2015
Regional Water Supply Plan

Tampa Bay Planning Region

November 17, 2015

Prepared by:

Southwest Florida
Water Management District
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With the Assistance of:

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Southwest Florida Water Management District

2015 Regional Water Supply Plan

This report is produced by the Southwest Florida Water Management District

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List of Abbreviations

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

INTBM	Integrated Northern Tampa Bay Model
IPCC	Intergovernmental Panel on Climate Change
L/R	Landscape/Recreation
LFA	Lower Floridan aquifer
LFU	Low Flush Urinal
LHR	Lower Hillsborough River
MAL	Minimum Aquifer Level
MAPPZ	Minimum Aquifer Level Protection Zone
MCU	Middle Confining Unit
MCU I	Middle Confining Unit I (1)
MCU II	Middle Confining Unit II (2)
M/D	Mining/Dewatering
MFL	Minimum Flows and Levels
MGD	Million Gallons per Day
MG/L	Milligrams per Liter
MIA	Most Impacted Area
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTB	Northern Tampa Bay
NTBWUCA	Northern Tampa Bay Water Use Caution Area
O&M	Operation and Maintenance
OFW	Outstanding Florida Water
OPPAGA	Office of Program Policy Analysis and Governmental Accountability
PG	Power Generation
PRMRWSA	Peace River Manasota Regional Water Supply Authority
PRSV	Pre-rinse Spray Valve
PS	Public Supply
PSI	Pounds per Square Inch
QWIP	Quality of Water Improvement Program
RC&D	Florida West Coast Resource Conservation and Development Council
RIB	Rapid Infiltration Basin
RO	Reverse Osmosis
ROMP	Regional Observation & Monitor-well Program
RWSP	Regional Water Supply Plan
SCADA	Supervisory Control and Data Acquisition
SHP	Stormwater Harvesting Program
SJRWMD	St. Johns River Water Management District
SMS	Soil Moisture Sensor
STAG	State and Tribal Assistance Grants
SWCFGWB	Southern West-Central Florida Groundwater Basin
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management Program
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 Load

UFA	Upper Floridan aquifer
UG/L	Micrograms per Liter
ULFT	Ultra Low-Flow Toilet
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geologic Survey
WMD	Water Management District
WMIS	Water Management Information System
WMP	Watershed Management Program
WQMP	Water Quality Monitoring Program
WRAP	Water Resource Assessment Project or West-Central Florida Water Restoration Action Plan
WRD	Water Resource Development
WSD	Water Supply Development
WTF	Water Treatment Facility
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

Chapter 1. Introduction

The Regional Water Supply Plan (RWSP) for the Southwest Florida Water Management District (District) is an assessment of projected water demands and potential sources of water to meet these demands for the period from 2015 through 2035. The RWSP has been prepared in accordance with the Florida Department of Environmental Protection's (DEP) 2009 Format and Guidelines for Regional Water Supply Planning. The RWSP consists of four geographically-based volumes that correspond to the District's four designated water supply planning regions: Northern, Tampa Bay, Southern and Heartland (Figure 1-1). This volume is the 2015 RWSP update for the Tampa Bay Planning Region, which includes Hillsborough, Pasco, and Pinellas counties. The District completed RWSPs in 2001, 2006, and 2010 that included the Tampa Bay Planning Region.

The purpose of the RWSP is to provide the framework for future water management decisions in the District. The RWSP shows that sufficient alternative water sources for the Tampa Bay Planning Region (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 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 development. 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 in the RWSP or combine elements of different options that better 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 has been prepared pursuant to these provisions. Key components of this legislation included:

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

Regional water supply planning requirements were amended as a result of the passage of Senate Bill 444 during the 2005 legislative session. The bill substantially strengthened requirements for the identification and listing of water supply development projects. In addition, the legislation was 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.

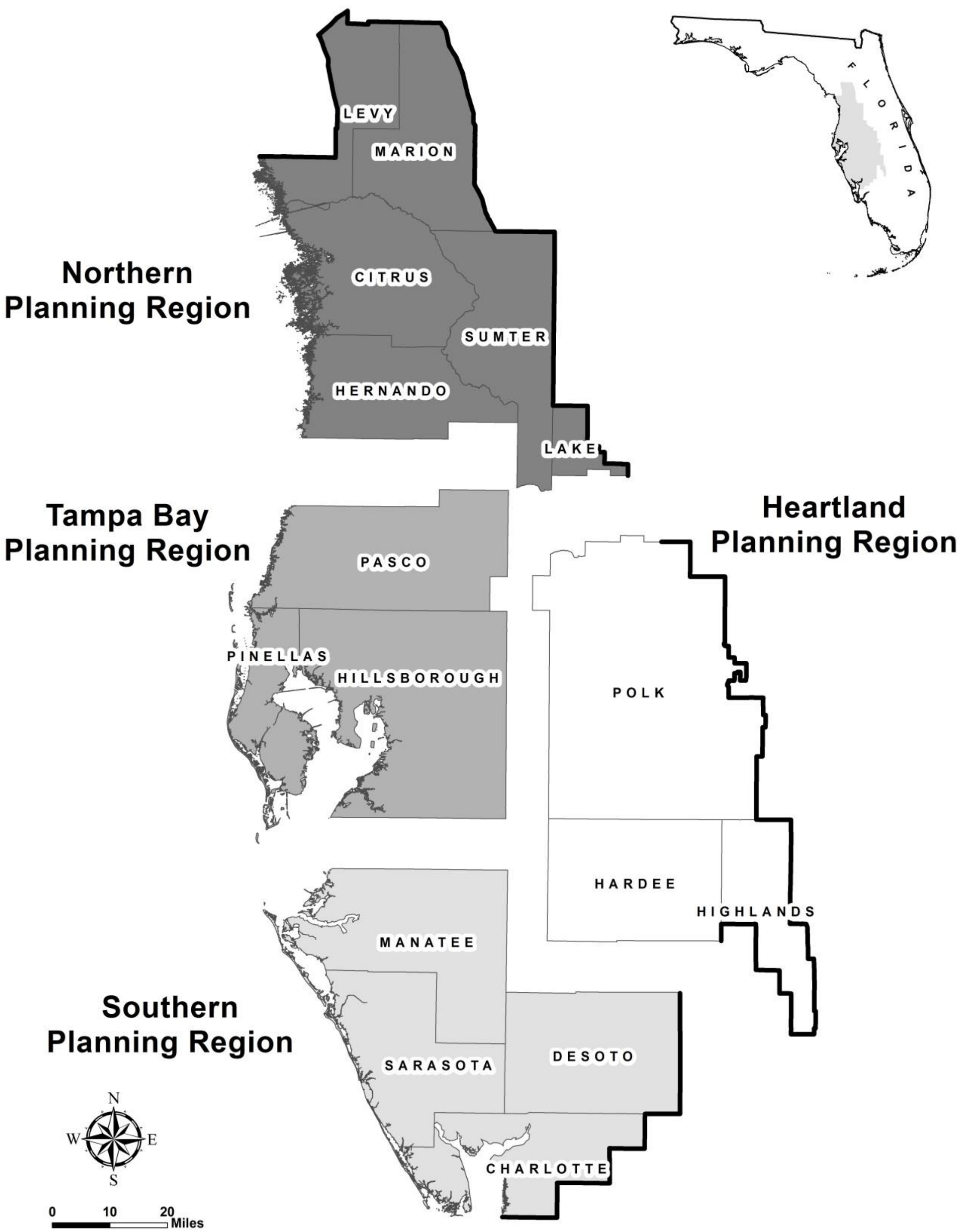

Figure 1-1. *Location of the four water supply planning regions within the District*

Part A. Introduction to the Tampa Bay Planning Region RWSP

The following describes the content of the Tampa Bay Planning Region RWSP: Chapter 1, Introduction contains an overview of the District's accomplishments in implementing the water supply planning objectives of the 2010 RWSP; a description of the land use, population, physical characteristics, hydrology and geology/hydrogeology of the area; and a description of the technical investigations that provide the basis for the District's water resource management strategies. Chapter 2, Resource Protection Criteria, addresses the resource protection strategies that the District has implemented or is considering implementing, including water use caution areas (WUCAs) and the District's minimum flows and levels (MFLs) program. Chapter 3, Demand Estimates and Projections, is a quantification of existing and projected water supply demand through the year 2035 for public supply, agricultural, industrial/commercial, mining/dewatering, power generation and landscape/recreation users and environmental restoration. Chapter 4, Evaluation of Water Sources, is an evaluation of the future water supply potential of traditional and alternative sources. Chapter 5, Water Supply Development Component, presents a list of alternative water supply development options for local governments and utilities, including surface water and stormwater, reclaimed water and water conservation. For each option, the estimated amount of water available for use and the estimated cost of developing the option are provided. Chapter 6 is an overview of water supply development projects that are currently under development and receiving District funding assistance. Chapter 7, the Water Resource Development Component, is an inventory of the District's ongoing data collection and analysis activities and water resource projects that are classified as water resource development. Chapter 8, Funding Mechanisms, provides an estimate of the capital cost of water supply and water resource development projects proposed by the District and its cooperators to meet the water supply demand projected through 2035 and to restore MFLs to impacted natural systems. An overview of mechanisms available to generate the necessary funds to implement these projects is also provided.

Part B. Accomplishments since Completion of the 2010 RWSP

The following is a summary of the District's major accomplishments in implementing the objectives of the RWSP in the planning region since the 2010 update was approved by the Governing Board in July 2011.

Section 1. Alternative Water Supply, Conservation and Reuse Development

1.0 Alternative Water Supply

The District provided cooperative funding to Tampa Bay Water (TBW) for their System Configuration II project and a surface water expansion study. The System Configuration II project, which was completed in 2011, expanded the capacity of TBW's surface water treatment plant and improved infrastructure within the regional system, resulting in a 25 mgd increase in the capacity of TBW's enhanced surface water system. The Long-Term Master Water Plan, which was completed in 2013, evaluated the availability of surface water from various sources, including the Alafia River and Bullfrog Creek.

The District has also provided cooperative funding for aquifer storage and recovery (ASR) and recharge projects within the region. Recharge feasibility and pilot testing projects funded include those for Hillsborough and Pasco counties and the City of Clearwater. ASR construction projects funded include Pinellas County and the cities of Oldsmar and Palmetto. The District has supported research efforts and pursuit of Underground Injection Control regulatory changes that have resulted in the issuance of an operational permit at the City of Tampa's Rome Avenue ASR facility. Moreover, District-initiated research resulted in development of a solution to the arsenic mobilization issue, which makes direct recharge projects possible and results in more cost-effective ASR projects.

Finally, the District provided cooperative funding to the cities of Oldsmar, Clearwater, and Tarpon Springs to augment water supplies by developing brackish groundwater wellfields and reverse osmosis membrane treatment facilities.

2.0 Water Conservation

The District continues to promote and cooperatively fund water conservation efforts to make more efficient use of existing water supplies. In the public supply sector, this includes cooperatively funded projects for plumbing retrofits, toilet rebates, rain sensor device rebates, water-efficient landscape and irrigation evaluations, soil moisture sensor device rebates, and pre-rinse spray valve rebates. In the planning region since 2010, the District has funded conservation projects undertaken by the Florida Governmental Utility Authority, Pasco and Pinellas counties, and the cities of New Port Richey, Port Richey, and St. Petersburg.

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

3.0 Reclaimed Water

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

In 2010, utilities within the region were utilizing approximately 40 perent or 91 mgd of the 226 mgd of available wastewater treatment plant flows resulting in nearly 60 mgd of water resource benefits (63 percent efficiency). In the planning region since 2010, 47 additional reclaimed water projects have been jointly undertaken with Pinellas, Hillsborough and Pasco counties, the cities of Clearwater, Dade City, Dunedin, Plant City, Oldsmar, New Port Richey, Tarpon Springs, Temple Terrace and Zephyrhills, and the Florida Government Utilities Authority. Of particular significance is the City of Clearwater's groundwater replenishment project, which is an innovative reclaimed water purification project that will produce 2.4 mgd of drinking water. As a result of these projects, an additional 23 mgd is anticipated to be supplied by 2020.

Section 2. Support for Water Supply Planning

In 2012, the District entered into a cooperative funding agreement with Pasco County to update its existing reclaimed water master plan. The update, which was completed in 2014, identified those areas in the County that could beneficially use reclaimed water, the amount of reclaimed water that the system can handle, upgrades and improvements needed to accommodate additional reclaimed water flows, how these flows can be routed to the best locations, and how these flows can be maximized to reduce groundwater withdrawals to further expand the beneficial use of reclaimed water in the Northern Tampa Bay WUCA (NTBWUCA). The update also evaluated regionalization of the County's master reuse system.

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

Section 3. Minimum Flows and Levels Establishment

1.0 Established MFLs

The MFLs established in the planning region during or since 2010 include those adopted in 2010 for the upper and lower segments of the Anclote River, the lower segment of the Alafia River, Lithia Springs, and Buckhorn Springs, and in 2012 or 2013 for lakes Carroll, Hooker, Raleigh, Rogers and Wimauma in Hillsborough County. A number of additional priority water bodies in the planning region have been scheduled for MFLs establishment, and as part of the Comprehensive Environmental Resources Recovery Plan for the NTBWUCA, several area MFLs are scheduled to be reevaluated (see Chapter 2, Part B, and Appendix 2).

2.0 MFLs Recovery Initiatives

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

The recovery strategy for lakes and wetlands in the NTBWUCA is primarily focused on reducing withdrawals from TBW's Central System Facilities to 90 mgd on a 12-month moving average basis as required in their water use permit (WUP). Through conservation efforts and development of an enhanced surface water system and a seawater desalination facility, this objective has been achieved since 2010.

The District established minimum flows for the lower Hillsborough River in 2007, along with a recovery strategy for achieving the minimum flows within a decade. As part of the recovery strategy, the District has entered into a joint funding agreement with the City of Tampa to implement a number of projects to divert water from various sources to meet the minimum flows. Two of the projects, involving changes to the weirs and pumping facilities at Sulphur Springs to allow diversion of more spring water to the lower river at the base of the Hillsborough River Dam, were completed in 2011 and 2012, respectively. In 2010, the District entered into a cooperative agreement with the City to fund a project for transfer of water from Blue Sink to the lower river. A WUP associated with the Blue Sink project was issued to the City in 2013, and the City has completed pipeline design for the project, selected an engineering firm for pumping station design and permitting activities, and is involved in obtaining applicable construction permits. The project is expected to be completed in 2015.

Several phases of another jointly funded project involving the investigation of other storage and supply options to meet recovery plan objectives for the lower river have been completed, with final project completion expected in 2015, following assessments of other recovery strategy elements that may be necessary. To promote timely recovery of the lower river, the recovery strategy required the District to divert water from the Tampa Bypass Canal (TBC) to the Hillsborough River Reservoir, and deliver a defined portion of this water from the reservoir to the lower river. This requirement has been addressed, as needed, since 2008, using temporary pumping facilities at Structure 161 (between the middle pool of the TBC), Structure 162 (between the middle and lower pools of the TBC), and at the Hillsborough River Dam. As part of the recovery strategy, the City of Tampa is to assume operation of pumping facilities used to divert water from the TBC middle pool to the reservoir and from the reservoir to the lower river. The District is currently preparing a cooperative funding agreement with the City to construct permanent pumping or water transfer facilities at Structure 161 and at the Hillsborough River Dam, both of which will be owned and operated by the City. Both facilities are expected to be completed in 2017. The District will continue to own and operate pumping facilities used for the recovery strategy at Structure 162. The District has also been moving forward with a project involving the pumping of water from Morris Bridge Sink to the TBC for delivery to the lower river to support minimum flow recovery. The District completed analyses supporting a permit application for withdrawals from the sink in 2014 that will be submitted to the DEP. In 2014, the District completed a required assessment of the effectiveness of completed recovery strategy elements.

Aerial view of the Tampa Bypass Canal in Hillsborough County

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

Since the 1970s, the QWIP has prevented waste and contamination of water resources (both groundwater and surface water) by plugging abandoned, improperly constructed artesian wells. The program focuses on the southern portion of the District where the UFA is under artesian conditions, creating the potential for mineralized water to migrate upward and contaminate other aquifers or surface waters. The program plugs approximately 200 wells per year and more than 6,000 wells have been plugged since inception. In the Tampa Bay Planning Region, 1,081 wells have been back-plugged 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 74 wells as of September 2014, with 55 of these in the target watersheds. Six of these wells were in the Tampa Bay Planning Region.

Section 5. Regulatory and Other Initiatives

For over 40 years, the farmers in the Dover/Plant City area pumped groundwater to protect their crops by irrigating when temperatures dropped below freezing. This had been a best management practice for many agricultural commodities such as strawberries, blueberries, citrus, nurseries and aquaculture. Because most farmers in the area turned on their irrigation systems to their full capacity all at the same time, it placed a tremendous strain on the aquifer, lowering groundwater levels. This, in turn, impacted residential wells and caused sinkholes to form. During an eleven-day freeze event in January, 2010, approximately 750 residential wells were impacted and more than 140 sinkholes were reported. In 2011, the District adopted a multifaceted, comprehensive management plan to address these impacts. In addition to declaring a 256 square mile area in the Dover/Plant City area a WUCA, new rules were adopted that established a minimum aquifer level (MAL) and related protection zone (MALPZ) and a recovery strategy to help meet the MAL.

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

Part C. Description of Tampa Bay Planning Region

Section 1. Land Use and Population

The Tampa Bay Planning Region encompasses approximately 2,120 square miles, covering all of Hillsborough, Pasco and Pinellas counties, in west-central Florida. This area is bounded on the west by the Gulf of Mexico, on the north by Hernando County, on the east by Polk County and on the south by Manatee County. Major cities within the area include Tampa, St.

Petersburg and Clearwater. Tampa Bay is the major surface water feature in the region. The region is characterized by a diversity of land-use types (Table 1-1), ranging from urban/built-up areas such as the cities of St. Petersburg, Clearwater, Tampa, Plant City, New Port Richey and Zephyrhills to predominantly agricultural land uses in the inland portions of Hillsborough and Pasco counties.

In southeastern Hillsborough County, the phosphate industry maintains significant processing operations and has been restoring large tracts of mined lands. However, mining operations continue to move southward as phosphate reserves at existing mines are depleted. The population of the planning region is projected to increase from approximately 2.9 million in 2010 to more than 3.7 million in 2035. This is an increase of approximately 800,000 residents, a 28 percent increase over the 25-year planning period. The majority of this population growth will be due to net migration.

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

Land Use/Land Cover Types (2011)	Acres	Percent
Urban and Built-up	520,928.50	38.45
Agriculture	233,385.18	17.23
Rangeland	34,825.18	2.57
Upland Forest	145,587.70	10.75
Water	45,447.35	3.35
Wetlands	256,447.35	18.91
Barren Land	3,528.38	0.26
Transportation, Communication and Utilities	41,420.74	3.06
Industrial and Mining	73,542.85	5.43
Total	**1,355,113.23**	**100.0**

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

Section 2. Physical Characteristics

The topography of the Tampa Bay Planning Region is largely a result of limestone dissolution and sediment deposition. Numerous closed depressions and sinkholes throughout the area reflect active solution of the underlying limestone. These sink features are especially prevalent in Hillsborough and Pasco counties and are the primary source of recharge to the underlying aquifers. Land surface elevations gradually increase from sea level at the gulf coast to a high of approximately 150 feet in eastern Pasco and Hillsborough counties. Pinellas County is largely characterized by hilly to flat uplands and level lowlands. The maximum elevation in Pinellas County is approximately 100 feet in the vicinity of Clearwater and Safety Harbor where a lineament of sandy ridges extends from Oakhurst northward to Tarpon Springs. Another rounded, 50-foot topographic high exists between Pinellas Park and St. Petersburg, with a diameter of five miles.

Section 3. Hydrology

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

1.0 Rivers

The planning region contains six major rivers and the TBC. The TBC is the former Six Mile Creek/Palm River that was extensively altered by construction of the TBC. The canal is designed to divert floodwaters from the Hillsborough River away from the cities of Tampa and Temple Terrace and into McKay Bay and is an important water source for the City of Tampa and TBW. The rivers include the Alafia, Little Manatee and Hillsborough, which discharge to Tampa Bay, and the Withlacoochee, Anclote and Pithlachascotee, which discharge to the Gulf of Mexico. There are many smaller tributaries to these systems as well as several coastal watersheds drained by small tidally influenced or intermittent streams.

2.0 Lakes

There are more than 150 named lakes with extensive water-level data in the planning region. Lakes greater than 20 acres in size are included in Figure 1-2. Many lakes were formed by sinkhole activity and some retain a hydraulic connection to the UFA. Others along the Brooksville Ridge in Pasco County are surface depressions perched on relatively impermeable materials that hydraulically isolate them from the UFA. Many of the lake systems are internally drained, while others are connected to river systems through natural streams or man-made canals. Many lakes have been altered by drainage and development, some with water-level control structures. Several lakes on or near TBW’s central system wellfields have been, or are currently, augmented with groundwater from the UFA.

3.0 Springs

Several second-magnitude springs (discharge between 10 and 100 cubic feet per second [cfs]) are located in the planning region. These include the Crystal Springs group in Pasco County, Wall (Health) and Crystal Beach springs in Pinellas County, and Sulphur, Lithia and Buckhorn springs in Hillsborough County. Crystal Springs is one of the principal springs on the Hillsborough River, though an appreciable decline in flow due to climatic and human causes has been noted over the past 40 years. Discharge of the spring group averaged 54 cfs (34.9 mgd) for the period of record (1923 to 2009); however, due to the difficulty of determining spring discharge during high-river stages, there is a large degree of uncertainty associated with the data collected prior to 1965, since spring discharge is measured by taking the difference in river flow above and below where the spring enters it.

Sulphur Springs is located on the Hillsborough River several miles north of downtown Tampa. During the dry season when the entire flow of the Hillsborough River is captured for water supply at the City of Tampa’s dam, Sulphur Springs has been the only input of water to the lower Hillsborough River, although this continues to change with the establishment of a minimum flow for the river and implementation of the associated recovery strategy. The average flow of Sulphur Springs during the past five years is approximately 31 cfs (SWFWMD, 2009).

Wall (Health) and Crystal Beach springs are located on the gulf coast in northern Pinellas County. Limited data indicate that the springs discharge brackish water and are strongly tidally influenced. Wall Springs was formerly a private recreation area that was purchased by Pinellas County and included in a county park. Although no flow data are available, it is probably a second-magnitude spring. Crystal Beach Spring is located in the Gulf of Mexico approximately 500 feet west of the shoreline.

Lithia and Buckhorn springs are located on the Alafia River, south of Brandon in southeastern Hillsborough County. Lithia Springs is composed of two vents: Lithia Major and Lithia Minor. Periodic measurements of Lithia Springs since the early 1930s indicate an average discharge of between 30 and 40 cfs. Buckhorn Springs, composed of a number of vents spread over several acres, is located at the head of a short run that enters the Alafia River several miles downstream of Lithia Springs. Periodic measurements made by District and TBW staff in the early 1990s indicated that the combined average flow from four significant vents was approximately 17.6 cfs. This included the water diverted from the spring for industrial purposes (Jones et al., 1993). An industrial operation is permitted to divert water from Lithia and Buckhorn springs. The majority of this diversion is pumped from Lithia Major.

