water Supply Planning*; Florida Department of Environmental Protection. Tallahassee, FL.

SWFWMD, 2017. Water Use Well Package Database

Water Planning Coordination Group (WPCG), 2005. *Final Report: Development and Reporting of Water Demand Projections in Florida's Water Supply Planning Process for the 2005 Water*

Supply Plan. Prepared by Water Demand Projection Subcommittee and the 1-in-10 Year Drought Subcommittee of the Water Planning Coordination Group; Florida Department of Environmental Protection; Northwest Florida Water Management District; South Florida Water Management District; Southwest Florida Water Management District; St. Johns River Water Management District; Suwannee River Water Management District for Florida Department of Environmental Protection, September 2001.

Chapter 4

Alliance for Water Efficiency, 2019. Water Conservation Tracking Tool, Version 3.0. Chicago, IL

Basso, Ron, 2009. Technical Memorandum: An Evaluation of Future Water Supply Yield from the Surficial and Intermediate Aquifer Systems in the Southwest Florida Water Management District. Southwest Florida Water Management District, Brooksville, FL.

Central Florida Water Initiative (CFWI), 2020. *2020 Central Florida Water Initiative Regional Water Supply Plan*.

FDEP, 2019. *2018 Reuse Inventory*. Tallahassee, FL.

Dukes, M.D. and M.J. Boyer, 2018. "Determination of Landscape Irrigation Water Use in Southwest Florida (B283)." Institute of Food and Agricultural Sciences, University of Florida.

Dziegielewski, B. J.C. Keifer, E.M. Optiz, G.A. Porter, G.L. Lantz, W. B. DeOreo, P.W. Mayer, and J.O. Nelson, 2000. Commercial and Institutional End Uses of Water. AWWA Research Foundation and the American Water Works Association, Denver, CO.

HSW Engineering, Inc., October 2004, Agricultural Conservation Update, Hollywood, FL.

McDiffett, W.F., 1981. Limnological Characteristics of Eutrophic Lake Istokpoga, FL. Florida Scientist, 44(3): 172-181

Miller, J.A. 1986. Hydrogeologic framework of the Floridan aquifer system in Florida and in parts of Georgia, Alabama, and South Carolina: U.S. Geological Survey Water-Resources Investigations Report 84-4135, 69 pp.

National Research Council of the National Academies. 2008. Desalinization, A National Perspective. The National Academies Press. Washington, D.C.

SFWMD, 2005. MFLs for Lake Istokpoga, West Palm Beach, FL.

SWFWMD, 2001. *Southwest Florida Water Management District 2000 Regional Water Supply Plan*. Brooksville, FL.

SWFWMD, 2006. *Southern Water Use Caution Area Recovery Strategy*. Brooksville, FL.

SWFWMD, 2011. *Southwest Florida Water Management District 2010 Regional Water Supply Plan*. Brooksville, FL.

SWFWMD, 2013. *Southern Water Use Caution Area Recovery Strategy Five-Year Assessment for FY2007-2011*. Southwest Florida Water Management District, Brooksville, FL.

SWFWMD, 2015. *Southwest Florida Water Management District 2015 Regional Water Supply Plan.* Brooksville, FL.

SWFWMD, 2019. *2018 Estimated Water Use Report*. Southwest Florida Water Management District, Brooksville, FL.

Vickers, Amy, 2010. *Handbook of Water Use and Conservation.* WaterPlow Press, Amherst, MA. 94 pp.

Chapter 5

Alliance for Water Efficiency, 2019. Water Conservation Tracking Tool, Version 3.0. Chicago, IL

Central Florida Water Initiative, 2020. *2020 Central Florida Water Initiative Regional Water Supply Plan*.

FDEP, 2019. *2018 Reuse Inventory*. Tallahassee, FL.

Dukes, M.D. and M.J. Boyer, 2018. "Determination of Landscape Irrigation Water Use in Southwest Florida (B283)." Institute of Food and Agricultural Sciences, University of Florida.

Mayer, P. W. (2004). The Impacts of High Efficiency Plumbing Fixture Retrofits in Single-Family Homes. Boulder: Aquacraft, Inc. Water Engineering and Management.

Vickers, Amy, 2010. *Handbook of Water Use and Conservation.* WaterPlow Press, Amherst, MA. 94 pp.

Chapter 6

No references

Chapter 7

No references

Chapter 8

American Water Works Association, 2004. *Avoiding Rate Shock: Making the Case for Water Rates*. ISBN 978-1-58321-334-6 – Cat. No. 20570. 131 pp.

American Water Works Association, 2005. *Thinking Outside the Bill: A Utility Manager's Guide to Assisting Low Income Water Customers*. ISBN 1-58321-359-7 – Cat. No. 20594. 52 pp.

Kulakowski, Walter. *Private Partnerships: Pros and Cons*. Presented to the Florida Section of the American Water Resources Association. July 29, 2005. Key West.

Office of Program Policy Analysis and Governmental Accountability, 1999. *Florida Water Policy: Discouraging Competing Applications for Water Permits; Encouraging Cost-Effective Water Development*. 45 pp.

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