The District is periodically questioned about freshwater springs in the Gulf of Mexico and the possibility of utilizing them for water supply. In response to these inquiries, the District conducted a two-year study of submarine springs in the Gulf of Mexico and Tampa Bay (Dewitt et al., 2003). The water quality and quantity of discharge were investigated at a number of submarine spring and karst features. Although some of the features discharged significant quantities of water, the quality of water in all cases was highly saline. This result was expected because the saltwater/freshwater interface (the boundary between fresh and saline groundwater in the UFA) is located onshore in much of the planning region. Therefore, it is highly unlikely that fresh groundwater could be discharging offshore through springs.

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. Approximately 25 percent of the TBPR is covered by either isolated cypress or riverine wetlands. Wetlands in the planning region can be grouped into saltwater and freshwater types. Saltwater wetlands are found bordering estuaries that are coastal wetlands influenced by the mixing of fresh water and seawater. Salt grasses and mangroves are common estuarine plants. The Tampa Bay estuary contains the most significant portion of saltwater wetlands in the planning region. Significant coastal wetlands are also located along the western portions of northern Pinellas and Pasco counties. Freshwater wetlands are common in inland areas. Hardwood-cypress swamps and marshes are two major freshwater wetland systems. Both systems are found either bordering lakes and rivers or standing alone as isolated wetlands. The hardwood-cypress swamps are forested systems with water at or above land surface for a considerable portion of the year. Marshes are typically shallower systems vegetated by herbaceous plants rather than trees. Wet prairies, also present in inland areas, are vegetated with a range of mesic herbaceous species and hardwood shrubs and are inundated during the wettest times of the year. Extensive hardwood swamps and wet prairies occur throughout the Hillsborough and Withlacoochee River watersheds. The Green Swamp covers the entire eastern end of Pasco County with isolated wetlands typically vegetated by herbaceous plants.

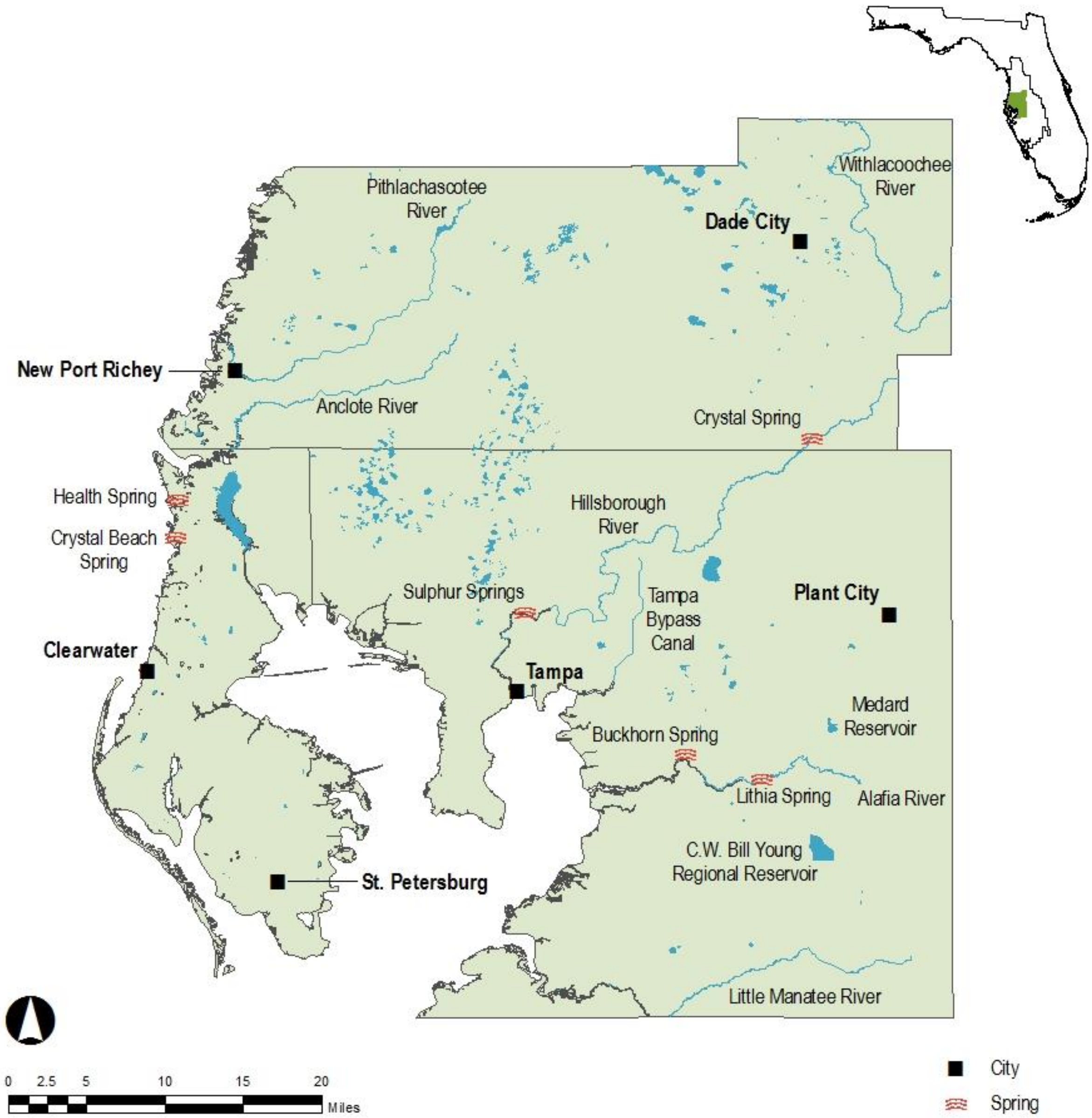

Figure 1-2. *Major hydrologic features in the Tampa Bay Planning Region*

Section 4. Geology/Hydrogeology

Three principal aquifer systems, the surficial, intermediate and UFA, are present in the planning region and are used as water supply sources. The surficial and UFA are present throughout the region, while the intermediate aquifer system is present only in southern Hillsborough County. Where the intermediate aquifer system is absent, an intermediate clay confining bed separates the surficial aquifer from the underlying UFA. Figure 1-3 is a generalized north-south cross section of the hydrogeology of the District and Figure 1-4 shows the locations of the West-Central Florida Groundwater Basins.

As seen in the figures, the planning region is primarily located in the Central West-Central Florida Groundwater Basin, which is a hydrogeologic transition zone between the southern and northern parts of the District. The Southern West-Central Florida Groundwater Basin encompasses the southern portion of the District where the intermediate aquifer system and its confining units become several hundred feet thick and separate the surficial and UFA. A small portion of the northeast part of the planning region is located in the North West-Central Florida Groundwater Basin where the confining unit is thin and discontinuous and eventually disappears further to the north.

The surficial aquifer system is composed primarily of unconsolidated sediments made up of fine-grained sand, silt and clayey sands, with an average thickness of 30 feet. The aquifer is present throughout most of the region, except for limited portions of coastal Pasco County, and produces relatively small quantities of water, which are generally used for low-volume irrigation or domestic water supply.

Underlying the surficial aquifer system over most of the planning region is the intermediate confining unit (ICU). The unit consists predominantly of thin and sometimes discontinuous clay that has been breached by karst features. This condition results in generally moderate-to-poor confinement of the UFA over most of the planning area. As a result, groundwater withdrawals from the UFA in this leaky system can lower water levels in the overlying surficial aquifer, wetlands, and lakes. In southern Hillsborough County, an intermediate aquifer exists that is composed of sand, gravel, and thin limestone beds with low permeability sandy clays and clays lying above and below this unit. The aquifer exists throughout the southern portion of the region, reaching a thickness of more than 100 feet in southern Hillsborough County. Further north, the unit thins and becomes a single ICU over the remainder of the planning region.

Underlying the ICU is the UFA. The UFA consists of a continuous series of carbonate units that include (in order of increasing geologic age and depth) portions of the Tampa Member of the Hawthorn Group, Suwannee Limestone, Ocala Limestone and Avon Park Formation. The UFA is generally under semi-confined conditions in most of the region due to the presence of the ICU. The aquifer can be separated into upper and lower flow zones. The Tampa Member of the Hawthorn Group and the Suwannee Limestone form 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 by diffuse leakage, vertical solution openings along fractures, or other zones of preferential flow (Menke et al., 1961). Gypsum beds become interbedded within the Avon Park Formation near its base which serves as the bottom confining unit of the freshwater flow system. This unit is referred to as Middle Confining Unit 2 (MCU II) (Miller, 1986). It is composed of evaporite minerals such as gypsum and anhydrite, which occur as thin beds or as nodules within dolomitic limestone that overall has very low permeability. The MCU II is generally considered to be the base of the freshwater production zone of the aquifer. Water quality and yield of the UFA are generally good, except where brackish groundwater occurs in close proximity to the coast. Groundwater from the aquifer is widely used for municipal and private water supplies in the planning region.

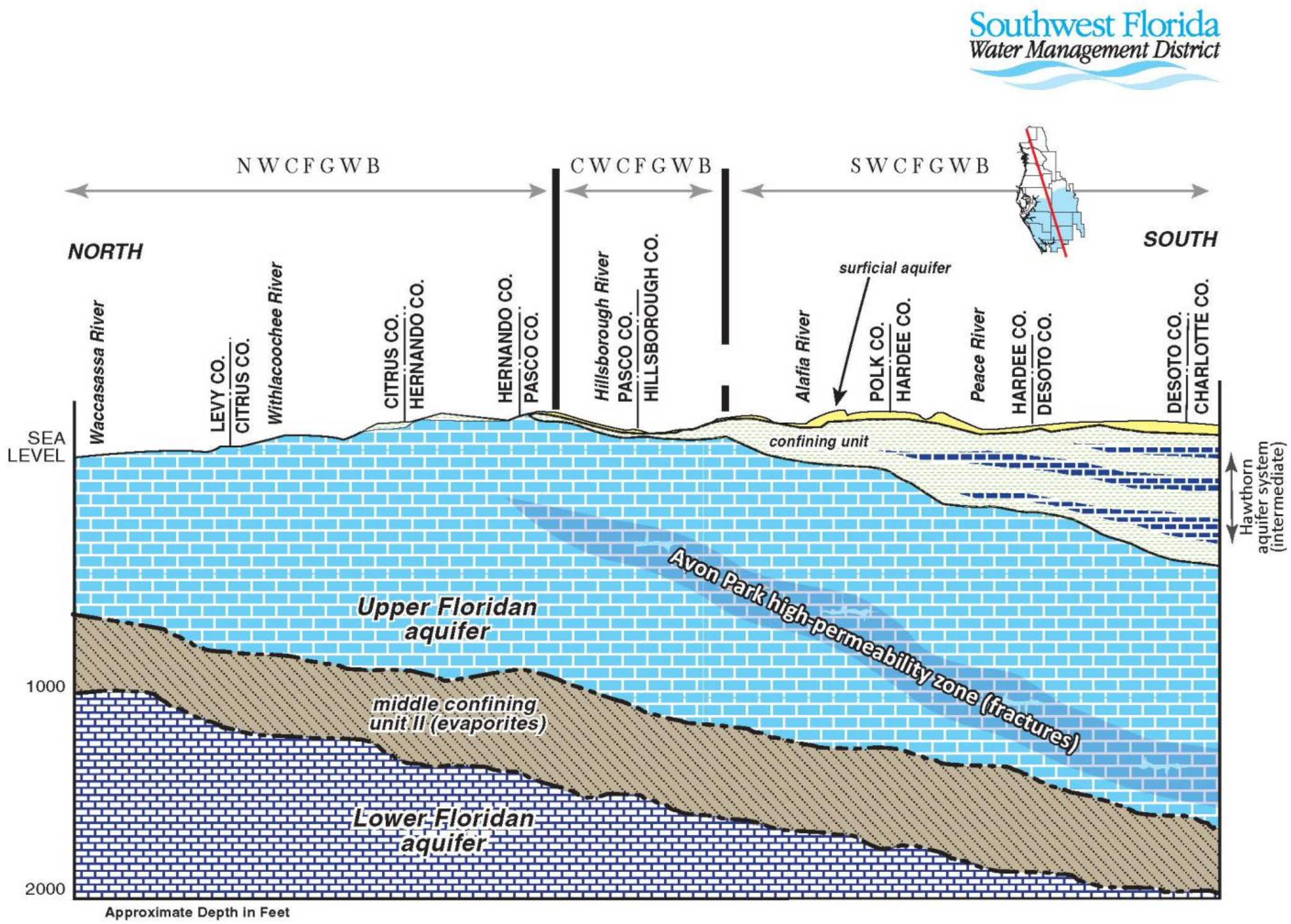

Figure 1-3. *Generalized north-south geologic cross section through the District*

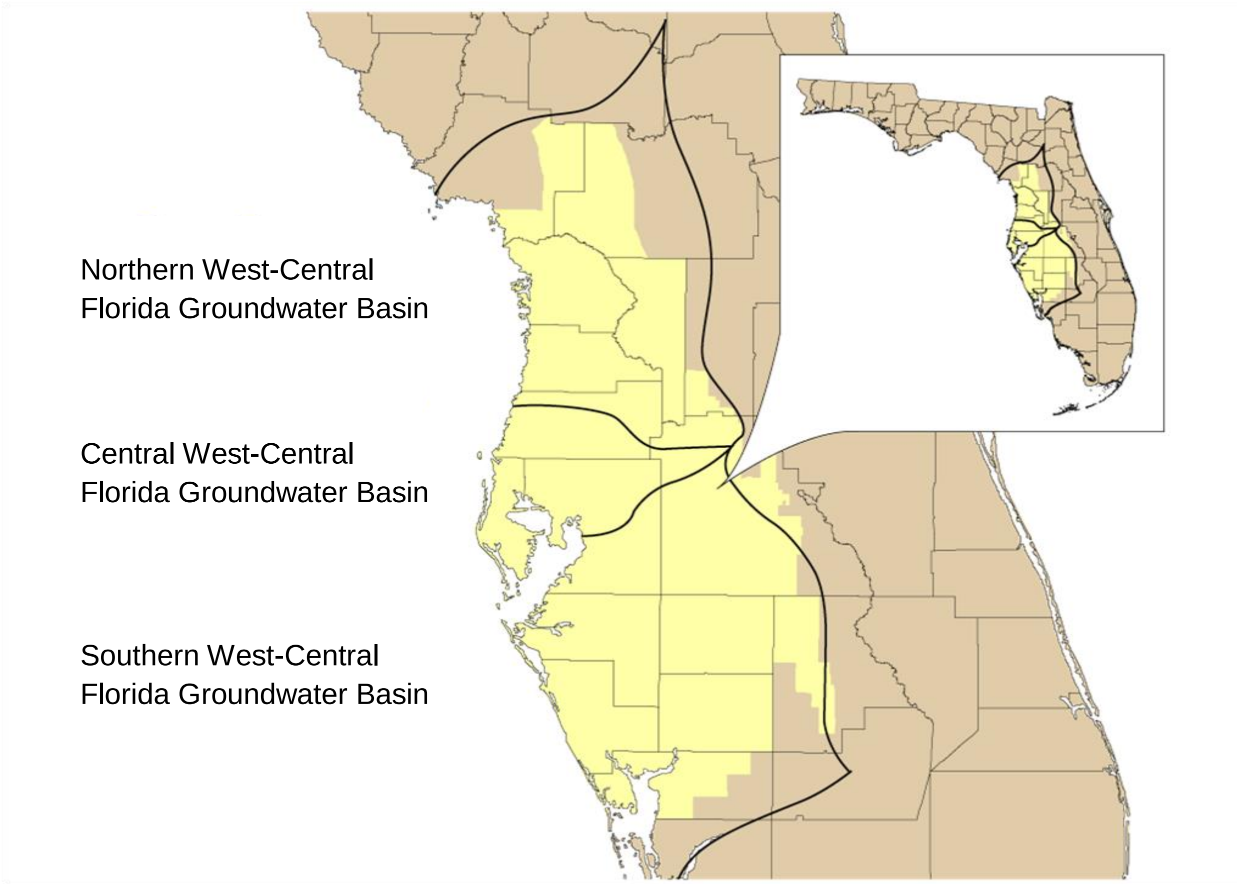

Figure 1-4. *The District and the West-Central Florida Groundwater Basins*

Part D. Previous Technical Investigations

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

Section 1. Water Resource Investigations

During the past 30 years, various water resource investigations were initiated by the District to collect critical information about the condition of Districtwide 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.

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

In 1989, based on the findings of the WRAP studies and continued concern about water resource impacts, the District established the NTB and ETB WUCAs and 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 NTB WUCAs. These meetings are summarized in the Eastern Tampa Bay Work Group Report (SWFWMD, 1990) and Management Plan (SWFWMD, 1990b) and Northern Tampa Bay Work Group Report (SWFWMD, 1990c) and Management Plan (SWFWMD, 1990d). These deliberations led to major revisions to the District's water use permitting rules as special conditions were added that applied to the ETB, NTB and other WUCAs. 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. A significant finding of the ETB WRAP was that the lowering of the potentiometric surface within the area was due to groundwater withdrawals from beyond, as well as within the area. 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 area and the remainder of the Southern West-Central Florida groundwater basin.

Beginning in October 1998, the District adopted minimum flows and levels for several water bodies in the NTBWUCA (Chapter 40D-8, F.A.C.). To address recovery of these natural systems, the District adopted the Recovery Strategy for Pasco, Northern Hillsborough, and Pinellas counties, or the "Recovery Strategy" (Rule 40D-80.073, F.A.C.) in 2000. Among other stipulations, the Recovery Strategy required that groundwater withdrawals from TBW's central system would be reduced to rates that could not exceed 90 mgd on a 12-month moving average basis by 2008. To compensate for this reduction in groundwater withdrawals, greater reliance would be placed on using alternative public water supplies, such as surface waters and a seawater desalination facility. In keeping with the intent of the Recovery Plan, TBW now obtains surface water supplies from the TBC, the Hillsborough and Alafia Rivers, maintains a 15.5 billion gallon offline reservoir, and maintains a 25 mgd capacity seawater desalination plant on Tampa Bay. In 2010, the District adopted a second phase of recovery for the NTBWUCA, entitled the Comprehensive Environmental Resources Recovery Plan for the NTBWUCA (Rule 40D-80.073, F.A.C.), or the "Comprehensive Plan". Among other actions, the Comprehensive Plan requires TBW to assess the water resources of the area and identify any remaining unacceptable adverse impacts caused by the 90 mgd of groundwater permitted to be withdrawn from their wellfields. The plan also requires TBW to develop a plan to address any identified unacceptable adverse impacts by 2020. The District is currently working with TBW on these assessments and plans.

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

Section 2. USGS Hydrologic Investigations

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

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

Investigation Type	Description
Completed Investigations	
Groundwater	Regional Groundwater Flow System Models of the SWFWMD, Cypress Creek, Cross Bar and Morris Bridge Wellfields, and the St. Petersburg Aquifer Storage and Recovery Site
	Hydrogeologic Characterization of the Intermediate Aquifer System
	Parameter Estimation and Optimization Simulating Groundwater Flow in the NTB Area
Groundwater and Surface Water	Hydrologic Assessment of the Alafia River
	Statistical Characterization of Lake-Level Fluctuations
	Lake-Stage Statistics Assessment to Enhance Lake Minimum Level Establishment
	Lake Augmentation Impacts
	Effects of Using Groundwater for Supplemental Hydration of Lakes and Wetlands
	Use of Groundwater Isotopes to Estimate Lake Seepage in the NTB and Highlands Ridge Lakes
	Effects of Recharge on Interaction Between Lakes and the Surficial aquifer
	Relation of Geology, Hydrology and Hydrologic Changes to Sinkhole Development in the Lake Grady Basin
	Relationship Between Groundwater Levels, Spring Flow, Tidal Stage and Water Quality for Selected Springs in Coastal Pasco, Hernando and Citrus Counties
	Surface and Groundwater Interaction in the Upper Hillsborough River Basin
	Hydrologic Changes in Wellfield Areas of Northern Tampa Bay
	Effects of Development on the Hydrologic Budget of the SWUCA
Surface Water	Primer of Hydrogeology and Ecology of Freshwater Wetlands in Central Florida
	Methods to Define Storm-Flow and Base-Flow Components of Total Stream Flow in Florida Watersheds
	Factors Influencing Water Levels in Selected Impaired Wetlands in the NTB Area
Ongoing Investigations/Data Collection Activities	
Data Collection	Minimum Flows and Levels Data Collection
	Surface Water Flow, Level and Water Quality Data Collection

Section 3. Water Supply Investigations

Water Supply investigations for the planning region were initiated in the 1960s as part of the United States Army Corps of Engineers (USACE) Four River Basins project. The Four River Basins project began as a flood control project developed in response to severe coastal and inland flooding caused by Hurricane Donna in September 1960. The District was formed in 1961 to help implement this federal project, which led to development of several large control structures including the 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 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 NTBWUCA (SWFWMD, 2001). The 2001 RWSP quantified water supply demands through the year 2020 within these counties and identified water supply options for developing sources other than fresh groundwater.

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

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

Section 4. MFL Investigations

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

Section 5. Modeling Investigations

Since the 1970s, the District has developed numerous computer models to support resource evaluations and water supply investigations. These models have been subdivided into groundwater flow models for general resource assessments and solute transport models to assess 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 of both the surface water and groundwater flow systems. These models are used to address issues where the interaction between groundwater and surface water is significant.

Many of the early groundwater flow models were developed by the USGS through the cooperative studies program with the District. Over time, as more data was collected and computers became more sophisticated, the models developed by the District have included more detail about the hydrologic system. The end result of the modeling process is a tool that can be used to assess effects of current and future withdrawals and better understand hydrologic relationships.

1.0 Groundwater Flow Models

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

The Southern District Model Version 1.0 simulates groundwater flow in the entire District south of Hernando County (Beach and Chan, 2003). However, the model is primarily designed to simulate conditions throughout the District south of the Hillsborough River and Green Swamp. The Southern District Model Version 1.0 has replaced the ETB model as the principal tool for resource assessment and resource management. The model was updated as the Southern District Model Version 2.0 (Beach, 2006).

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

2.0 Saltwater Intrusion Models

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

In support of establishing a minimum aquifer level to protect against saltwater intrusion in the MIA of the SWUCA, a fully three-dimensional, solute transport model of the ETB area was developed in 2002 by HydroGeoLogic, Inc. The model encompasses all of Manatee and Sarasota counties, the southern half of Hillsborough and Pinellas counties and extends approximately 25 miles offshore. The model only simulates flow and transport in the UFA. Estimates of the number of wells and amount of water supply at risk to future saltwater intrusion under different pumping scenarios were derived using this model.

Although regional saltwater intrusion in the NTB area is not as major of a resource concern as it is in the SWUCA, local and sub-regional saltwater intrusion has been observed. Saltwater intrusion models completed for the area include Dames and Moore, Inc. (1988), GeoTrans, Inc. (1991), HydroGeoLogic, Inc. (1992), HydroGeoLogic, Inc. (1994) and Tihansky (2005). These models have generally confirmed the localized nature of saltwater intrusion in the NTB area. HydroGeoLogic, Inc. completed a regional saltwater intrusion model in May 2008 that covered the coastal region of Pasco, Hernando, Citrus and Levy counties. This work was completed in conjunction with the development of the NDM.

3.0 Integrated Groundwater/Surface Water Models

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

4.0 Districtwide Regulation Model

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

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, and climate change.

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 current WUCAs. In order to determine whether an area should be declared a WUCA, the Governing Board must consider the following factors:

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

In the late 1980s, the District determined that certain interim resource management initiatives could be implemented to help prevent existing problems in the water resource assessment project (WRAP) areas from getting worse prior to the completion of each WRAP. As a result, in 1989, the District established three WUCAs: Northern Tampa Bay (NTBWUCA), Eastern Tampa Bay (ETBWUCA) and Highlands Ridge (HRWUCA). For each of the initial WUCAs, a three-phased approach to water resource management was implemented, including: (1) short-term actions that could be put into place immediately, (2) mid-term actions that could be implemented concurrent with the ongoing WRAPs and (3) long-term actions that would be based upon the results of the WRAPs. In addition to the development of conservation plans, cumulative impact analysis-based permitting and requiring withdrawals from stressed lakes to cease within three years, the District developed management plans for each WUCA to stabilize and restore the water resources in each area through a combination of regulatory and non-regulatory efforts. One significant change that occurred as a result of the implementation of the management plans was the designation of the most impacted area (MIA) in the ETBWUCA. The MIA consists of the coastal portion of the SWUCA in southern Hillsborough, Manatee and northern Sarasota counties. The Saltwater Intrusion Minimum Aquifer Level (SWIMAL) was established to stabilize regional water level declines so that long-term management efforts could slow the rate of regional saltwater intrusion in the MIA. Within this area, no increases in permitted groundwater withdrawals from the Upper Floridan Aquifer (UFA) were allowed and withdrawals from outside the area could not cause further lowering of UFA levels within the area. The ETBWUCA and HRWUCA were superseded in 1992 by the establishment of the Southern Water Use Caution Area (SWUCA), which encompasses the entire southern portion of the District. The NTBWUCA was expanded in 2007 to include an additional portion of northeastern Hillsborough County and the remainder of Pasco County. In 2011, the District established the Dover/Plant City WUCA in eastern Hillsborough and western Polk counties following impacts from intense frost/freeze protection withdrawals. The District has not declared a WUCA in the Northern Planning Region; however, the St. Johns River Water Management District (SJRWMD) has declared a priority water resource caution area adjacent to the District boundary in Lake and Marion counties.

The District established the Dover/Plant City WUCA in eastern Hillsborough and western Polk counties following impacts from intense frost/freeze protection withdrawals.

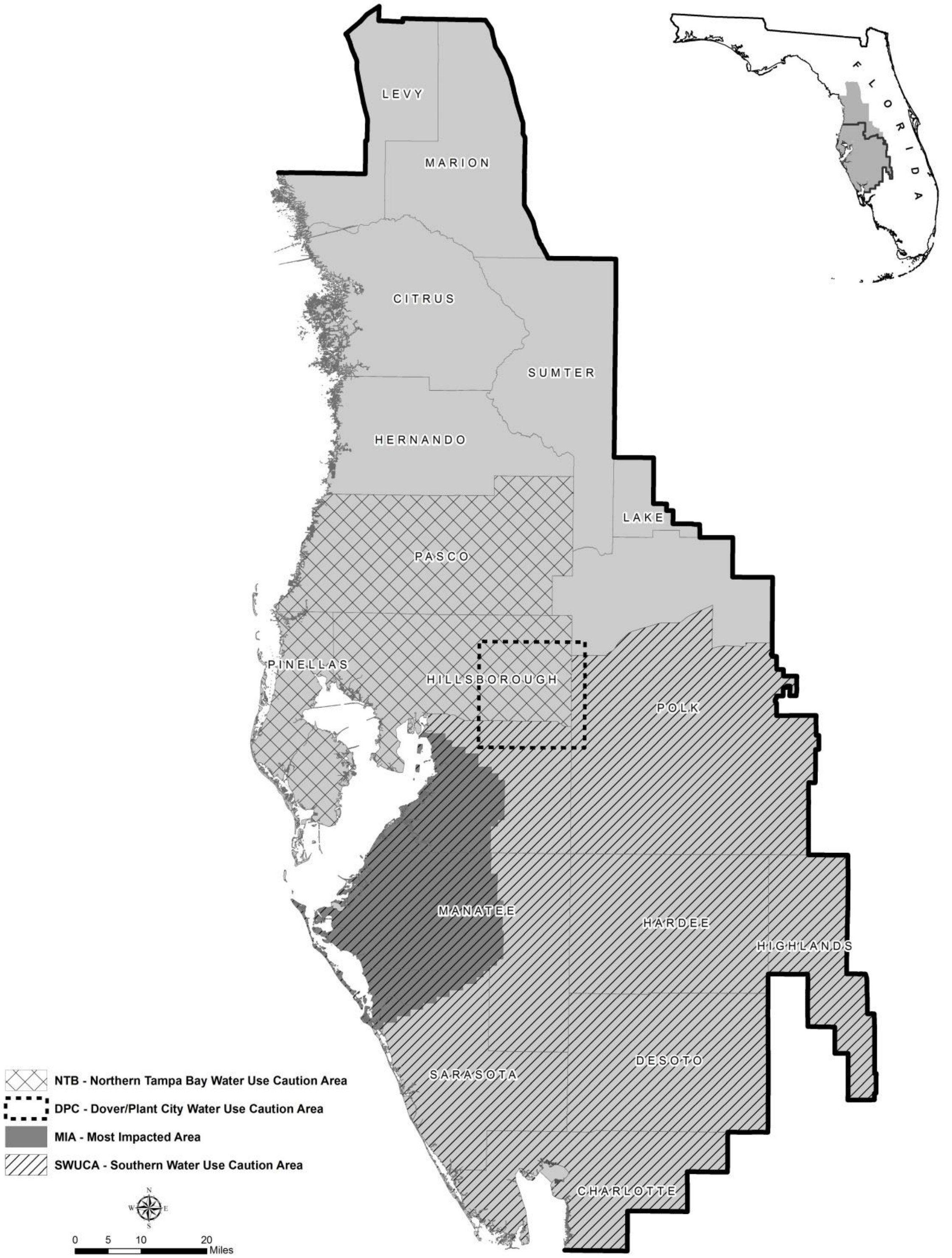

Figure 2-1. *Location of the District's water use caution areas and the MIA of the SWUCA*

1.0 Northern Tampa Bay Water Use Caution Area (NTBWUCA)

In 1989, the District established the NTBWUCA, an area encompassing parts of Hillsborough and Pasco counties and all of Pinellas County. In 2007, the NTBWUCA was expanded to include an additional portion of northeastern Hillsborough County and the remainder of Pasco County. The District took these actions based on concerns about hydrologic impacts to wetlands, lakes and rivers resulting from groundwater withdrawals and concerns regarding rapid growth and development pressures in the region. Because the majority of groundwater use in the NTBWUCA is for public supply, most of the water resource impacts were located in areas surrounding the major public supply wellfields.

To address effects of these water resource impacts, the District has taken several important actions, including the implementation of an enhanced MFLs program. Beginning in October 1998, the District approved and ultimately established new MFLs in the NTB area for cypress wetlands, lakes, rivers, springs and the UFA. Additionally, the District has committed to collecting additional data to support the refinement and improvement of its MFLs methodologies and to study the benefits of using other management methods, such as augmentation, to achieve adopted MFLs. In 2000, the District initiated the Northern Tampa Bay Phase II Local Technical Peer Review Group (LTPRG) to coordinate with local governments, agencies and other stakeholders on hydrologic, biologic and geologic studies being performed in the NTBWUCA.

Concurrent with the District's efforts to establish and refine MFLs in the region, Tampa Bay Water (TBW) and its member governments entered into an agreement in 1998 with the District to significantly reduce groundwater withdrawals from its Central System Facilities (Cosme-Odessa, Eldridge-Wilde, Section 21, South Pasco, Cypress Creek, Cross Bar Ranch, Starkey, Morris Bridge, Northwest Hillsborough Regional, Cypress Bridge and North Pasco wellfields) and work toward recovery in areas where water resources had been impacted. This agreement, commonly referred to as the Partnership Agreement, established that groundwater withdrawals from the Central System Facilities operated by TBW would be reduced from 158 mgd to 90 mgd (12-month moving average) by Jan. 1, 2008. The Partnership Agreement was one part of the Recovery Strategy for Pasco, Hillsborough, and Pinellas counties (Recovery Strategy), a plan adopted by rule 40D-80.073, Florida Administrative Code (F.A.C.) in 1999 for environmental recovery in the NTBWUCA. As part of the Partnership Agreement, the District combined all of the permits for the Central System Facilities into a single permit known as the Consolidated Permit. The Consolidated Permit requires an extensive water resource monitoring network around the individual wellfields, along with many other data reporting and planning requirements. It is anticipated that a monitoring network developed by TBW will address most of the data collection needs in and around major withdrawal centers, while District efforts will focus on the areas between and beyond the TBW withdrawal centers.

In 2010, the District adopted a second phase of recovery for the area, entitled the Comprehensive Environmental Resources Recovery Plan for the Northern Tampa Bay Water Use Caution Area (Comprehensive Plan). Among other actions, the Comprehensive Plan requires TBW to assess the water resources of the area and identify any remaining unacceptable adverse impacts caused by the 90 mgd of groundwater withdrawn from their Central System Facilities. The plan also required TBW to develop a plan to address any identified unacceptable adverse impacts by 2020. In 2011, the District renewed the Consolidated Permit through 2020, at which time many of the requirements of the Comprehensive Plan are due for District approval. The District is coordinating with TBW to evaluate area recovery in preparation for TBW's request to renew their permit.

2.0 Southern Water Use Caution Area (SWUCA)

Since the early 1900s, groundwater withdrawals 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 Highland 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, the HRWUCA, and the MIA within these counties. Although groundwater withdrawals in the region have stabilized over the past few decades as a result of management efforts, area water resources continue to be impacted by the historic decline in aquifer water levels.

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

In 1998, the District initiated a reevaluation of the SWUCA management strategy and, in March 2006, established minimum flows for the upper Peace River, minimum levels for eight lakes along the Lake Wales Ridge in Polk and Highlands counties, and a SWIMAL for the UFA in the MIA. Since most, if not all, of these water resources were not meeting their established MFLs, the District adopted a recovery strategy for the SWUCA in 2006 (SWFWMD, 2006). As part of the strategy, the status of District monitoring efforts are reported to the Governing Board on an annual basis, and every five years a comprehensive review of the strategy is performed. Adjustments to the strategy will be made based on results of the ongoing monitoring and recovery assessments. In 2013, the District completed the first five-year review of the recovery strategy. Because adopted MFLs for many water bodies were still not being met, the District initiated a series of stakeholder meetings to review results of the technical assessments and identify potential recovery options. The stakeholder process is expected to be completed by mid-2015.

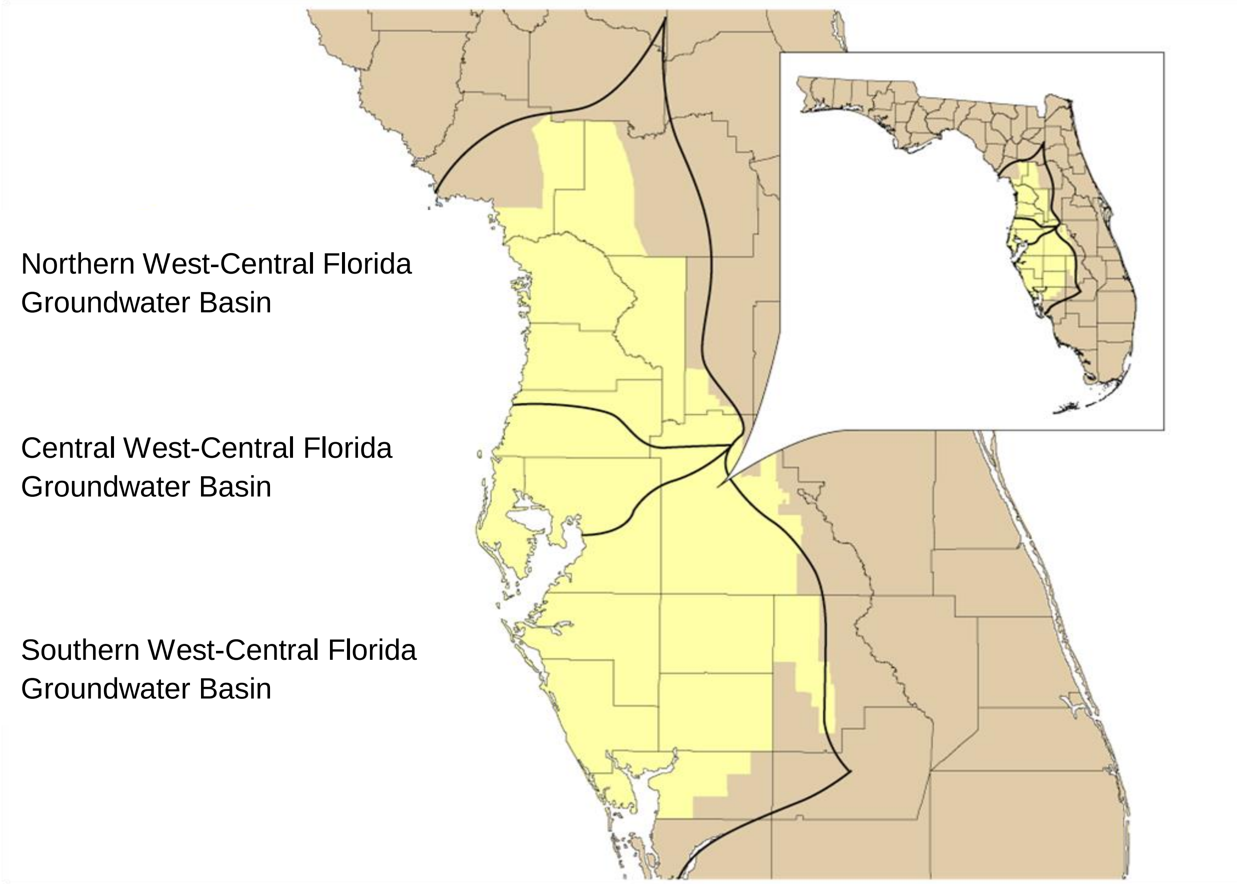

Figure 2-2. *The District and the West-Central Florida Groundwater Basins*

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

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

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

Part B. Minimum Flows and Levels

Section 1. Definitions and History

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

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

1.0 Statutory and Regulatory Framework

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

Section 2. Priority Setting Process

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

- Importance of the water bodies to the state or region.
- Existence of or potential for significant harm to the water resources or ecology of the state or region.
- Required inclusion of all first-magnitude springs and all second-magnitude springs within state or federally owned lands purchased for conservation purposes.
- Availability of historic hydrologic records (flows and/or levels) sufficient to allow statistical analysis and calibration of computer models when selecting particular water bodies in areas with many water bodies.
- Proximity of MFLs already established for nearby water bodies.
- Possibility that the water body may be developed as a potential water supply in the foreseeable future.
- Value of developing an MFL for regulatory purposes or permit evaluation.
- Stakeholder input.

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

Section 3. Technical Approach to the Establishment of MFLs

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

1.0 Ongoing Work, Reassessment and Future Development

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

2.0 Scientific Peer Review

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

3.0 Methodology

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

Section 4. MFLs Established to Date

Figure 2-3 depicts priority MFLs water resources that are located within the planning region. A complete list of water resources with established MFLs in the District is provided in the Chapter 2 Appendix. Water resources with established MFLs in the planning region include the following:

- 41 palustrine cypress wetlands in Hillsborough, Pasco, and Pinellas counties
- 71 lakes in Hillsborough and Pasco counties
- Seven UFA wells for saltwater intrusion in the NTBWUCA
- Dover/Plant City WUCA MAL
- SWIMAL for the MIA of the SWUCA
- Upper and Lower Hillsborough River
- Upper and Lower Alafia River
- Upper and Lower Anclote River
- Tampa Bypass Canal (TBC)
- Crystal Springs
- Lithia and Buckhorn springs (as part of the Upper Alafia River MFL)
- Sulphur Springs

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

- Upper and Lower Little Manatee River
- Upper and Middle Withlacoochee River (three segments)
- Upper and Lower Pithlachascotee River

- Brooker Creek
- North Prong Alafia River
- South Prong Alafia River
- Bullfrog Creek
- Cypress Creek
- Crews Lake (Pasco County)
- Lake Starvation (Hillsborough County)
- Bird, Crystal, Dan, Hobbs, Horse, Juanita, Merrywater, Rainbow, and Sunset lakes (Hillsborough County lakes for reevaluation)
- Big Fish, Buddy, Camp, Moon, Padgett, and Pasadena lakes (Pasco County lakes for reevaluation)

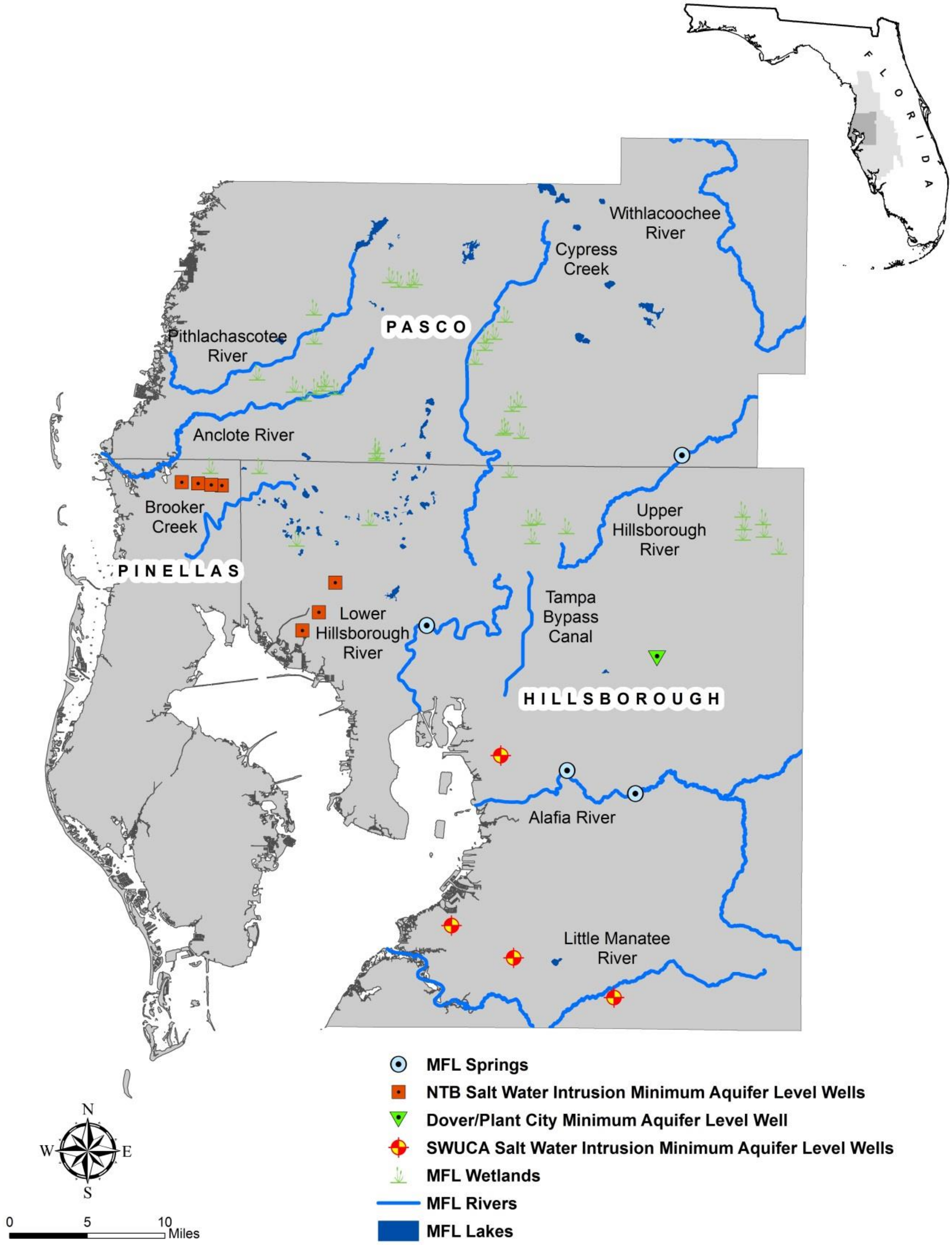

Figure 2-3. *MFL priority water resources in the Tampa Bay Planning Region*

Part C. Prevention and Recovery Strategies

Section 1. Prevention Activities

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

In addition to water supply planning activities initiated by the District, other entities in the planning region are involved in planning efforts in cooperation with those of the District. The goal is to ensure that future water supply demands will be met without adversely impacting proposed or established MFLs. The following is an example of an additional water supply planning activity in the planning region.

1.0 Tampa Bay Water Long-Term Water Supply Master Plan

The purpose of TBW's long-term water supply planning is to ensure that water supplies are sufficient to meet current and future demands. This is being accomplished through reduced reliance on groundwater and increased development of alternative supplies in order to allow recovery of natural systems within the TBW service area. The most recent (third) update to the current Master Water Plan was completed in 2013. This document analyzed current and future water supplies and demands to determine when new supplies will be required. The current Master Water Plan does not recommend that new water supply facilities be developed at this time due to lower regional demand projections; however, project concepts presented in the 2008 plan will continue to be studied so they can be evaluated and developed when demand projections support the need for new sources. Additionally, seasonal and severe drought events and long-term future water supply needs will continue to be addressed through planning and management activities.

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 several recovery plans for achieving recovery to established MFLs as soon as practicable in the Tampa Bay Planning Region. Regional strategies have been developed for the NTBWCA, SWUCA and Dover/Plant City WUCA. Recovery strategies have also been developed for the Lower Hillsborough and Lower Alafia rivers. Regulatory components of the recovery strategies for water resources in these areas have been incorporated into District rules (Chapter 40D-80, F.A.C.), into individual WUPs, and outlined in District reports.

1.0 NTBWUCA

The first phase of the NTBWUCA Recovery Strategy was approved by the District in 1999 and required that new withdrawals not violate established MFLs unless the withdrawal was part of the NTBWUCA Recovery Strategy. The strategy included the establishment of MFLs, reductions in groundwater withdrawals and the development of alternative water supplies as required in the Partnership Agreement. Executed in 1998, the Partnership Agreement required a reduction in groundwater withdrawals from the TBW Central System Facilities (Cosme-Odessa, Eldridge-Wilde, Section 21, South Pasco, Cypress Creek, Cross Bar Ranch, Starkey, Morris Bridge, Northwest Hillsborough Regional, Cypress Bridge and North Pasco wellfields) from 158 mgd to 90 mgd (12-month moving average) by 2008. As part of the Partnership Agreement, the District also committed to provide funding assistance to TBW for the development of alternative water supply projects designed to replace the reductions in groundwater withdrawals. The first phase of the strategy extended through 2010 and was based on current knowledge of the state of the area's water resources, the technology for water supply development (WSD) including alternative sources and conservation, and existing and future reasonable-beneficial uses. The District evaluated the degree of recovery that had occurred in the region and determined that a second phase of recovery was necessary. This determination was based largely on the need for additional time to evaluate the full hydrologic and biologic effects of the reduction in groundwater withdrawals that took place during the first phase of recovery, as well as the need for further assessment of the optimized distribution of the 90 mgd of withdrawals.

Tampa Bay Regional Reservoir

In December 2009, the District approved the second phase of the recovery strategy for the NTBWUCA (Rule 40D-80.073, F.A.C) for implementation through 2020. Major components of the strategy include: (1) the Consolidated Permit issued to TBW was renewed for 90 mgd for 10 years; (2) TBW will continue to conduct withdrawals pursuant to the Operations Plan; (3) TBW will continue expansive environmental data collection and analysis; (4) TBW will continue to evaluate and implement environmental mitigation; (5) TBW member governments will continue water conservation activities; (6) further impacts caused by other WUP holders will continue to be limited; and (7) a "reservoir renovation exception period" that allowed a temporary exceedance of the 90 mgd permit limit during the period while the C. W. Bill Young Regional Reservoir was under repair. The repairs were completed in 2014 and the temporary allowance was never used.

2.0 Lower Hillsborough River

The District established MFLs for the Lower Hillsborough River, Sulphur Springs and the TBC in 2007. Because flows in the Lower Hillsborough River were below the proposed MFLs, the District incorporated a recovery strategy for the river into Rule 40D-80.073(8), F.A.C. The strategy outlines several proposed projects and a timeline for their implementation. To implement and provide partial funding for a number of proposed projects, the District approved a joint funding agreement with the City of Tampa in 2007. As outlined in the funding agreement, project costs are expected to be allocated on a 50/50 cost-share basis with the City.

Implementation of specific projects to achieve recovery is subject to applicable diagnostic/feasibility studies and contingent on whether required permits can be obtained. Although the City may propose alternative or additional projects to the District for funding consideration, a number of projects were explicitly outlined in the recovery strategy. These projects, with estimated costs, timeline for implementation, and status are shown in Table 2-1.

In addition to these projects, the District has constructed three temporary pump stations to transfer water from the TBC to the base of the Hillsborough River dam. The District is also exploring the feasibility of a project to install the infrastructure necessary to pump water from the Morris Bridge Sink into the TBC. The City is expected to eventually assume operation of pumping facilities at two of the three temporary pump station sites currently operated by the District.

Table 2-1. *Lower Hillsborough River recovery strategy projects*

Project	Cost	Completion Date and Status
Sulphur Spring Weir Modification and Pump Station	$2.5 million	October 1, 2010 (completed)
Blue Sink	$11 million	October 1, 2011 (ongoing)
Transmission Pipeline	$26 million	October 1, 2013 (discontinued; not viable)
Investigation of Storage Options	$5 million	October 1, 2016 (ongoing)

3.0 SWUCA

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

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

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

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

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

4.0 Lower Alafia River System

In establishing the MFLs for the Lower Alafia River system in 2010, the District determined that flow rates under certain conditions were below the minimum flows due to withdrawals from Lithia and Buckhorn springs by Mosaic Fertilizer, LLC ("Mosaic") for use at its Riverview plant. The District incorporated conditions associated with a phased recovery strategy into Mosaic's WUP (No. 20013228.000). Under this WUP, Mosaic will augment the South Prong of the Alafia River with groundwater so that by January 1, 2017, Mosaic's withdrawals will not negatively impact the Lower Alafia River. Through December 31, 2016, Mosaic will augment the South Prong of the Alafia River with up to 1.3 mgd of groundwater when flow at the Lithia gauge falls below 67 cfs, provided the augmentation does not exceed the quantity of water withdrawn by Mosaic from the Lower Alafia River System on the previous day. Beginning January 1, 2017, Mosaic will augment the South Prong of the Alafia River with up to 4.5 mgd of groundwater when flow at the Lithia gage falls below 67 cfs, provided the augmentation equals but does not exceed the quantity of water withdrawn by Mosaic from the Lower Alafia River System on the previous day.

To meet adopted MFLs, the Alafia River is augmented with groundwater during low flow periods

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

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

Part D. Reservations

Subsection 373.223(4), F.S., authorizes reservations of water as follows: "The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety…" The District will consider establishing a reservation of water when a District WRD project will produce water needed to achieve adopted MFLs. Reservations of water will be established by rule. The rule-making process allows for public input to the Governing Board in its deliberations about establishing a reservation, including, among other matters, the amount of water to be reserved and the time of year the reservation would be effective. When a reservation is established and incorporated into Rule 40D-2.302, F.A.C., only those water use withdrawals that do not reduce the reserved quantity can be evaluated for permitting.

In 2007, as part of the recovery strategy for the Lower Hillsborough River, the District established that "all available water from the Morris Bridge Sink, but not greater than 3.9 mgd on any given day, is reserved to be used to contribute to achieving or maintaining the minimum flow for the lower Hillsborough River…" (Rule 40D-2.302(1), F.A.C.). It has been concluded that this reservation will require a WUP. Because the District cannot issue a permit to itself, the District has prepared a WUP application that will be submitted to the DEP for use of Morris Bridge Sink to provide minimum flows to the Lower Hillsborough River at a rate not to exceed 3.9 mgd.

Part E. Climate Change

Section 1. Overview

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

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

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

Section 2. Possible Effects

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

1.0 Sea Level Rise

The best available information is provided by the United States Army Corps of Engineers (USACE) for civil works projects, which estimate a sea level rise projection of 2.0 to 8.0 inches locally over the 20-year horizon of this report (2015-2035), with an intermediate-level projection of 3.5 inches. Over a 50-year horizon (2015-2065), a frequently used lifecycle for infrastructure design, the projected increase is 5.2 to 26 inches, with an intermediate-level projection of 10.3 inches. These estimates are consistent with National Oceanic and Atmospheric Administration and IPCC methodologies, and the given ranges are largely dependent on the continuing level of global emissions and the melting rate of land-locked ice (USACE, 2014).

Sea level rise is likely to stress the District's water resources in a variety of ways. The inundation or upward migration of coastal wetlands may affect their ability to improve the quality of stormwater runoff and provide natural habitats. Estuarine water encroachment in coastal rivers may reduce the viable withdrawal periods at non-isolated freshwater intakes of water treatment facilities. Saltwater intrusion reduces water quality in aquifers that supply urban, agricultural, and industrial water users. Municipal sewer systems may experience infiltration that reduces the quality of reclaimed water.

Climate change may result in increased storm frequency

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

2.0 Air Temperature Rise

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

3.0 Precipitation Regimes and Storm Frequency

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

Section 3. Current Management Strategies

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

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

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

Section 4. Future Adaptive Management Strategies

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

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

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

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

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Chapter 3. Demand Estimates and Projections

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

The demand projections represent reasonable and beneficial uses of water that are anticipated to occur through the year 2035. The District determined 5-in-10 (average condition) and 1-in-10 (drought condition) demands for each five-year increment from 2010 to 2035 for each sector. Decreases in demand are reductions in the use of groundwater for the agricultural and industrial/commercial, mining/dewatering and power generation use categories.

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

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

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

Part A. Water Demand Projections

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

Section 1. Public Supply

1.0 Definition of the Public Supply Water Use Sector

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

2.0 Population Projections

2.1 Base Year Population

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

2.2 Methodology for Projecting Population

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

3.0 2005 Base Year Water Use and Per Capita Rate

3.1 Base Year Water Use

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

4.0 Water Demand Projection Methodology

4.1 Public Supply

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

4.2 Domestic Self-Supply (DSS)

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

5.0 Water Demand Projections

Table 3-1 shows the projected public supply demand for the planning period. The table shows that demand is projected to increase by 83.11 mgd for the 5-in-10 condition. The projections are inconsistent with those in the District's 2010 RWSP. The differences can be attributed to slower than anticipated population immigration, the economic downturn and more accurate utility level population projections using a GIS model which accounts for growth and build-out at the parcel level.

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

County	2010 Base		2015		2020		2025		2030		2035		Change 2010-2035		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Hillsborough	139.09	147.43	149.64	158.62	162.40	172.14	174.32	184.78	184.63	195.71	194.08	205.73	55.00	58.30	39.5%	39.5%
Pasco	53.70	56.92	58.73	62.25	64.85	68.74	70.53	74.76	75.68	80.22	80.36	85.19	26.66	28.26	49.6%	49.6%
Pinellas	99.50	105.47	100.52	106.55	100.66	106.69	100.77	106.81	100.87	106.92	100.95	107.01	1.45	1.54	1.5%	1.5%
Total	**292.29**	**309.83**	**308.89**	**327.43**	**327.90**	**347.58**	**345.62**	**366.35**	**361.18**	**382.85**	**375.40**	**397.92**	**83.11**	**88.09**	**28.4%**	**28.4%**

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

6.0 Stakeholder Review

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

Section 2. Agriculture

1.0 Description of the Agricultural Water Use Sector

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

2.0 Water Demand Projection Methodology

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

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

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

For livestock and aquaculture (non-irrigation) water demands, the FSAID2 projections were based primarily on livestock count data and permitted quantities per head. Similar to the

District's methodology, demands were held steady throughout the planning period, based on steady, if not declining, demands and lack of data upon which to make better projections.

3.0 Water Demand Projections

Trends in the Tampa Bay area are dominated by both a long-term and short-term decline in citrus acreage and demand in Hillsborough and Pasco counties, likely due to a combination of non-agricultural development and citrus diseases such as greening and canker. While some crop acreage is increasing noticeably, such as strawberries and blueberries, the general trend in the rapidly urbanizing counties of the planning region is for reduced acreage and demand with most of the reduction stemming from declines in citrus acreage. The small remaining agricultural production in Pinellas County is limited largely to nurseries and other farm uses.

For the 5-in-10 condition in 2015, the District projects 67.98 mgd will be used to irrigate 35,950 acres of agricultural commodities in the region. From 2010 to 2035, irrigated acreage is expected to decrease by approximately 19.68 percent, or 7,564 acres. As would be expected in an urbanizing area where agricultural land has viable alternative uses and land value is driven by forces other than agricultural production value, it appears agricultural land is being used more intensively. Although irrigated acreage in the region is projected to decline by 19.68 percent between 2010 and 2035, 5-in10 irrigation demand is projected to decline by 16.18 percent, indicating that less water intensive crops are projected to be replaced by more water intensive (and likely higher value) crops. An example may be the conversion of citrus to strawberry acreage.

Table 3-2 displays projected combined agricultural irrigation and non-irrigation demand for the 5-in-10 (average) and 2-in-10 (drought) conditions for the planning period. For the 5-in-10 condition, total regional demand, including non-irrigation demand, is projected to decline from 75.97 mgd in 2010 to 64.21 mgd in 2035, a decrease of 11.76 mgd or 15.5 percent.

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

As noted above in Section 2.0 (Water Demand Projection Methodology), FDACS produced agricultural water demand projections for 2015 through 2035. Once some reasonable adjustments are made to the FSAID2 projections based on the two significant differences in data and methodology addressed above, there is only about 1.85 percent difference Districtwide between the District's 2035 average condition irrigation demand projections and the FSAID2 average condition projections. Those adjustments include changing the FSAID2 projections for Polk and Lake Counties to the CFWI demand projections and holding FSAID2 citrus acre-in application rates to 2015 rates throughout the planning period. Without the adjustments, the FSAIDS 2035 Districtwide irrigation projections are about 32.07 percent higher than the District's and the FSAID2 Districtwide drought year projections are 21.51 percent higher than the District's.

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

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

4.0 Stakeholder Review

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

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

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

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

Strawberries are a significant agricultural product in the Tampa Bay Planning Region

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

County	2010 Base		2015		2020		2025		2030		2035		Change 2010-2035		% Change	
	5-10	2-10	5-10	2-10	5-10	2-10	5-10	2-10	5-10	2-10	5-10	2-10	5-10	2-10	5-10	2-10
Hillsborough	60.62	66.21	56.75	61.49	53.77	57.74	52.86	56.31	51.81	54.80	51.15	53.78	-9.47	-12.43	-15.6%	-18.8%
Pasco	15.21	18.55	14.31	17.48	13.83	16.84	13.45	16.30	13.14	15.86	12.91	15.51	-2.29	-3.04	-15.1%	-16.4%
Pinellas	0.14	0.15	0.20	0.20	0.18	0.19	0.17	0.17	0.16	0.16	0.14	0.15	0.00	0.00	0.5%	-0.8%
Total	**75.97**	**84.90**	**71.26**	**79.17**	**67.79**	**74.76**	**66.48**	**72.78**	**65.11**	**70.82**	**64.21**	**69.43**	**-11.76**	**-15.47**	**-15.5%**	**-18.2%**

Note: Summation and/or percentage calculation differences occur due to rounding. See Appendix 3-1 for source values. Changes in small demand numbers across time can represent significant percent changes in demand over time that are not readily apparent from the rounded values in the table.

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

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

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

2.0 Demand Projection Methodology

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

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

Based on the WUWPD data, there were 65 I/C and 7 M/D water use permits in the planning region as of 2010.

3.0 Water Demand Projections

Table 3-3 shows the projected decrease in I/C and M/D water demand for the planning period. The table shows a change in demand for the planning period of -0.83 mgd, primarily due to a projected decrease in M/D use in Hillsborough County. For several years, the permitted quantity in the I/C and M/D sectors had been declining. Much of this reduction was due to revisions in the way permitted quantities for M/D are allocated by the District's WUP 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).

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

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

County	2010 Base	2015	2020	2025	2030	2035	Change 2010-2035	% Change
Hillsborough	12.27	13.04	10.41	10.69	10.97	11.26	-1.01	-8.3%
Pasco	1.07	1.10	1.14	1.17	1.21	1.25	0.18	16.9%
Pinellas	0.06	0.06	0.06	0.06	0.07	0.07	0.01	10.4%
Total	**13.40**	**14.20**	**11.61**	**11.93**	**12.25**	**12.57**	**-0.83**	**-6.2%**

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

4.0 Stakeholder Review

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

Section 4. Power Generation (PG)

1.0 Description of the PG Water Use Sector

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

2.0 Demand Projection Methodology

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

3.0 Water Demand Projections

Table 3-4 shows the projected increase in PG water demand for the planning period. The table shows an increase in demand for the planning period of 0.06 mgd, or 16.9 percent. The demand projections do not include reclaimed, seawater or non-consumptive use of freshwater.

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

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

County	2010 Base	2015	2020	2025	2030	2035	Change 2010-2035	% Change
Hillsborough	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Pasco	0.37	0.39	0.40	0.41	0.42	0.44	0.06	16.9%
Pinellas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Total	**0.37**	**0.39**	**0.40**	**0.41**	**0.42**	**0.44**	**0.06**	**16.9%**

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

4.0 Stakeholder Review

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

Section 4. Landscape/Recreation (L/R)

1.0 Description of the L/R Water-Use Sector

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

2.0 Demand Projection Methodology

Landscape/Recreation baseline use data is from the WUWPD (SWFWMD, 2014). This database includes metered use for active individual/general permits and estimated use for General Permits by Rule. The projection methodologies are divided into those for golf and those for other landscape and recreation. A more detailed description of the methodologies used is contained in Appendix 3-4.

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

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

3.0 Water Demand Projections

Table 3-5 provides total L/R demand for the planning period (both golf and other L/R demand). An increase in demand of 6.46 mgd for the 5-in-10 condition is projected between 2010 and 2035. This represents an increase in demand of 40.5 percent. The L/R irrigation demand in the region seems to have been affected by high land cost and low water availability. Pinellas County is the most densely populated county in the District and has one of the lowest population growth rates in the District. As both golf and other L/R uses are in large part driven by population growth, it is not surprising that Pinellas shows the smallest percentage increase in demand for this sector in the planning region. The region also has the smallest projected percentage increase in 18-hole equivalent golf courses (32 percent) of all planning regions, in no small part due to demographics. Those 55 years of age and older tend to play more golf. In Sumter County, the county with the largest increase in golf demand, those 55 and over are projected to make up 74 percent of the population in 2035. In Hillsborough County, those 55 years of age and older will make up only 28 percent of the county population.

4.0 Stakeholder Review

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

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

County	2010 Base		2015		2020		2025		2030		2035		Change 2010-2035		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Hillsborough	9.12	11.64	9.55	12.19	10.49	13.38	11.45	14.61	12.41	15.83	13.37	17.06	4.25	5.42	46.6%	46.6%
Pasco	3.71	4.75	3.80	4.87	4.21	5.40	4.64	5.95	5.08	6.51	5.52	7.08	1.81	2.32	48.9%	48.9%
Pinellas	3.12	4.00	3.15	4.04	3.27	4.20	3.38	4.33	3.46	4.43	3.51	4.50	0.39	0.50	12.6%	12.6%
Total	**15.94**	**20.39**	**16.50**	**21.09**	**17.98**	**22.98**	**19.47**	**24.89**	**20.94**	**26.77**	**22.40**	**28.64**	**6.46**	**8.25**	**40.5%**	**40.5%**

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

Section 5. Environmental Restoration (ER)

1.0 Description of the ER Water Use Category

ER comprises quantities of water that may need to be developed and/or existing quantities that need to be retired to facilitate recovery of natural systems to meet their MFLs. Table 3-6 summarizes ER quantities that will be required for the planning region through 2035.

2.0 Water Resources to Be Recovered

2.1 Southern Water Use Caution Area (SWUCA)

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

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

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

2.2 Northern Tampa Bay Water Use Caution Area (NTBWUCA)

The overuse of groundwater by multiple users in the NTBWUCA resulted in the area being designated a water use caution area (WUCA) in 1989. The most significant environmental impacts in the NTBWUCA resulted from the West Coast Regional Water Supply Authority's (Tampa Bay Water's (TBW's) predecessor agency) groundwater withdrawals from their central wellfield system. To reduce groundwater withdrawals and mitigate impacts, the District entered into a Partnership Agreement with TBW and its member governments in 1998. Key objectives of the Partnership Agreement were to develop new water supplies from sources other than groundwater, end litigation, provide financial assistance for development of alternative water supplies, and increase conservation. Since the early 2000s, the development of new water sources has allowed for the phased reduction of groundwater withdrawals from 158 mgd to 90 mgd (12-month moving average) from TBW's central wellfield system. In 2010, Phase II of the recovery plan was implemented to identify any environmental impacts remaining after withdrawals were reduced to 90 mgd over a 10-year period. TBW is also required to develop a plan to address any identified unacceptable adverse impacts by 2020. This plan could include projects that require an environmental restoration demand.

2.3 Lower Hillsborough River

Due to diversions of water from the City of Tampa's reservoir to meet public supply demands for the city, there have been frequent periods when the Hillsborough River does not flow below the dam, especially during the dry season. In 2007, minimum flows for the Lower Hillsborough River were established at 24 cfs (15.5 mgd) fresh water equivalent from April 1 through June 30 and 20 cfs (13 mgd) fresh water equivalent the remainder of the year. Flows from Sulphur Springs are not completely fresh; therefore, more than 24 and 20 cfs, respectively, will be needed to meet the rule criteria. It is estimated that flows of 27 cfs (17.4 mgd) will be needed to meet the 24 cfs fresh water equivalent and flows of 23 cfs (14.9 mgd) will be needed to meet the 20 cfs fresh water equivalent. Based on flow conditions from 2001 to 2012, the lower river will require augmentation 203 days per year, on average, to meet minimum flows. Diversions from Sulphur Springs are used first to meet the minimum flows, but additional sources are needed, which comprise the environmental restoration demand. An annual average of 4.8 mgd of environmental restoration demand is expected to be needed to meet the minimum flows for the Lower Hillsborough River by 2017. More or less water might be needed to meet minimum flows at any given time or over an extended period of time, depending on rainfall and resulting fluctuations in river flows. The minimum flows must be met by October 2017; however, they will likely be met earlier, as water transfer projects are implemented. Projects to transfer water from the Tampa Bay Canal (TBC), Sulphur Springs, Morris Bridge Sink and Blue Sink to the river have been completed or are under development. Water from Sulphur Springs is being sent to the base of the dam, and water is being diverted from the TBC to the Hillsborough River.

2.4 Lower Alafia River

In 2010, a low-flow threshold of 120 cfs (77.6 mgd) was adopted for the Lower Alafia River. At the time, TBW and Mosaic Fertilizer (Mosaic) were permitted for surface water withdrawals that would be affected by minimum flows limitations. TBW agreed to modify its operations to comply with the low-flow threshold for the Lower Alafia River. Mosaic's Riverview Facility depends on withdrawals from Lithia Major Spring and Buckhorn Main Spring for plant operations. However, during low flow periods, these springs provide critical freshwater flow to the estuarine portion of the Alafia River. Mosaic obtained a water use permit to augment the South Prong of the Alafia

River with UFA groundwater to replace withdrawals from the springs when the flows in the lower Alafia River fall below the low-flow threshold. An estimated annual average of 0.74 mgd will be needed to meet the minimum flow for the Lower Alafia River. More or less water could be needed to meet the minimum flow at any given time or over an extended period of time, depending on fluctuations in river flows.

Table 3-6. *Projected increase in ER demand for the Tampa Bay Planning Region (mgd)*

Water Resource to be Recovered	2010 Base	2015	2020	2025	2030	2035	Change 2010-2035
SWUCA SWIMAL	-	-	TBD	5.0+[1]	5.0+[1]	5.0+[1]	5.0+
NTBWUCA	-	-	TBD	TBD	TBD	TBD	TBD
Lower Hillsborough River	-	-	4.8[2]	4.8[2]	4.8[2]	4.8[2]	4.8
Lower Alafia River	-	-	0.74	0.74	0.74	0.74	0.74
Total	**-**	**-**	**5.54+**	**10.54+**	**10.54+**	**10.54+**	**10.54+**

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

[2] An annual average of 4.8 of mgd environmental restoration demand is expected to be needed to meet the minimum flows for the lower Hillsborough River by 2017; however, they will likely be met earlier as water transfer projects are implemented. More or less water might be needed to meet minimum flows at any given time or over an extended period of time, depending on rainfall and resulting fluctuations in river flows.

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

Section 6. Summary of Projected Demands

Tables 3-7 summarizes the demands for the 5-in-10 and 1-in-10 conditions for water use categories in the planning region. This table shows that 87.57 mgd of additional water supply will need to be developed and/or existing use retired to meet the 5-in-10 demand in the planning region through 2035. Public supply water use will increase by 83.11 mgd during the planning period. This is the largest increase of all the water use categories. Environmental restoration is next at approximately 10.54+ mgd. Table 3-6 shows a -11.76 mgd reduction in agricultural water use and a slight net decrease of -0.83 mgd in I/C and M/D water use, most of which is groundwater.

The District estimated that approximately 15 mgd is needed to recharge the UFA to meet the required MIA aquifer level. The 15 mgd estimated to be needed for recovery of the MIA was divided equally between the Heartland, Tampa Bay, and Southern planning regions and is subject to change as part of the next five-year assessment of the SWUCA Recovery Strategy. An additional 4.8 and 0.74 mgd is expected to be needed to recover the lower Hillsborough and lower Alafia rivers, respectively.

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

Table 3-7. *Summary of the projected demand in the Tampa Bay Planning Region (5-in-10 and 1-in-10)*[1] *(mgd)*

Water Use Category	2010 Base		2015		2020		2025		2030		2035		Change 2010-2035		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Public Supply	292.29	309.83	308.89	327.43	327.90	347.58	345.62	366.35	361.18	382.85	375.40	397.92	83.11	88.09	28.4%	28.4%
Agriculture	75.97	84.90	71.26	79.17	67.79	74.76	66.48	72.78	65.11	70.82	64.21	69.43	-11.76	-15.47	-15.5%	-18.2%
I/C & M/D	13.40	13.40	14.20	14.20	11.61	11.61	11.93	11.93	12.25	12.25	12.57	12.57	-0.83	-0.83	-6.2%	-6.2%
Power Gen.	0.37	0.37	0.39	0.39	0.40	0.40	0.41	0.41	0.42	0.42	0.44	0.44	0.06	0.06	16.9%	16.9%
Landscape/Rec.	15.94	20.39	16.50	21.09	17.98	22.98	19.47	24.89	20.94	26.77	22.40	28.64	6.46	8.25	40.5%	40.5%
Env. Restoration	-	-	-	-	5.54+	5.54+	10.54+	10.54+	10.54+	10.54+	10.54+	10.54+	10.54+	10.54+	NA	NA
Total	**397.97**	**428.89**	**411.24**	**442.28**	**431.21**	**462.87**	**454.45**	**486.91**	**470.44**	**503.65**	**485.55**	**519.54**	**87.57**	**90.65**	**22.0%**	**21.1%**

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

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

Table 3-8. *Summary of the projected increase in demand for counties in the Tampa Bay Planning Region (5-in-10) (mgd)*

Water Use Category	Planning Period						Change 2010-2035	
	2010	2015	2020	2025	2030	2035	mgd	%
Hillsborough								
Public Supply	139.09	149.64	162.40	174.32	184.63	194.08	55.00	39.5%
Agriculture	60.62	56.75	53.77	52.86	51.81	51.15	-9.47	-15.6%
I/C & M/D	12.27	13.04	10.41	10.69	10.97	11.26	-1.01	-8.3%
Power Gen.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Landscape/Rec.	9.12	9.55	10.49	11.45	12.41	13.37	4.25	46.6%
Env. Restoration	0.0	0.0	TBD	TBD	TBD	TBD	TBD	NA
Cumulative Total	**221.09**	**228.99**	**237.06**	**249.33**	**259.82**	**269.86**	**48.77**	**22.1%**
Pasco								
Public Supply	53.70	58.73	64.85	70.53	75.68	80.36	26.66	49.6%
Agriculture	15.21	14.31	13.83	13.45	13.14	12.91	-2.29	-15.1%
I/C & M/D	1.07	1.10	1.14	1.17	1.21	1.25	0.18	16.9%
Power Gen.	0.37	0.39	0.40	0.41	0.42	0.44	0.06	16.9%
Landscape/Rec.	3.71	3.80	4.21	4.64	5.08	5.52	1.81	48.9%
Env. Restoration	0.0	0.0	TBD	TBD	TBD	TBD	TBD	NA
Cumulative Total	**74.06**	**78.32**	**84.43**	**90.20**	**95.54**	**100.48**	**26.42**	**35.7%**
Pinellas								
Public Supply	99.50	100.52	100.66	100.77	100.87	100.95	1.45	1.5%
Agriculture	0.14	0.20	0.18	0.17	0.16	0.14	0.00	0.5%
I/C & M/D	0.06	0.06	0.06	0.06	0.07	0.07	0.01	10.4%
Power Gen.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Landscape/Rec.	3.12	3.15	3.27	3.38	3.46	3.51	0.39	12.6%
Env. Restoration	0.0	0.0	5.54+	10.54+	10.54+	10.54+	10.54+	NA
Cumulative Total	**102.82**	**103.93**	**109.72**	**114.92**	**115.09**	**115.21**	**12.39**	**12.0%**
Region Total	**397.97**	**411.24**	**431.21**	**454.45**	**470.44**	**485.55**	**87.57**	**22.0%**

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

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

There are significant differences between the 2010 and 2015 RWSP demand projections in the agricultural, public supply, I/C, M/D, PG, landscape/recreation, and environmental restoration water use categories. The 2010 base numbers are reduced in all sectors from the 2010 projected numbers used in 2010 RWSP due to methodology changes and over projections. The projection differences can also be attributed to slower than anticipated population growth and the economic downturn. Regarding the public supply category, the 2010 RWSP projected an increase of 91.3 mgd for the 2005–2030 planning period while the 2015 RWSP projects an increase of 83.11 mgd from 2010–2035, lower than the 2010 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 (District) to quantify the amount of water that is potentially available from all sources of water within the planning region to meet demands through 2035. Sources of water that were evaluated include surface water/stormwater, reclaimed water, seawater desalination, brackish groundwater desalination, fresh groundwater and conservation. Aquifer storage and recovery (ASR) is also discussed as a storage option with great potential to maximize the utilization of surface water and reclaimed water. Aquifer recharge (AR), either indirect through rapid infiltration basins (RIBs) or direct through injection wells, is discussed as an option to increase water supply, restore aquifer levels and manage saltwater intrusion. The amount of water that is potentially available from these sources is compared to the demand projections for the planning region presented in Chapter 3, and a determination is made as to the sufficiency of the sources to meet demand through 2035.

Part A. Evaluation of Water Sources

Fresh groundwater from the Upper Floridan aquifer (UFA) is currently the primary source of supply for all use categories in the planning region. It is assumed that the principal source of water to meet 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 planning region, as 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 possibly from the UFA, subject to a rigorous, case-by-case permitting review.

Water users throughout the region are increasingly implementing conservation measures to reduce their water demands. Such conservation measures will 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, seawater and surface water with off-stream reservoirs and ASR systems for storage or AR to provide recovery and offset impacts from withdrawals. 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. In 2013, approximately 68 percent (256 mgd) of the 376 mgd of water (including domestic self-supply) used in the planning region was from groundwater sources. Approximately 66 percent (168 mgd) of the fresh groundwater used was for public supply (permitted and domestic self-supply). Fresh groundwater is also withdrawn from the surficial and intermediate aquifers for water supply, but in much smaller quantities. The following is an assessment of the availability of fresh groundwater in the surficial, intermediate and UFA in the planning region.

1.0 Surficial Aquifer

Due to the karst geologic setting of the region, the thickness of the surficial aquifer is highly variable, ranging from less than 5 to more than 90 feet. The aquifer is generally low in permeability due to the presence of fine-grained sediments, has limited saturated thickness and is suitable mostly for lawn irrigation and watering livestock. The surficial aquifer in the northern half of Hillsborough County and all of Pasco County provides very little water for water supply and is not anticipated to supply a significant amount in the future.

Because the clay-confining layer between the surficial and Upper Floridan aquifers is thin and leaky in this area, groundwater withdrawals from the UFA can significantly affect water levels within the surficial aquifer, thereby impacting surface features such as wetlands and lakes. Decades of large-scale groundwater withdrawals from the UFA for public supply have lowered surficial aquifer water levels near wellfields. Although there are no permitted withdrawals from the surficial aquifer in Pinellas County, the aquifer is used as a source of supply for irrigation of residential turf and landscaping. A shallow well reimbursement program has been implemented in Pinellas County to encourage homeowners to install wells into the surficial aquifer for lawn irrigation as an alternative to utilizing potable water from their public supply connection.

In 2006, the surficial aquifer yielded 0.7 mgd of unpermitted withdrawals in Pinellas County, which was mostly used for landscape irrigation. It is anticipated that an additional irrigation demand of 0.3 mgd can be met through the use of the surficial aquifer in Pinellas County (Basso, 2009). In Hillsborough County, permitted withdrawals from the surficial aquifer in 2006 were 0.17 mgd. In southern Hillsborough County, it is anticipated that an additional irrigation demand of 0.4 mgd can be met through the use of the surficial aquifer.

2.0 Intermediate Aquifer System

The intermediate aquifer system in the planning region exists only in central and southern Hillsborough County. Annual average water use from permitted withdrawals in the intermediate aquifer system in 2006 was 0.2 mgd in Hillsborough County. There were no permitted withdrawals in Pinellas or Pasco counties. 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 be a total of 0.02 mgd in Hillsborough County in 2006.

Due to its limited extent, only approximately one-third of projected 2035 demand for domestic self-supply, landscape irrigation and recreational water use in Hillsborough County can be met from the aquifer. Projected 2035 demand supplied through withdrawals from the surficial and intermediate aquifers in the planning region is expected to total 5.5 mgd, with 2.1 mgd allocated to recreational use and 3.4 mgd to domestic self-supply and household irrigation use (Basso, 2009). See Table 4-1 for a summary of this estimated demand.

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

County	Domestic Self-Supply/Irrigation	Recreation
Hillsborough	3.1[1]	2.1[1]
Pinellas	0.3	0
Pasco	0	0
Total	**3.4**	**2.1**

[1] Reduced due to limited extent of IAS in this count

3.0 Upper Floridan Aquifer

To reverse the extensive water resource impacts of large-scale groundwater withdrawals from wellfields in the Northern Tampa Bay Water Use Caution Area (NTBWUCA), the District and Tampa Bay Water (TBW) agreed to phased reductions that would scale down production by 68 mgd to an annual average of 90 mgd. As a result of the development of alternative water supply projects and favorable hydrologic conditions, TBW achieved the reduction in withdrawals in 2003. The Phase II Recovery Plan was implemented in 2010 to monitor the impacts of 90 mgd of withdrawals over a 10-year period. By 2020, a determination will be made as to whether or not an additional reduction in groundwater withdrawals and/or mitigation will be required. Because so much of the planning region is still in recovery, the development of additional groundwater quantities from the UFA will be very limited.

3.1 Upper Floridan Aquifer Permitted/Unused Quantities

A number of public supply utilities in the planning region are not currently using their entire permitted allocation of groundwater. The District anticipates that these utilities will eventually grow into these unused quantities to meet future demand. Based on a review of the unused quantities of water associated with public supply water use permits (WUPs), approximately 15.0 mgd of additional groundwater quantities are available to public supply utilities from the UFA.

Section 2. Water Conservation

1.0 Non-Agricultural Water Conservation

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

- Infrastructure and Operating Costs. The conservation of water allows utilities to defer expensive expansions of potable water and wastewater systems while limiting operation and maintenance (O&M) costs at existing treatment plants, such as the use of electricity for pumping and treatment or expensive water treatment chemicals.
- Fiscal Responsibility. Most water conservation measures have a cost-effectiveness that is more affordable than that of other alternative water supply sources such as reclaimed

water or desalination. Cost-effectiveness is defined as the cost of each measure compared to the amount of water expected to be conserved over the lifetime of the measure.

- Environmental Stewardship. Proper irrigation designs and practices, including the promotion of Florida-Friendly Landscaping™ (FFL), can provide natural habitat for native wildlife as well as reduce unnecessary runoff from properties into water bodies. This, in-turn, can reduce nonpoint-source pollution, particularly from operations that use fertilizers, pesticides or fungicides which, in turn, may hamper a local government's overall strategy of dealing with total maximum daily load (TMDL) restrictions within their local water bodies or maintain spring water quality health.

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

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

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

FWS landscapes use large mulch beds to reduce irrigable turf.

The District's water loss reduction program provides guidance and technical expertise to public supply water utilities and helps to identify and reduce water loss. The non-regulatory assistance and educational components of the program maximize water conservation throughout the public supply water use sector and improve both local utility system efficiency and regional water resource benefits. Among the services provided upon request are comprehensive leak detection surveys, meter accuracy testing and water audit guidance and evaluation. Since the program's inception, the leak detection team has conducted 104 comprehensive leak detection surveys throughout the District, locating 1,219 leaks of various sizes. This has resulted in an estimated 6.1 mgd of water savings. For the Tampa Bay Planning Region, the leak detection team has conducted 25 comprehensive leak detection surveys, locating 246 leaks of various sizes. This has resulted in an estimated 1.4 mgd of water savings within the Region.

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

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

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

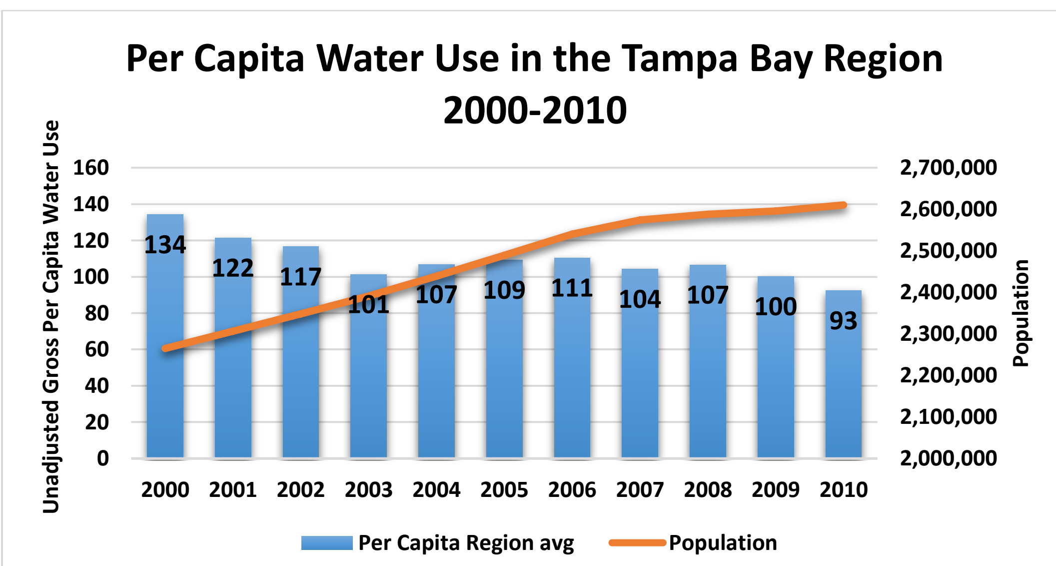


Figure 4-1. *Per capita water use rates in the Tampa Bay Region, 2000-2010*

1.1 Public Supply

The public supply sector includes all water users that receive water from public water systems and private water utilities. The public supply sector may include non-residential customers such as hospitals and restaurants that are connected to a utility potable distribution system. Water conservation in the public supply sector will continue to be the primary source of water savings in the District. Public supply systems lend themselves most easily to the administration of conservation programs, since they measure each water customer's water use and can focus, evaluate and adjust the program to maximize savings potential. The success of the District's water conservation programs for public supply systems to date is demonstrated by the 14.70 mgd in savings that has been achieved within the District since programs began in 1991. Within the region, it is estimated that savings for the public supply sector could be 42 mgd by 2035, if all water conservation programs presented below are implemented (see Table 4-2).

1.1.1 Water Conservation Potential in the Tampa Bay Region

Estimated conservation potential for the planning region is based on the Tampa Bay Water Long-Term Master Water Plan (2013). This plan uses the 2010-2035 planning horizon and is understood to be a well-quantified demand management plan. The plan takes into account statistical evaluations of existing conservation programs that have been implemented by member governments of TBW as well as literature review of available and emerging technologies/programs.

1.1.2 Assessment Methodology

Tampa Bay Water includes six member governments and, as a single entity, accounted for 74.4 percent of public supply water use in the planning region in 2010. In order to include the region's entire conservation potential, including what is available for the other 25.6 percent of demand, the District has projected the estimated conservation potential found for TBW member governments onto the remaining population of the planning region. This process is described further below.

In TBW's Demand Management Plan, water demand is divided into three major sectors: single-family residential, multifamily residential, and nonresidential. Single-family residential water demand is greater than multifamily residential and nonresidential demand combined. Single-family demand and its potential for conservation was examined by conducting a residential end users survey within the planning region followed by a statistical evaluation of actual billing data matched with parcel level information. Results showed the majority of water use indoors was attributable to showers, clothes washers, and toilets. This is consistent with national studies on end uses of water. Parcel level data that contains home age and heated square footage was used to estimate the original number of plumbing fixtures and their age and efficiency. This information was used to calculate passive conservation (change-outs to more efficient model fixtures by combinations of national standards, consumer preference and market-based certification programs).

Active conservation was calculated after accounting for passive conservation. Only 10 out of 24 possible conservation programs met TBW's screening criteria. The conservation programs that were included in the analysis are: cooling tower, pre-rinse spray valve, high-efficiency urinal (HEU), ultra-low-flow toilet (ULFT), alternative irrigation source, high-efficiency toilet (HET), residential HET, evapotranspiration (ET)/soil moisture sensor irrigation controller, residential HET (multifamily), and conveyor dishwasher. These programs were selected based primarily on cost effectiveness. TBW focused only on avoided variable costs of their most expensive existing source of water (avoided cost vs. new supply sources were not calculated).

The District-estimated 2035 demand projections in the planning region for the public supply sector (including domestic self-supply) is 370.91 mgd. The savings percentage rate that was calculated in TBW's demand management plan (12.5 percent reduction in demand by 2035) was applied to the region's entire projected demands. It should be noted that TBW baseline-projected demands for their respective utilities are higher than the District's projected demands for those same utilities. There is approximately a 36.2 mgd difference by 2035. For this reason, the 12.5 percent reduction in demand was used to calculate conservation potential.

For each program, savings were divided by the total savings for all active programs. This ratio was used to estimate how much potential savings exist for the regional demand that is not included in the TBW Demand Management Plan. Results of this effort are shown in Chapter 5.

1.1.3 Results

For TBW's Demand Management Plan, total conservation is shown to be 37.8 mgd. This results in a 12.5 percent reduction in 2035 projected base line demand of 302 mgd. This percentage, as a reduction in demand, was applied to the entire region's public supply demand. A 12.5 percent reduction in 2035 demand equates to 42.1 mgd of savings across public supply within the region. This includes passive conservation.

Roughly 67 percent of total savings can be attributed to passive conservation. In other words, the 8.4 percent reduction in sector demand is attributable to passive conservation. That is approximately 28.36 mgd in savings. Active programs thought to be feasible by TBW account for the other 33 percent of total savings. In other words, the 4.08 percent reduction in sector demands is attributable to active conservation measures. This amounts to approximately 13.73 mgd in savings.

The cost effectiveness of these active programs average just $0.31 per thousand gallons. The most cost-effective conservation program is the cooling tower retrofit/upgrade coming in at $0.07 cost/thousand gallons. The least cost effective program is the conveyor dishwasher program with an average cost of $0.42 per thousand gallons. Region-wide total cost for active programs is estimated at $35.2 million.

Passive conservation was included in TBW estimations, and it represents a significant portion of the region's overall savings. Passive conservation occurs when old fixtures are replaced with new, more efficient fixtures. When old fixtures become worn out or obsolete, the only replacement fixtures available on the market are significantly more efficient, and the resulting savings occur without a rebate or other incentive.

1.2 Domestic Self-Supply (DSS)

The domestic self-supply sector includes individual private homes and businesses that are not utility customers and receive their domestic water supply from a well or from a surface supply for uses such as irrigation. DSS wells do not require a District WUP, as the well diameters do not meet the District's requirement for a permit. DSS systems are not metered and, therefore, changes in water use patterns are less measurable than those that occur in the public supply sector. Conservation programs for DSS users can still be very successful, especially when outreach for the program is done in parallel with local public supply programs. Within the region, it is estimated that savings for the DSS sector could be 1.47 mgd by 2035 if all water conservation programs are implemented (See Table 4-2).

1.2.1 DSS Assessment Methodology

The water conservation potential for DSS sector is assumed to be directly proportional to that of the residential part of public supply and its estimate is dependent on the calculation of public supply residential indoor and outdoor water conservation potential. After the aggregate estimate of residential indoor and outdoor water conservation was completed, the total amount of potential public supply residential water conservation was divided by the aggregate service area population to yield a residential per capita water conservation potential of 3.20 gallons per day. This public supply per capita water conservation estimate was then multiplied by the projected DSS population of 457,990 to get the DSS water conservation estimate of 1.47 mgd. This method was used in the Draft 2015 Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP) and has been publicly vetted on a regional scale. The 1.47 mgd was then divided out to match the same portion of savings selected for each BMP in the TBW plan for the residential sector. The breakout is shown in Table 5-2.

1.3 Industrial/Commercial (I/C) Sector

This water use category includes factories and other industrial enterprises that obtain water directly from surface water and/or groundwater sources through a WUP. According to a survey sent to I/C permittees, water use efficiency improvements related to industrial processes have been implemented to a limited extent since 1999. Businesses try to minimize water use to reduce pumping, purchasing, treatment process and disposal costs. To date, the District has focused efforts on education, indoor and outdoor surveys and commercial applications, such as spray valves and low-flow toilets. The industrial processes being used in this category 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 0.56 mgd by 2035 (See Table 4-2).

1.3.1 I/C Assessment Methodology

The water conservation potential for I/C sector supply is considered to be directly proportional to that of I/C uses served by public supply systems. It was not feasible for this analysis to evaluate the conservation potential of the many varied commercial and industrial processes and it is assumed that the consumptive use permitting process and business economics already drive commercial and industrial establishments to minimize their use of process water. This estimate is dependent on the calculation of public supply I/C water conservation potential, which was derived from the TBW plan. The aggregate estimate of public supply I/C water conservation potential was pulled from the TBW plan and the percentage of savings for that use type was applied to the 2035 projected demand for the I/C category (12.35 mgd X 4.54 percent = 0.56 mgd). This methodology focuses on the domestic indoor uses associated with I/C sector facilities and does not account for the potential savings of commercial and industrial process water. This method was used in the Draft 2015 CFWI RWSP and has been publicly vetted on a regional scale.

1.4 Landscape/Recreation (L/R) Sector

The L/R water use category 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 category could be 1.55 mgd by 2035 (See Table 4-2).

1.4.1 L/R Assessment Methodology

The estimate of the water conservation potential of this category was derived from the percentage of water conservation estimated by the TBW plan for publicly-supplied outdoor water use. Savings were based on the evapotranspiration and soil moisture sensor irrigation controller BMP. The percentage of savings for that use type (outdoor use) was applied to the 2035 projected demand for the L/R category (22.40 mgd X 6.9 percent = 1.55 mgd). This method was used in the Draft 2015 CFWI RWSP and has been publicly vetted on a regional scale.

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

Table 4-2 summarizes the potential non-agricultural water conservation savings in the planning region. This table shows that 45.69 mgd could be saved by 2035 at a total projected cost of $44 million. This is an 11.25 percent reduction in total demand.

Table 4-2. *Potential water savings from non-agricultural water conservation*

Use Category	Demand (mgd)	Savings (mgd)	Reduction in Demand (%)	Average Cost Effectiveness ($)
Public Supply (PS)	336.72	13.73	4.08%	$0.31
PS Passive*	-	28.36	8.42%	-
DSS	34.03	1.47	4.31%	$0.33
L/R	22.40	1.55	6.91%	$0.35
I/C	12.35	0.56	4.54%	$0.21
Total	**405.49**	**45.69**	**11.25%**	**$0.31**

*PS Passive - Although passive conservation estimations were not included in previous RWSPs is an important component of the output generated by the particular model used in this region.

2.0 Agricultural Water Conservation

The District uses the “model” farms concept to estimate potential water savings through agricultural conservation. The concept is a tool to determine the potential for water savings for scenarios of irrigation system conversions and/or BMPs that are specific to different commodities and water use factors such as soil type, climate, crop type, etc. The District also achieves agricultural water savings through the Facilitating Agricultural Resource Management Systems (FARMS) Program. The FARMS Program is categorized as water resource development (WSD). Water savings achieved through the program are assigned to WSD quantities, rather than water conservation.

There are 20 model farms options available with different best management/irrigation system modifications applied to the existing farms. It is recognized that the model design parameters and case study results may not be directly transferable to all operations within a given commodity category. The model farm case studies should be viewed as a standard basis for comparison of cost analyses and for estimation of water savings. An additional benefit of the model farms data is that it is used to determine whether specific elements of projects implemented as part of the FARMS Program are cost-effective. The District reviewed the 20 model farms options and selected three as being the most applicable in the planning region (HSW, 2004). These three model farms represent BMPs for irrigation of citrus, nurseries and tomatoes. Information on these model farms is contained in Tables 4-3 and 4-4.

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

For the three model farms chosen for the planning region, the costs per acre required to convert to a more efficient irrigation system and the cost to implement BMPs were estimated based on publicly available data and information and interviews with local irrigation system and farm management providers. The potential savings associated with each of the model farm scenarios is summarized in Tables 4-3 and 4-4 for the 5-in-10 and 1-in-10 conditions, respectively. The data in these tables represent the maximum potential savings if all growers were to install the most efficient irrigation systems and implement appropriate BMPs for their respective commodities.

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

Table 4-3. *Model farm potential water savings (5-in-10)*

Description of Model Farm/ Irrigation System/BMPs Scenario				Water Savings (mgd)						
Model Farm Scenario ID	Crop	Existing Irrigation System	Irrigation System Conversion	2005	2010	2015	2020	2025	2030	Assumptions
1	Citrus – flatwoods	Microjet	No, other BMPs only	1.67	1.41	1.32	1.24	1.16	1.06	100 percent implementation, maximum improvement
3	Tomatoes	Semi-closed seepage	Drip and other BMPs	0.56	0.65	0.72	0.78	0.85	0.94	100 percent implementation, maximum improvement
8	Nurseries, container	Sprinkler	Line source emitter and other BMPs	2.68	2.79	2.97	3.15	3.34	3.55	100 percent implementation, maximum improvement

Model farm potential savings adjusted to be consistent with demand projections. Model Farm 1 (Citrus–flatwoods): existing microjet system is sufficient and no system conversion required, implement other BMPs only to achieve water savings. Model Farm 3 (Tomatoes): assumes drip system added to semi-closed seep, implement other BMPs only to achieve savings. Model Farm 8 (Nurseries, container): replacement of sprinkler system with line source emitter system assumed, implement other BMPs only to achieve savings. Data in table is max potential savings if all growers install the most efficient irrigation systems and implement BMPs. 100% grower participation assumed Source: SWFWMD (2008a), Hazen and Sawyer (2009).

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

Description of Model Farm/ Irrigation System/BMPs Scenario				Water Savings (mgd)						
Model Farm Scenario ID	Crop	Existing Irrigation System	Irrigation System Conversion	2005	2010	2015	2020	2025	2030	Assumptions
1	Citrus – flatwoods	Microjet	No, other BMPs only	0.95	0.80	0.75	0.71	0.67	0.61	100 percent implementation, maximum improvement
3	Tomatoes	Semi-closed seepage	Drip and other BMPs	0.73	0.85	0.94	1.03	1.11	1.24	100 percent implementation, maximum improvement
8	Nurseries, container	Sprinkler	Line source emitter and other BMPs	0.41	0.42	0.45	0.47	0.50	0.53	100 percent implementation, maximum improvement

Model farm potential water savings adjusted to be consistent with demand projections. Model Farm 1 (Citrus–flatwoods): existing microjet irrigation system is sufficient and no irrigation system conversion required, implement other BMPs only to achieve water savings. Model Farm 3 (Tomatoes): replacing semi-closed seep system with fully enclosed seep assumed, implement other BMPs only to achieve savings. Model Farm 8 (Nurseries, container): replace sprinkler system with lines source emitter system assumed, implement other BMPs only to achieve savings. Data in table is max potential savings if all growers install the most efficient irrigation systems and implement BMPs and 100% grower participation assumed. Source: SWFWMD (2008a), Hazen and Sawyer (2009).

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

Commodity	Total Estimated Savings (mgd)[1]	Total Cost ($/acre)[2]
Citrus	0.61	$105
Nurseries, container	0.53	$347
Strawberries	1.17	$172
Remaining	4.03	$100
Total	**6.34**	

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

Section 3. Reclaimed Water

Reclaimed water is defined by the Florida Department of Environmental Protection (DEP) as water that is beneficially reused after being treated to at least secondary wastewater treatment standards by a domestic wastewater treatment plant (WWTP). Reclaimed water can be used to accomplish a number of goals, including decreasing reliance on potable water supplies, increasing groundwater recharge and restoring natural systems. Figure 4-2 illustrates the reclaimed water infrastructure, utilization and availability of reclaimed water within the District in 2010, as well as planned utilization that is anticipated to occur by 2020 as a result of funded projects. Pinellas County has one of the largest reclaimed water systems in the nation. As of 2010, Pinellas County Utilities (Southcross and Dunn systems) used an average daily flow of nearly 20 mgd of reclaimed water for residential irrigation, golf course irrigation and industrial/commercial use. Funded projects are expected to result in reclaimed water increases of 23 mgd, bringing utilization within the planning region to approximately 114 mgd by 2020. Appendix 4-1 contains anticipated 2020 reclaimed water utilization.

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

TECO Advanced Treatment Facility

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 in-ground irrigation system connected to potable water uses approximately 300 gpd for irrigation. However, if the same single-family residence converts to an unmetered flat rate, reclaimed water irrigation supply without day-of-week restrictions, it will use approximately two and one-half times (804 gpd) this amount. In this example, the benefit rate would be 37 percent (300 gpd benefit for 804 gpd reclaimed water utilization). Different types of reclaimed water uses have different benefit potentials. For example, a power plant or industry using one mgd of potable water for cooling or process water will, after converting to reclaimed water, normally use approximately the same quantity. In this example, the benefit rate would be 100 percent. Most reclaimed water utilities provide service to a wide variety of customers and, as a result, the average reclaimed water benefit rate is estimated to be 65 percent. The District is actively cooperating with utilities to help identify ways to increase reclaimed water utilization and benefit. For example, efficiency can be further enhanced with practices such as individual metering coupled with storage, water-conserving rates, and efficient irrigation design and irrigation restrictions.

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

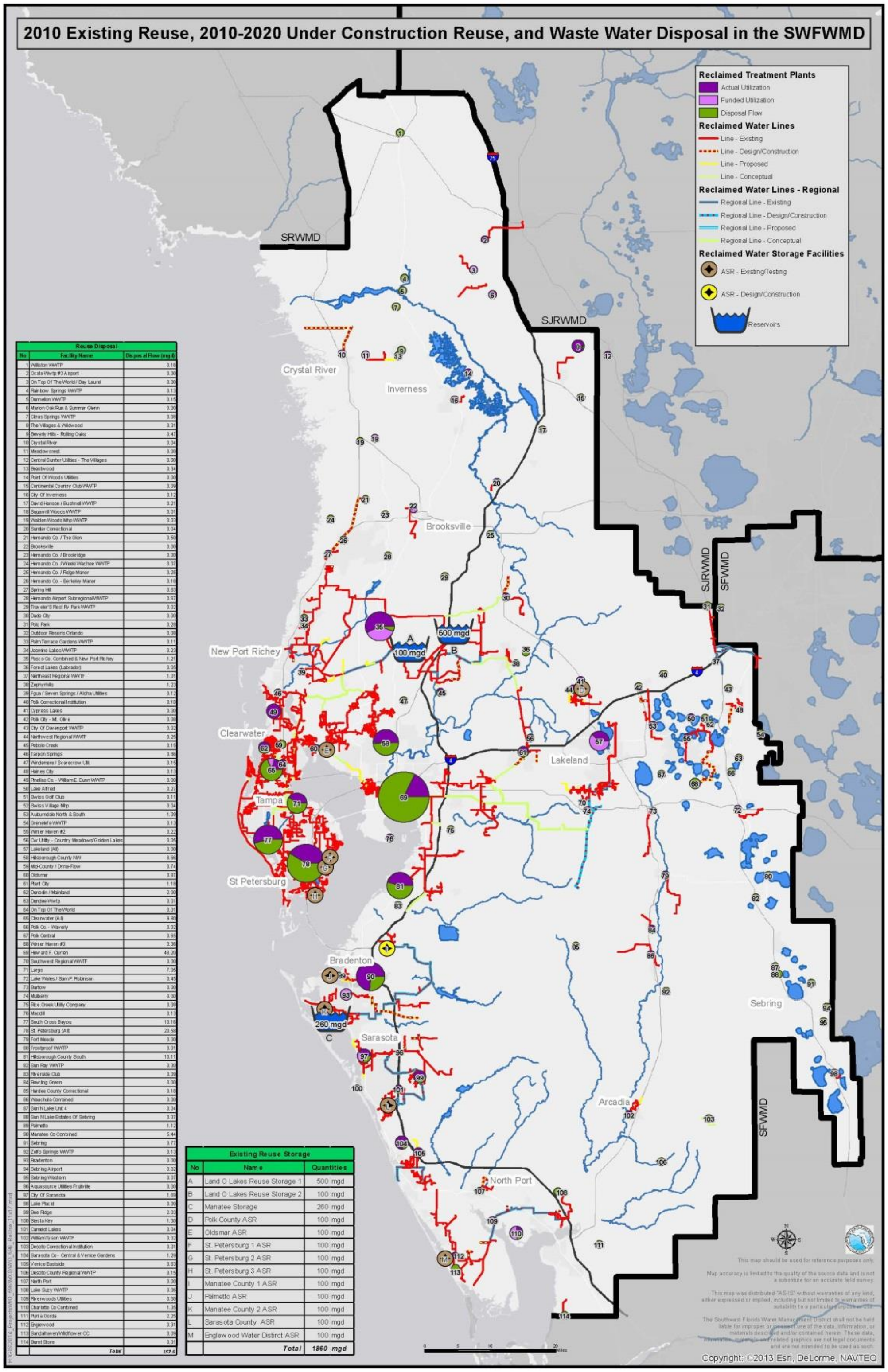


Figure 4-2. *Districtwide reclaimed water map*
To download this map, visit http://www.swfwmd.state.fl.us/conservation/reclaimed/

1.0 Potential for Water Supply from Reclaimed Water

Table 4-6 provides information on the current and future availability of reclaimed water in the planning region and the potential to achieve potable-quality water benefits through 2035. In 2010, there were 46 WWTPs in Hillsborough, Pasco and Pinellas counties that collectively produced 226 mgd of treated wastewater. Of that quantity, 91 mgd was used resulting in nearly 58 mgd of benefits to traditional water supplies. Therefore, only approximately 40 percent of the wastewater produced in the region was utilized for irrigation, industrial cooling or other beneficial purposes. By 2035, it is expected that more than 70 percent of wastewater available in the planning region will be utilized, and that efficiency of use will average more than 70 percent through a combination of measures, such as development of a customer base with significant numbers of high-volume, high-efficiency users, metering, volume-based rate structures, storage and education. As a result, by 2035, it is estimated that 176 (approximately 70 percent) of the 248 mgd of wastewater produced will be beneficially reused. This will result in approximately 123 mgd of benefits, of which 65.7 mgd is additional post-2010 (70 percent efficiency).

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

County	2010 Availability, Utilization and benefit[1]				2010–2035 Potential Availability, Utilization and benefit[2]			
	Number of WWTPs in 2010	WWTP Flow in 2010	Utilization in 2010	Potable-Quality Water Benefit (63%)	2035 Total WWTP Flow	2035 Utilization (70%)[3]	2035 Potable-Quality Water Benefit (70%)[3]	Post 2010 Benefit
Hillsborough	15	100.21	30.56	19.25	124.92	87.44	61.21	41.96
Pasco	16	26.32	14.45	9.10	33.40	23.38	16.37	7.27
Pinellas	15	99.11	46.35	29.20	89.4	65.24	45.67	16.47
Total	**46**	**225.64**	**91.36**	**57.55**	**247.72**	**176.06**	**123.25**	**65.7**

[1]Estimated at 63 percent regionwide average.
[2]See Table 4-1 in Appendix 4.
[3]Unless otherwise noted.

Section 4. Surface Water

The major river systems in the planning region include the Anclote, Hillsborough (including the Tampa Bypass Canal (TBC)), Alafia and Little Manatee. Major public utilities use the Alafia and Hillsborough rivers and the TBC for water supply. The Hillsborough River has an in-stream dam that forms a reservoir for storage. The potential yield for all rivers will ultimately be determined by their established minimum flows. However, yields associated with rivers that have in-stream dams also depend on the degree of structural alteration that has occurred and the habitat that is supported by the flows. The City of Tampa, which relies on the Hillsborough River and the TBC for most of its water needs, is currently permitted an annual average quantity of 83 mgd from these sources. TBW also uses the Hillsborough River and the TBC. From January 2007 to December 2011, TBW supplied an average of 30.9 mgd from the TBC (including withdrawals from the TBC Middle Pool, which is augmented by the Hillsborough River, and the Lower Pool).

Water from these withdrawals is treated at TBW's regional water treatment plant and conveyed to the regional distribution system.

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 the minimum flow for the river was not yet established or a hydrodynamic model was not available, a planning-level minimum flow criteria was utilized. A five-step process was used to estimate potential surface water availability that included (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 detailed explanation of this methodology is located in the Chapter 4 Appendix 4-2.

2.0 Overview of River Systems

2.1 Anclote River

The Anclote River originates in south-central Pasco County and discharges to the Gulf of Mexico at Tarpon Springs. The headwaters are poorly defined and consist mostly of agricultural and natural lands. The lower portion of the watershed is urbanized. The watershed area is approximately 120 square miles and contains several gauging stations with long-term flow data. The annual average discharge from 1965 to 2013 at the most downstream gauging station is 43 mgd (67 cfs).

The Anclote River is located in Pasco and Pinellas counties and has a watershed of 120 square miles

The Anclote Power Station withdraws water from the river near the confluence with the Gulf of Mexico; however, there are no permitted withdrawals upstream of the gulf. According to *Anclote River System Recommended Minimum Flows and Levels* (Heyl et. al., 2010), there may be little or no water available from the river. Declines in flow have occurred due to groundwater withdrawals from the five regional wellfields in the Northern Tampa Bay Region. River flows are expected to improve as a result of the recovery strategy for the NTBWUCA.

2.2 Alafia River

The Alafia River watershed encompasses approximately 460 square miles. While most of the watershed is located in Hillsborough County, the headwaters are located in Polk County, where the land has been mined extensively for phosphate ore. The river extends 23 miles from its mouth at Hillsborough Bay near Gibsonton, eastward to the confluence of its two major tributaries (North and South prongs). Below this confluence, the river has three major tributaries: Turkey, Fishhawk and Bell creeks. The adjusted annual flow of the Alafia River is 232.8 mgd (360.2 cfs). Mosaic Fertilizer is permitted to withdraw an annual average of nearly 6.0 mgd from Lithia and Buckhorn springs, which supply base flow to the river.

TBW's withdrawals are permitted according to a flow-based withdrawal schedule. The annual average withdrawal is anticipated to be 17.5 mgd, based on an analysis of the period from 1977 to 1996 that is summarized in the permit. Over this period, average annual withdrawals were predicted to range from 7.2 to 28.9 mgd. The schedules of withdrawals for Mosaic and TBW are not conditioned or constrained by the withdrawals of the other party. Water withdrawn by TBW can be used directly or diverted to the C. W. Bill Young Regional Reservoir for storage. Two additional minor permitted agricultural use withdrawals are located on Bell Creek and Howell Branch. The combined permitted withdrawals from the river are 23.6 mgd, and use for the period 2007 through 2011 is 14 mgd. Based on the MFLs for the Alafia River, an additional 19 mgd of water supply is potentially available from the river.

2.3 Hillsborough River

The Hillsborough River is the most hydrologically significant river in the planning region. The river has a watershed area of 650 square miles. The interactions between the Hillsborough River watershed and the UFA are complex and result in large wetland areas that act as groundwater discharge points in some areas and surface water storage basins in others. Minimum flows have been established for both the freshwater and estuarine reaches.

Although most of the river systems in the northern Tampa Bay Region are fed almost totally by overland flow or surficial aquifer discharge, the Hillsborough River receives significant discharge from the UFA. The river originates in the Green Swamp, but much of the base flow entering the river is discharged from the Upper Floridan and surficial aquifers along the course of the river. Several reaches of the river have direct contact with the UFA and many springs are found along the bottom and banks. The Hillsborough River corridor is heavily urbanized in its lower reaches and the river has been dammed 10 miles upstream from its mouth to create a reservoir for the City of Tampa's water supply. The greater part of the headwaters and upper reaches of the river are undeveloped.

Minimum flows have been established for the Upper Hillsborough River, but not the Middle Hillsborough River. The annual average discharge from 1965 to 2013 was 184 mgd (285 cfs) as measured at the dam. This is net discharge after withdrawals. The annual average flow for the other rivers in the District included in the RWSP for each planning region is calculated after all upstream withdrawals have been added back to reproduce the unimpacted flow. The transfer of water to and from the Hillsborough River is extremely complex, involving not only public supply use but also transfers to and from the TBC. Consequently, the reported flow in Table 4-7 is not corrected for withdrawals.

Two withdrawals are permitted on the Hillsborough River: one for the City of Tampa and one for TBW. The City is currently permitted to withdraw an annual average of 82 mgd from the Hillsborough River Reservoir for delivery to the City's water treatment plant, located upstream of the dam. TBW is permitted to divert up to 194 mgd (dependent on flows over the dam) from the Hillsborough River to the TBC Middle Pool for withdrawal at TBW's pump station. The City can accept an annual average of up to 20 mgd into its reservoir from the TBC Middle Pool in accordance with TBW's WUP. From January 2007 through December 2011, the City of Tampa's annual average withdrawal from the Hillsborough River was 67.9 mgd. TBW's annual average diversion from the Hillsborough River to the TBC Middle Pool was 1.9 mgd. The net withdrawal from the Hillsborough River was 69.8 mgd. During the same period, TBW diverted 9.95 mgd from the TBC Middle Pool to augment the Hillsborough River.

2.4 Tampa Bypass Canal (TBC)

The TBC System was built by the U.S. Army Corps of Engineers to provide flood protection for the Tampa metropolitan area. The canal system was completed in 1984 and extends 18 miles from the Lower Hillsborough Flood Detention Area to McKay Bay. The canal breaches the UFA, which allows groundwater to discharge from the aquifer into the canal. Minimum flows have been established for the TBC Lower Pool.

TBW operates two pumping stations on the TBC. The Harney Pump Station withdraws water from Harney Canal (Middle Pool) of the TBC and delivers this water to the City of Tampa's Hillsborough River Reservoir. The purpose of this transfer of water is to augment the City's reservoir during low-flow conditions in the Hillsborough River. TBW also operates the TBC Pump Station, which is permitted to withdraw water from the Middle Pool and Lower Pool of the TBC. The withdrawal intakes are located just upstream and downstream of Structure S-162. This control structure separates the Middle and Lower pools. TBW's Harney Canal augmentation permit allows withdrawals up to an annual average of 20 mgd. TBW's Hillsborough River/TBC WUP does not limit the annual amount of withdrawal allowed. Diversions from the Hillsborough River to the TBC are based on flow calculated at the Hillsborough River Dam. Water is diverted from the Hillsborough River through Structure S-161 into the TBC for subsequent use by TBW. TBW's withdrawals from the TBC Lower Pool are based on stage. The minimum flow at Structure S-160 is zero, so no flow downstream of S-160 is required. TBW is permitted to take 100 percent of the available water when the pool stage is at nine feet or above, up to the permit capacity of 258 mgd. TBW manages the pool stages in the Middle Pool and Lower Pool to maximize the availability of water on a day-to-day basis. TBW's long-term yield analysis estimates that 88.5 mgd of water is available for withdrawal from the TBC, including the current flow-based diversions from the Hillsborough River.

From January 2007 to December 2011, TBW withdrew an annual average of 30.9 mgd from the TBC for distribution to their regional system. Approximately 1.9 mgd was water taken from the Middle Pool of the TBC and 29 mgd was non-augmented water from the Lower Pool of the TBC. During the same period, TBW diverted 9.95 mgd from the Middle Pool to augment the Hillsborough River. Total net diversions from January 2007 through December 2011 were 39 mgd.

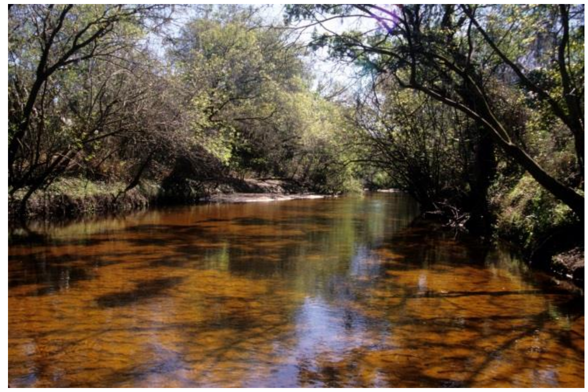
As part of the recovery strategy for the NTBWUCA, TBW developed the enhanced surface water system, which withdraws additional quantities of water for potable supply from the TBC. This water can be used directly or diverted to the C. W. Bill Young Regional Reservoir for storage.

2.5 Little Manatee River

The Little Manatee River watershed straddles the Manatee/Hillsborough county line and encompasses approximately 225 square miles. The river extends nearly 40 miles from its source in southeastern Hillsborough County, westward to its mouth at Tampa Bay near Ruskin. Tidal effects in the Little Manatee River are discernible up to 15 miles upstream from the mouth. Based on flow data collected at the United States Geological Survey (USGS) gage near Wimauma, average annual discharge for the Little Manatee River is approximately 112 mgd (173 cfs).

Florida Power and Light (FPL) withdraws water from the Little Manatee River and stores it in a 3,500-acre cooling pond (Lake Parrish) for its 1,600 megawatt power generation facility.

Average annual diversions from 2007 to 2011 were 5.7 mgd. The original WUP authorized FPL to withdraw water from the river during high-flow periods and for quantities greater than 10 percent of total flows. Under a permit revised in 2002, FPL is now authorized to withdraw up to an annual average of 8.7 mgd, with maximum daily withdrawals limited to 10 percent of the total river flow. The revised permit includes a single withdrawal schedule for normal operations and a schedule for what is termed "emergency conditions." Emergency conditions become active when the level of the cooling pond falls below a pre-determined level. An additional 0.3 mgd is permitted to agricultural operations on the Little Manatee River. Total permitted withdrawals are 9 mgd. Based on permitted withdrawals and the planning level minimum flow criteria, no additional water is available from the river.



The Little Manatee River is located in Manatee and Hillsborough counties and extends 40 miles from its source to Tampa Bay near Ruskin

3.0 Summary of Surface Water Availability in the Planning Region

Table 4-7 summarizes potential surface water availability for rivers in the planning region. The estimated additional surface water that could potentially be obtained from rivers in the planning region ranges from approximately 65.6 mgd to 84.6 mgd. The lower end of the range is the amount of surface water that has been permitted but is currently unused (194.4 mgd minus 128.8 mgd), and the upper end includes permitted, but unused quantities (65.6 mgd) plus the estimated remaining unpermitted available surface water (19 mgd). Additional factors that could affect the quantities of water that are ultimately developed for water supply include the future establishment of minimum flows, the ability to develop sufficient storage capacity, variation in discharges to the river from outside sources, and the ultimate success of adopted recovery plans.

Table 4-7. *Summary of surface water availability in the Tampa Bay Planning Region (mgd) based on planning-level minimum flow criteria (p85/10 percent) or the proposed or established minimum flow*

Water Body	In-stream Impoundment	Adjusted Annual Average Flow[1]	Potentially Available Flow Prior to Withdrawal[2]	Permitted Average Withdrawal Limits[3]	Current Withdrawal[4]	Unpermitted Potentially Available Withdrawals[5]	Days/Year New Water Available[6]		
							Avg	Min	Max
Tampa Bay Planning Region									
Anclote River[7]	No	43.0	TBD	0.0	0.0	TBD	--	--	--
Alafia River @ Bell Shoals Rd.[8]	No	232.8	41.3	23.4	14	19	266	204	365
Hillsborough River @ Dam[9,10]	Yes	184.3	18.4	113.0	69.8	TBD	TBD	TBD	TBD
Tampa Bypass Canal @ S-160[10,11]	Yes	NA	0	88.5	39	TBD	TBD	TBD	TBD
Little Manatee River @ FPL Reservoir	No	112.0	11.2	9.0	6.0	0.0			
Total				**233.9**	**128.8**	**19**			

[1] Mean flow based on recorded USGS flow plus reported WUP withdrawals added back when applicable. Maximum period of record used for rivers in the region is 1965–2013. An MFL of zero has been established for TBC S-160; therefore, adjusted annual average flow is indicated as not applicable (NA).
[2] Based on 10 percent of mean flow for Little Manatee River. MFLs were established and applied to calculate potentially available quantities for Alafia River. Adopted MFL for TBC at S-160 is zero.
[3] Based on individual WUP conditions, which may or may not follow current 10 percent diversion limitation guidelines.
[4] Based on average reported withdrawals from 2007–2011.
[5] Equal to remainder of 10 percent of total flow after permitted uses allocated, with minimum flow cutoff for new withdrawals of P85 and max system diversion capacity of twice median flow (P50)
[6] Based on estimated number of days that additional withdrawal is available considering current permitted quantities and withdrawal restrictions. Min and max are the estimated range of days that additional withdrawals would have been available in any particular year.
[7] Anclote River flow recovery will be based on monitoring and reporting required by the Northern Tampa Bay New Water Supply and Ground Water Withdrawal Reduction Agreement (Rule 40D-80.073(3), F.A.C..
[8] Permitted Alafia River withdrawals are sum of TBW's long-term annual yield based on WUP withdrawal schedule, Mosaic Fertilizer withdrawals from Lithia and Buckhorn springs, and two small agricultural permitted withdrawals. Current use for TBW withdrawals is water sent to regional distribution system and was 10.9 mgd, based on average pumping from 2007–20011. May be possible to develop additional supply from these sources by expanding current WUP withdrawal limits. Additional work necessary to ensure additional withdrawals do not cause impacts.
[9] Adjusted annual average flow not corrected for withdrawals due to complex transfer of water to/from Hills. River involving public supply use and transfers to/from TBC. TBW's permitted withdrawals from Hills. River based on their WUP flow schedule, as described in Footnote 11.. City of Tampa's permitted withdrawals from Hills. River are 82 mgd, which is quantity permitted for public supply. Availability of the 82 mgd is dependent on Hills. River augmentation with water from TBC (up to 20 mgd), Sulphur Springs (up to 11 mgd), and stored Hills. River water from City of Tampa ASR that is returned to river as needed (up to 10 mgd). Current use for Jan. 2007–Dec. 2011 includes 67.9 mgd used by city and 1.9 mgd by TBW for total of 69.8 mgd. Current use does not include 9.95mgd transferred from TBC to augment Hills. River.
[10] May be possible to develop additional water from Hills. River and TBC by expanding current WUP withdrawal limits. Additional work necessary to ensure additional withdrawals do not cause environmental impacts.
[11] TBW's permitted TBC withdrawals are flow schedule-based; annual average withdrawals expected to be 29 mgd, based on analysis of 1975–1995. TBW's permitted withdrawals from TBC Middle Pool to augment Hills. River Reservoir are 20 mgd. Total permitted withdrawals from TBC are 49 mgd. Current augmentation use for Jan. 2007-Dec. 2011 from TBC Middle Pool to Hills. River is9.95 mgd. Current use based on Jan. 2007–Dec. 2011 is difference between 30.9 mgd withdrawn by TBW from Lower and Middle Pools and 1.9 mgd transferred from Hills. River to augment TBC Middle Pool. Net withdrawal from TBC is 29 mgd. Total current use for TBC is 39 mgd. TBW's permitted TBC withdrawals based on stage levels in Lower Pool and a flow-based diversion schedule from Hills. River through S-161. Permitted withdrawal capacity from TBC is 258 mgd. TBW is permitted for 100 percent of water in Lower Pool when stage is above 9.0 feet. Long-term yield from TBC estimated by TBW to be 88.5 mgd, including diversion from Hills. River through S-161 with estimated long-term yield of 45 mgd.

Section 5. Brackish Groundwater Desalination

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

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

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

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

The Florida Legislature declared brackish groundwater an alternative water source in 2005 (Senate Bill 444). However, it remains a groundwater withdrawal and must occur in a manner that is consistent with applicable rules, regulations, and water use management strategies of the District. Factors affecting the development of supplies include the hydraulic properties and water quality of the aquifer, rates of groundwater withdrawal, and well configurations.

The District revised its Cooperative Funding Initiative policy in December 2007, which previously restricted any funding for the construction of projects that develop groundwater. Since then, the District has assisted with the construction of four brackish groundwater treatment projects. The funding is intended to incentivize the development of integrated, robust, multijurisdictional water supply systems that are reliable, sustainable, and utilize diverse water sources. A phased approach to brackish groundwater development is recommended that includes hydrogeologic evaluations to determine project viability, design phases that help refine the economic and permitting feasibility, and construction procured through a competitive bidding process.

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

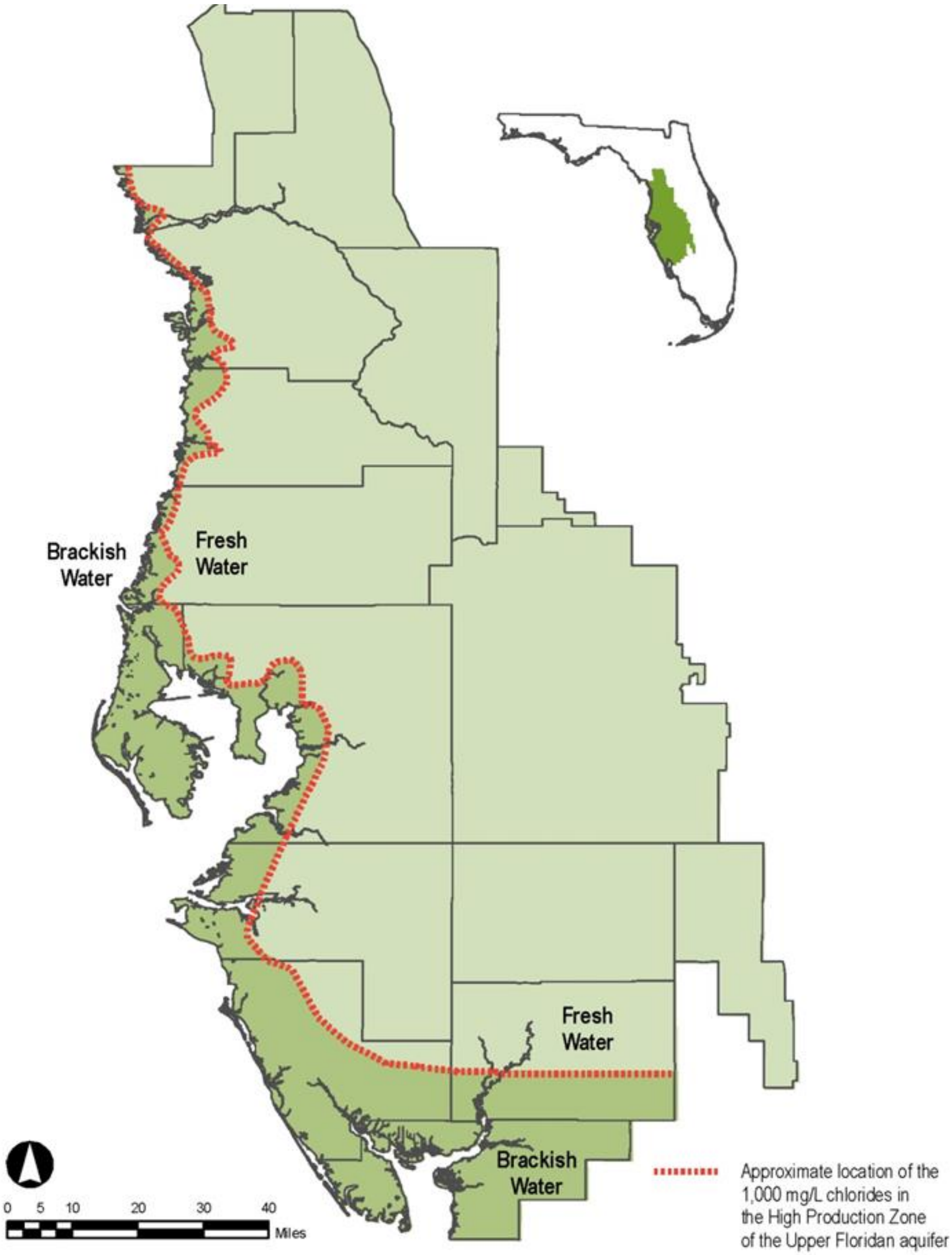


Figure 4-3. *Generalized location of the freshwater/saltwater interface*

1.0 Potential for Water Supply from Brackish Groundwater

Impacts from excessive withdrawals of groundwater from the UFA in the NTBWUCA have significantly lowered water levels in lakes and wetlands throughout the region. Though withdrawals from TBW's wellfields in Pasco and northern Hillsborough counties have created a regional drawdown effect and degraded water quality in some wells, the water quality effects are associated primarily with localized upwelling of brackish water, rather than exasperated saltwater intrusion. In Pinellas County, the water quality in the UFA has degraded over the last century, although recharge quantities have been sufficient to maintain some fresh-quality production zones that are still utilized for public supply. Approximately three quarters of the public supply currently used in Pinellas County is imported from sources outside the county, originating primarily from TBW's consolidated wellfields. As listed in Table 4-8, four utilities in Pinellas County are currently treating brackish groundwater or have RO facilities under construction. These facilities are helping to reduce demands on fresh groundwater resources in the NTBWUCA.

The southern coastal portion of Hillsborough County is located within the Most Impacted Area (MIA) of the Southern Water Use Caution Area (SWUCA), and impacts from saltwater intrusion have occurred here prompting a recovery strategy that limits additional groundwater withdrawals. Proposed groundwater withdrawals, fresh or brackish, cannot impact UFA water levels in the MIA 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.

With the proper evaluation of groundwater resources, utilities may be able to obtain or modify permits to withdraw brackish groundwater from the UFA in Pinellas, Pasco, and northern Hillsborough counties, so long as existing users and natural resources are not negatively impacted. Recently permitted and developed brackish groundwater wellfields in the cities of Oldsmar, Clearwater, and Tarpon Springs have environmental monitoring programs for detecting impacts. The monitoring data will be beneficial for future determinations of whether additional quantities are permittable.

The City of Oldsmar completed construction of a new brackish wellfield and RO facility in 2012. The project was cooperatively funded by the District. The facility has a 2.0 mgd average flow capacity, and the wellfield has a 2.7 mgd permitted average withdrawal capacity. Prior to 2012, the City imported approximately 1.5 mgd of water supply from Pinellas County Utilities. The interconnection between the entities is maintained as a back-up supply for the City and a potential source for the County during emergencies.

The City of Clearwater has three water treatment facilities and also imports water from Pinellas County Utilities. RO facility #1, located in the southwestern portion of the city, has been in operation since 2009 and has a 3.0 mgd average treatment capacity. RO facility #1 is undergoing an expansion to 4.5 mgd capacity. The City's new RO facility, #2, is located in the southeast portion of the city and has a 5.0 mgd average treatment capacity. RO Facility #2 and its associated wellfield were cooperatively funded by the District and will begin production in 2015. The third facility is a fresh water wellfield located in the northeast portion of the city. The new and expanded RO facilities will offset most of the supply the City previously imported from Pinellas County Utilities. The interconnections with the County system will be maintained.

Table 4-8. *Brackish groundwater desalination facilities in the Tampa Bay Planning Region (mgd)*

Name of Utility	County	Brackish GW Treatment Capacity (mgd)	Annual Average Permitted Withdrawal (mgd)	2013 Total Withdrawals (mgd)	2013 Finished Supply (mgd)	Estimated Available Supply[1] (mgd)	Source Aquifer	Raw Water Quality TDS (mg/L)	Concentrate Discharge Type[2]
Dunedin	Pinellas	9.50	6.620	4.234	3.296	1.857	UFA	250 - 990	WWTP
City of Clearwater (Plants 1 & 2)	Pinellas	9.25	14.300	5.348	4.857	3.544	UFA	300 -1,100	WWTP
City of Tarpon Springs	Pinellas	5.00	4.200	0.554	0.554	3.646	UFA	480 - 9,800	Surface/ Deep Well
City of Oldsmar	Pinellas	2.00	2.700	1.568	1.169	0.322	UFA	200 - 2,600	DIW

[1] Estimated available supply is calculated as either the Treatment Capacity or Permit Capacity (whichever is less) subtracted by the 2013 withdrawals, then multiplied by the treatment efficiency (Finished Supply/Withdrawal).
[2] WWTP: wastewater treatment plant, SWP: surface/stormwater pond.
Note: The utilities shown have water use permits with the District. Other small RO systems exist for self-supplied users.

The City of Tarpon Springs is developing a brackish wellfield and RO facility, with funding assistance from the District.

The City of Tarpon Springs is developing a brackish wellfield and RO facility with a 5.0 mgd flow capacity located north of the Anclote River. The project, which is cooperatively funded by the District, is scheduled to commence production in 2015. The City also withdrawals fresh groundwater from wells located south of the Anclote River and imports water from Pinellas County Utilities. The new facility is expected to offset the imported quantities; however, the interconnections will be maintained.

The City of Dunedin has operated a RO facility with a treatment capacity of 9.5 mgd since 1991. The facility's capacity exceeds the city's current and projected water demands due to conservation efforts.

The Town of Belleair has historically used 0.7 to 1.1 mgd of locally withdrawn fresh groundwater. The chloride concentration in some of the Town's wells has been increasing in recent years. The District is cooperatively funding studies with the Town to determine the feasibility of brackish water treatment, along with innovative wellfield withdrawal management strategies.

Since 2001, TBW has completed multiple studies to evaluate "small footprint" brackish groundwater development options in coastal Pasco and Pinellas counties. Currently, TBW is monitoring the city-initiated brackish groundwater projects and has not identified any specific small footprint options for development in their 2013 master plan.

The ultimate availability of additional brackish groundwater in the planning region for water supply, whether through the development of new facilities or expansion of existing ones, must be determined on a case-by-case basis through the permitting process. Because of this approach, an analysis to determine the total amount of brackish groundwater available for future water supply in the planning region has not been undertaken. As an alternative, the availability of brackish groundwater for water supply planning purposes was estimated by the unused capacity at existing facilities and facilities under development. The unused capacity of existing/ongoing facilities was calculated by subtracting the permittee's 2013 water withdrawals from either the permit capacity or treatment capacity, whichever was less. Using the lower value helps account for utilities that have more than one wellfield or treatment facility under their permit, or have additional fresh groundwater available. The unused capacity was reduced by each utility's treatment efficiency to determine water available to meet demands. The treatment efficiency was calculated as the ratio of finished supply per the total withdrawal. The unused available quantity is shown on Table 4-8.

Section 6. Aquifer Storage and Recovery

Aquifers are reservoirs and conveyance systems that can provide tremendous storage capabilities, enabling rapid storage or recharge of captured excess wet season flows. ASR and recharge projects enable us to smooth 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 an ASR, direct aquifer recharge (AR), or indirect AR system. Each of the methods has different levels of regulatory constraints that are largely based on the source water quality and the water quality of the receiving aquifer. Each method offers unique opportunities that match up with the various sources and qualities of available water.

ASR is the process of storing water in an aquifer when water supplies exceed demand and subsequently withdrawing the water when supplies are low and/or demands are high. The locations of ASR projects in the District are shown in Figure 4-4. ASR may be used for potable, reclaimed, groundwater or partially treated surface water. If water stored in the aquifer is for potable supply, when it is withdrawn from the aquifer 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 AR and recovery projects that use one location for injection and another for withdrawal.

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

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

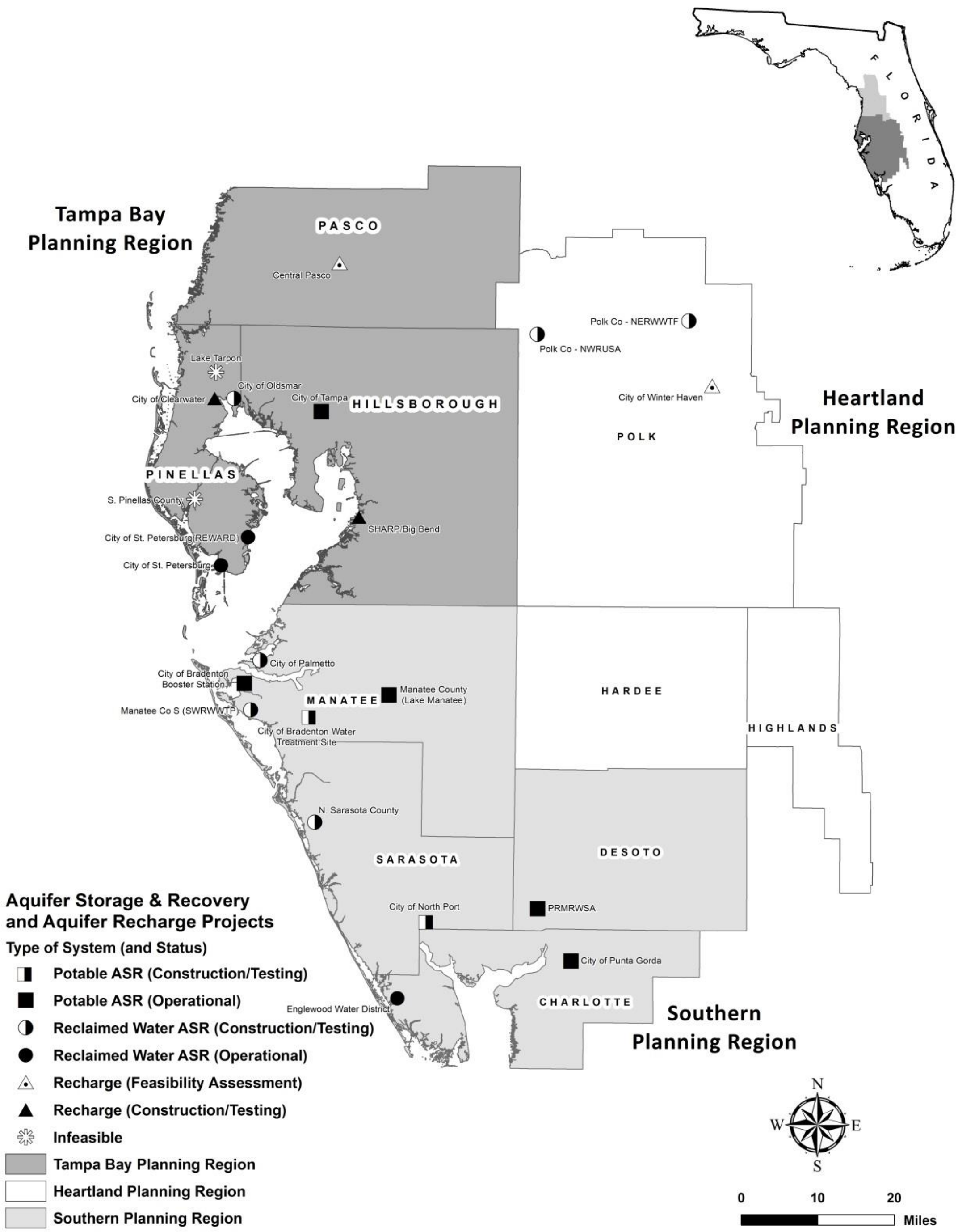


Figure 4-4. *Location of aquifer storage and recovery and aquifer recharge projects in the District that are operational or under development.*

Projects under development are those the District is co-funding and are either (1) actively in the planning, design, or construction phase, or (2) not yet in the planning phase but have been at least partially funded through FY2015, or (3) been completed since the year 2010 and are included to report on the status of implementation since the previous RWSP.

1.0 ASR Hydrologic and Geochemical Considerations

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

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

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

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

2.0 ASR Permitting

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

Significant clarifications of ASR regulations, as they apply to public water supply systems storing treated drinking water underground, were issued by EPA in 2013. The 2013 guidance allows the DEP to evaluate ASR systems on a case by case basis to determine if mobilization of arsenic and subsequent recovery and treatment of the water can be done in a manner that doesn't 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.

DEP 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 ASR and Arsenic

When the last RWSP was under development in 2010, permitting of ASR facilities in Florida was hindered by the mobilization of naturally occurring arsenic in the aquifer by the interaction of DO and other oxidants in the injected water with the aquifer's limestone matrix, which contains natural arsenic as a trace mineral. Since the last RWSP, effective solutions to the arsenic mobilization issue have been developed. The City of Bradenton ran a pilot project that removed DO from the injection water prior to injection and successfully eliminated the mobilization of arsenic. Arsenic concentrations in the recovered water were well below the drinking water standard of 10 ug/L, allowing the City to recover directly to the distribution system after standard disinfection requirements were met. At least one other site has duplicated the solution using the same technology. DO control offers one method of achieving an operation permit for ASR and recharge facilities. DO control can be achieved through physical removal, chemical scavenging or direct use of groundwater as a source for injection. Projects are currently testing chemical scavenging as a method for arsenic control.

Another method of achieving an operation permit is the attenuation of arsenic through removal during successive cycles of operation. The City of Tampa has seen arsenic concentrations consistently diminish over the years since startup in 1996. Most of the City's wells are now within the drinking water standard for arsenic and those that exceed it are just barely over the limit for a brief period during recovery. In 2013, the City received its 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 UFA water is brackish. In much of this area, the aquifer is not utilized for potable supply and the recovered water from ASR systems is treated to remove arsenic prior to distribution. Therefore, there has been no known exposure to arsenic above the current drinking water standard from water injected into the aquifer as a result of ASR operations.

Section 7. Aquifer Recharge

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

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

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

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

1.0 Direct Aquifer Recharge

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

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

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

2.0 Indirect Aquifer Recharge

Indirect AR is when water is applied to land surface where it can infiltrate and recharge the aquifer. Indirect AR can be accomplished by using a variety of techniques, including spray fields, recharge wetlands, large-scale drain fields, and RIBs. This recharge approach is used in areas where there is a good connection between the surface and source aquifer for water supply. Water applied to the surface must meet minimum water quality standards approved by the DEP. Infiltration capacity and permeability of the soil, presence of drainage features, depth to the water table, local hydrogeology, locations of nearby drinking water wells, as well as locations of nearby wetlands and lakes are all important to identify, test and characterize to determine 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. The District estimated that, as of 2010, 22.22 mgd of available reclaimed water (Districtwide) was being applied through RIBs for indirect AR (DEP, 2012).

Section 8. Seawater Desalination

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

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

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

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

Inside a desalination facility

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

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

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

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

1.0 Potential for Water Supply from Seawater Desalination

Two options for large-scale seawater desalination facilities in the planning region were evaluated for TBW's Long Term Master Water Plan (2013). The options include a 10 mgd expansion of TBW's existing facility at the Big Bend power station in Hillsborough County, and a new facility co-located with the Anclote River power station near the Gulf of Mexico in Pasco County.

The existing TBW desalination facility has transmission components that were designed to accommodate a future 10 mgd expansion. The Anclote River desalination facility option was evaluated as either a 25 mgd capacity project, or the phased development of a 7 mgd facility with a later expansion to 21 mgd to accommodate the pace of water demands. Additional information on these options is presented in Chapter 5. The proposed locations of these options, along with the locations of other existing and proposed seawater and brackish groundwater desalination facilities in the District, are shown in Figure 4-5.

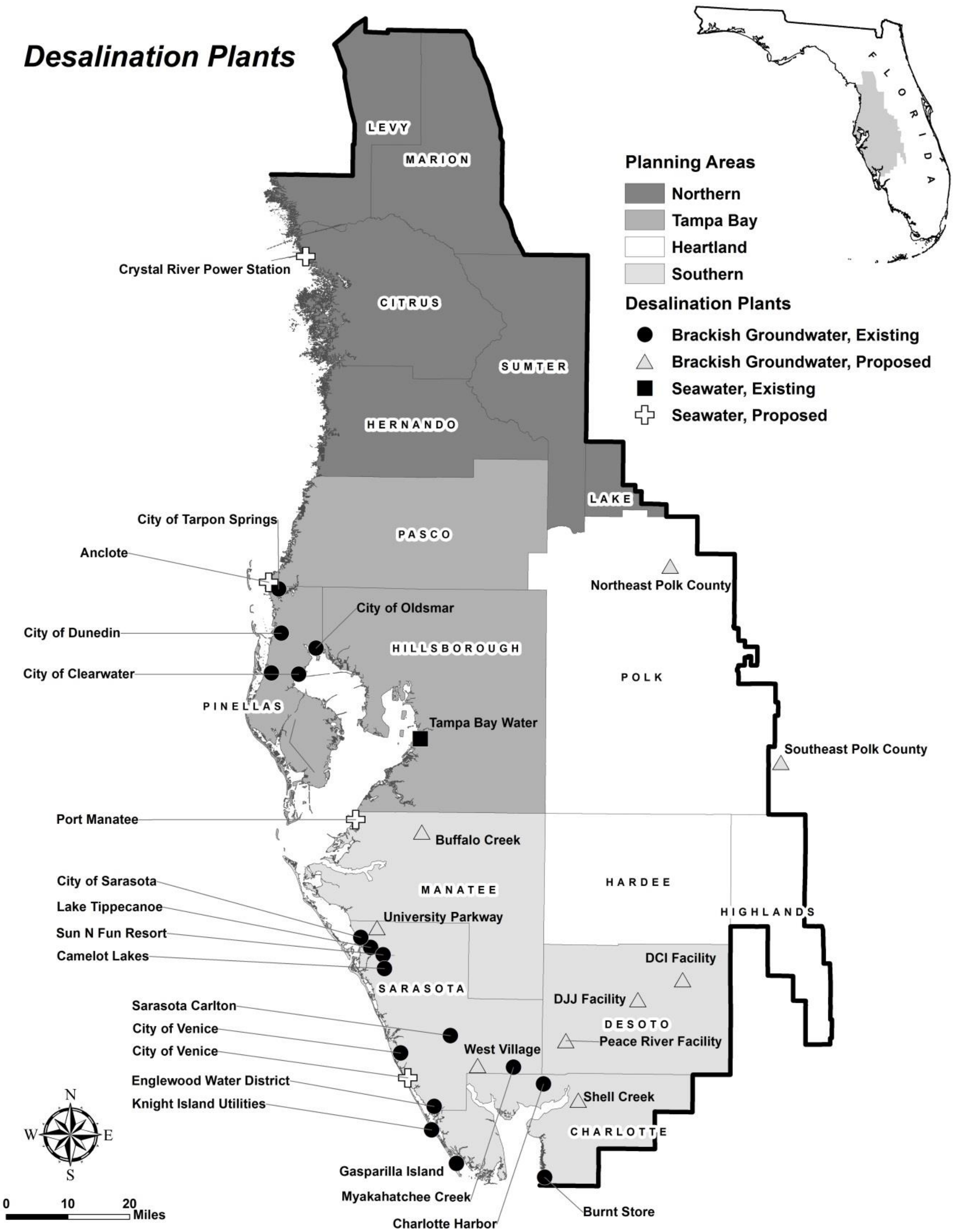


Figure 4-5. *Location of existing and potential seawater and brackish groundwater desalination facilities in the District*

Section 9. Stormwater

In the coming years, additional effort may be focused towards the investigation and advancement of stormwater capture and reuse, which is otherwise known as “Stormwater Harvesting”. The intent of this Stormwater Harvesting Program (SHP) is to expand upon existing stormwater reuse efforts, to facilitate innovation in this underdeveloped arena, and to take advantage of programs that have been successfully implemented by other Districts.

There are additional opportunities to capture and reuse surplus stormwater. A guiding principle for SHP is to support the pre-development behavior of hydrologic systems to retain and naturally percolate rainwater. It is also very important to try to recapture surface water discharges that would otherwise result in a tidal discharge. There are understandably numerous considerations and impediments to the successful implementation of a SHP. Below is a list of impediments and critical considerations for stormwater harvesting:

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

A defined “need” may be the most significant element in a stormwater harvesting program. There are scenarios where water is available, and the solutions may be cost effective; however, the alternatives might not be the highest and best use of available resources. A stormwater harvesting program must therefore balance stormwater availability against a defined need, so it must identify areas in the District where traditional water supply sources are limited. For this reason, a need-based approach may target areas such as the MIA, as well as water use caution areas (WUCAs).

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

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

Section 10. Summary of Potentially Available Water Supply

Table 4-9 is a summary of the additional quantity of water that will potentially be available from all sources of water in each county in the planning region from 2010 through 2035. The table shows that the total quantity available is 267.24 mgd.

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

County	Surface Water		Reclaimed Water	Desalination		Fresh Groundwater		Water Conservation		Total
	Permitted Unused	Available Unpermitted	Benefits	Seawater	Brackish Groundwater (Permitted Unused)	Surficial and Intermediate	Upper Floridan[1] Permitted Unused	Non-Agricultural	Agricultural	
Pasco	-	-	7.27	25.00	-	-	4.87	8.71	0.95	46.80
Pinellas	-	-	16.47	-	9.40	0.3	3.38	12.60	0.10	42.25
Hillsborough	65.6	19.0	41.96	10.00	-	5.2	6.75	24.38	5.30	178.19
Total	**65.6**	**19.0**	**65.70**	**35.00**	**9.40**	**5.5**	**15.00**	**45.69**	**6.35**	**267.24**

[1] Groundwater that is permitted but unused for public supply. Based on 2013 Estimated Water Use (SWFWMD, 2014).

Part B. Determination of Water Supply Deficits/Surpluses

Future water supply deficits/surpluses in the planning region were calculated as the difference between projected demands for 2035 and demands calculated for the 2010 base year (Table 3-6). The projected additional water demand in the planning region for the 2010–2035 planning period is approximately 87.57 mgd. As shown in Table 4-9, up to 267.24 mgd is potentially available from water sources in the planning region to meet this demand. Based on a comparison of projected demands and available supplies, it is concluded that sufficient sources of water are available within the planning region to meet projected demands through 2035.

Chapter 5. Overview of Water Supply Development Options

The water supply development (WSD) component of the Regional Water Supply Plan (RWSP) requires the Southwest Florida Water Management District (District) to identify water supply options from which water users 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, water conservation, reclaimed water, surface and stormwater, brackish groundwater desalination, ASR and Aquifer Recharge, and seawater desalination. Investigations were conducted to identify reasonable options for developing each of the sources, to provide planning level technical and environmental feasibility analyses, and to determine costs to develop the options.

The RWSP Executive Summary presents statutory guidance on how water supply entities are to incorporate WSD options from the 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 provide reasonable estimates of the quantity of water that could be developed and the associated costs of development. The District referenced cost information for the options to the appropriate document or applied a cost index to update the value from the 2010 RWSP. The following sections include a description of several representative options for each source that more fully develops the concepts and refines estimates of development costs. This is followed by a table that includes the remaining options for each source.

Some of the options included in the 2010 RWSP that continue to be viable are presented in this chapter and are updated accordingly. Where applicable, water supply options developed through the work of additional regional planning efforts, such as Tampa Bay Water's (TBW) Long-Term Water Supply Plan, are incorporated into this chapter. These options 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 supply authority or a group of users. Other options, such as those involving reclaimed water and conservation, would be implemented by individual utilities. 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.

Section 1. Fresh Groundwater

In the vicinity of TBW's consolidated wellfield system, it is unlikely additional groundwater will be developed until a full evaluation of wellfield withdrawal reductions and water level recovery in the region is made. The permitted allocation for the combined 11 wellfields in the system is 90 mgd annual average, and the permit is effective through January 2021. The District and TBW will continue monitoring and modeling activities to evaluate progress of the Northern Tampa Bay recovery strategy.

Future requests for fresh groundwater will be evaluated based on projected impacts to existing legal users and water resources. The District will give further consideration to projects that can mitigate the impacts of groundwater withdrawals on water resources with established minimum flows and levels (MFLs), including those that use reclaimed water for direct and indirect aquifer recharge.

Section 2. Water Conservation Options

1.0 Non-Agricultural Conservation

The District identified a series of conservation measures that are appropriate for implementation by the public supply, 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 measures and the methodology for determining the water savings potential for each measure within each non-agricultural water use category is described in Chapter 4.

Some readily applicable conservation measures are not addressed due to the wide variance in implementation costs and the site-specific nature of their implementation. Two such measures are water-conserving rate structures and local codes/ordinances, which have savings potential, but are not addressed as part of the 2015 RWSP. The District strongly encourages these measures and, when properly designed, they can be effective at conserving water. In addition, permittees are required to address these measures in their water conservation plan, which is part of the package provided by permittees during the water use permit application or renewal period. Below is a description of each non-agricultural water conservation option. Savings and costs for each BMP option are summarized, by sector, in the tables below.

Table 5-1. *Conservation options for Public Supply sector*

BMP – Program Option	Savings in 2035 (mgd)	Cost Effectiveness	Total Cost
Alternative irrigation source	4.15	$0.32	$10,378,349
Residential High-Efficiency Toilet (HET)	2.94	$0.35	$8,658,653
Evapotranspiration (ET) Soil Moisture Sensor (SMS) irrigation controller	2.29	$0.35	$4,818,979
Residential Multi-family HET	1.26	$0.37	$3,897,424
Commercial High-Efficiency Urinal (HEU)	1.52	$0.22	$4,066,315
Commercial Ultra-Low-Flow Toilet (ULFT)	0.70	$0.23	$1,747,596
Cooling Tower	0.42	$0.07	$238,946
Commercial HET	0.33	$0.32	$1,204,266
Pre-Rinse Spray Valve	0.07	$0.08	$45,505
Dishwasher	0.05	$0.42	$146,640
Total Public Supply	**13.73**	**$0.31**	**$35,202,674**

Table 5-2. *Conservation BMP options for Domestic Self-Supply sector*

BMP – Program Option	Savings in 3035 (mgd)	Cost Effectiveness	Total Cost
MF Residential HET	0.174	$0.37	$536,972
Alternative irrigation source	0.571	$0.32	$1,429,888
Residential HET	0.406	$0.35	$1,192,955
ET SMS irrigation controller	0.315	$0.35	$663,940
Total DSS	**1.465**	**$0.33**	**$3,823,755**

Table 5-3. *Conservation BMP options for Industrial/Commercial sector*

BMP – Program Option	Savings in 2035 (mgd)	Cost Effectiveness	Total Cost
HEU	0.28	$0.22	$738,374
ULFT	0.13	$0.23	$317,334
Cooling Tower	0.08	$0.07	$43,389
HET	0.06	$0.32	$218,674
Pre-Rinse Spray Valve (PRSV)	0.01	$0.08	$8,263
Dishwasher	0.01	$0.42	$26,627
Total C/I	**0.56**	**$0.21**	**$1,352,660**

Table 5-4. *Conservation BMP options for Landscape/Recreation sector*

Residential	Savings in 2035 (mgd)	Cost Effectiveness	Total Cost
ET SMS irrigation controller	1.55	$0.35	$3,263,049
Total L/R	**1.55**	**$0.35**	**$3,263,049**

1.1 Description of Non-Agricultural Water Conservation Options

1.1.1 Alternative Irrigation Source

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

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

Residential HET rebates were identified as a major potential source of water conservation.

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

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

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

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

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

1.1.5 Cooling Tower Modifications (Industrial, Commercial, Institutional)

As seen in TBW's Water Demand Management Plan, some larger buildings use cooling towers as their primary cooling system. Water-cooled cooling towers use a circulating loop to recycle water. Cycles of concentration (COC) define the accumulation of dissolved minerals (e.g. chlorides, total dissolved solids (TDS) or calcium) as the number of times the tower water is concentrated over that of the makeup water. As water loss occurs through evaporation and drift, most contaminants are left behind, thus increasing the dissolved mineral concentration of the tower water. Water use occurs as makeup water is added to compensate for water losses in a system. Water use also occurs as a result of cooling tower blowdown (i.e., discharge or bleed-off), a process which removes a portion of the concentrated water from the cooling tower and replaces it with makeup water. By increasing the COC, the amount of supplemental make-up water needed to operate the cooling tower efficiently is reduced. COCs can be optimized and increased based on tracking of pertinent water quality data, and through use of conductivity controllers. High-efficiency drift eliminators that reduce drift loss are available and may yield considerable savings.

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

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

1.1.7 Dish Washers (Commercial and Institutional)

Restaurant dishwashers are available in a variety of types, sizes, and flow rates ranging from 2.5 to 8.0 gpm. Dishwashers are normally selected and sized based on their ability to meet the service requirements of the food establishment. Water use reduction can be achieved by converting older inefficient machines to an Energy Star product which typically uses 40 percent less water than a standard dishwasher. High-efficiency dishwashers include several innovations, such as ”soil” sensors and high-efficiency jets, and innovative dish rack designs that reduce energy and water consumption and improve performance.

2.0 Agricultural Water Conservation Options

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

2.1 Facilitating Agricultural Resource Management Systems (FARMS)

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

2.2 Well Back-Plugging Program

The well back-plugging program provides funding assistance for property owners to partially back-plug wells with poor water quality. Back-plugging involves plugging the lower portion of deep wells with cement to isolate the geological formation where poor-quality groundwater originates. Back-plugged wells show a dramatic reduction in concentrations of chloride and sulfate, which are the constituents that typically exceed standards in the region. Because the District classifies the well back-plugging program as water resource development, additional information pertaining to the program, status of project implementation, and water savings achieved to date is provided in Chapter 7.

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

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

2.4 Mobile Irrigation Laboratory

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

Agricultural radial irrigation

2.5 Model Farms

The “model” farms concept is a tool to determine the potential for water savings for various scenarios of irrigation system conversions and/or BMPs for a number of different agricultural commodities. There are 20 model farms available with different best management/irrigation system modifications applied to the existing farms. Currently, there are seven model farms projects that are either in operation or planned for implementation in the planning region.

2.6 Best Management Practices (BMPs)

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

BMP Option #1. Tailwater Recovery System

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

The Holmberg Nursery project is an example of a tailwater recovery system in Hillsborough County. The project includes one new and two existing tailwater recovery and surface water irrigation reservoirs that are connected to capture and store irrigation tailwater. The project is expected to reduce the use of groundwater by approximately 10 percent or 0.18 mgd. The estimated project cost is $589,000. The annualized costs to create a tailwater recovery system in 2008 dollars are $530 per acre for a 10-acre blueberry farm, $228 per acre for a 30-acre field nursery, and $105 per acre for a 300-acre farm. See Table 5-5 for a summary of this option's potential costs and savings.

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

Option	Potential Savings (mgd)[1]	Capital Cost Per Acre[2]	O&M Cost /Acre[3]	Cost/1,000 Gallons
Tailwater Recovery System	0.18	$105-530	$3.50 - $12.60	$0.63

[1] If implemented in year 2010 on all acreage.
[2] Costs estimated in 2008 and included depreciation, insurance, taxes and repairs (for a 300-acre farm).
[3] Hazen and Sawyer (2009) BMP cost update using 2008 construction costs.

BMP Option #2. Precision Irrigation Systems

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

Several different types of electronic systems that increase irrigation system efficiency have been implemented through the FARMS Program.

BMP Option #3. Farm-Sited Weather Stations

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

Automated Irrigation Valve

2.7 Development of Alternative Water Sources for Agricultural Irrigation

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

Agricultural Alternative Source Option #1. Rainwater Harvesting

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

Components of the system would include a surface water withdrawal pump station, a 30-acre reservoir, a pump station and distribution system, and a surface water runoff interception/diversion ditch. A 500-foot intake ditch would convey water from an intermittent stream to a sump where it would be withdrawn by a 3,000-gpm pump and conveyed via a 6,000-foot, 16-inch-diameter pipe to a 30-acre irrigation reservoir. Water from the reservoir would be distributed to the fields using two 2,500-gpm pumps and 25,000 feet of irrigation main. A 6,100-foot interception ditch would divert runoff to an existing wetland perimeter ditch that would discharge into the sump. Control structures would be installed on the interception ditch to maintain base flow downstream and allow large storm events to bypass the ditch.

The amount of rainwater that could be harvested is conservatively estimated to be 0.53 mgd, which is 35 percent of the annual average water use allocation and 76 percent of the fall allocation. Assuming the grower participated in incentive programs such as FARMS and the NRCS Environmental Quality Incentives Program, the cost to the grower could be significantly less than the $2,980,000 capital cost. The water savings that could be achieved by implementing similar rainwater harvesting systems in the planning region is conservatively estimated to be 20 mgd. See Table 5-6 for a summary of this option's potential costs and savings.

Table 5-6. *Rainwater Harvesting costs/savings*

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

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

Agricultural Alternative Source Option #2. Reclaimed Water

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

Agricultural Alternative Source Option #3. Surface Water Sources

This option involves the capture and storage of surface water for agricultural irrigation. An example is the M.D. Council and Sons Surface Water Withdrawal Project in Hillsborough County. The project includes a surface water irrigation reservoir, two surface water irrigation pump stations, and the necessary piping to connect the surface water reservoir to the existing irrigation system. The annual average groundwater withdrawal is 0.28 mgd for irrigation of 60 acres of strawberries and melons. The estimated water savings from this project is 30 percent of permitted quantity or approximately 0.08 mgd. See Table 5-7 for a summary of this option's potential costs and savings.

Table 5-7. *Surface Water Sources costs/savings*

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

Section 3. Reclaimed Water Options

The diversity and abundance of urban, industrial and agricultural land uses in the planning region provides opportunities to use large quantities of reclaimed water in numerous, beneficial ways. Large wetland areas and abandoned mining operations in eastern Hillsborough County provide unique opportunities to beneficially utilize reclaimed water through restoration of natural systems and storage of wet-weather flows for dry season use. Brackish aquifers in coastal Hillsborough and Pinellas counties may also be ideal for seasonal storage or long-term aquifer recharge. The reclaimed water systems in the region are generally mature and, as such, the representative project options are dominated by interconnections, recharge potential, purification and seasonal storage project concepts.

Listed below are the different types of reclaimed water options that are compatible with the geology, hydrology, geography and available reclaimed water supplies in the planning region.

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

- **Potable reuse:** purification of reclaimed water to meet drinking water standards prior to introduction into a potable raw water source.

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

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

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

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

The District developed 41 reclaimed water project options (Table 5-8) for the planning region with input from utilities and other interested parties. The District determined the quantity of reclaimed water available for each option based on an analysis of wastewater flows anticipated to be available in 2035 at a utilization rate of 70 percent 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. The options are listed in Table 5-8.

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

Construction of Pasco County's 500 MG Boyette Reclaimed Water Reservoir

Table 5-8. *List of reclaimed water options for the Tampa Bay Planning Region*

Option Name and Entity	County	Type	Supply (mgd)	Benefit (mgd)	Capital Cost	Cost/ Benefit	O&M/ Benefit
City of Tampa and McKay Bay Restoration, Tampa. and the District	Hillsborough	Interconnect, NSE	7.1	7.1	$57,226,000	$1.59	$0.30
Reuse Expan Country Meadows WWTP 2016–2035, CW Utilities	Hillsborough	System Expansion	0.05	0.04	$403,000	$1.98	$0.30
Reuse NSE CAX Riverside 2016–2035, Rice Cr. Utilities	Hillsborough	Rehydrate/Wetland/NSE	0.06	0.06	$483,600	$1.59	$0.30
Reuse NSE Rice Creek 2016–2035, Rice Cr. Utilities	Hillsborough	Rehydrate/Wetland/NSE	0.06	0.06	$483,600	$1.59	$0.30
Reuse Expansion Windermere 2016–2035, Scarecrow Utilities	Hillsborough	Rehydrate/Wetland/NSE	0.1	0.07	$806,000	$2.27	$0.30
N.W. Hillsborough Reuse Expansion, Hillsborough County	Hillsborough	System Expansion	4	2.8	$32,240,000	$2.27	$0.30
S. Hillsborough County Recharge/Saltwater Intrusion Barrier, Hillsborough County, City of Tampa and others	Hillsborough	Recharge, SWB	20	TBD	$161,200,000	TBD	$0.30
N.W Hillsborough County/City of Temple Terrace Interconnect, City of Temple Terrace	Hillsborough	Interconnect	3.4	2.38	$7,500,000	$0.62	$0.30
Central Hillsborough County/Plant City Interconnect, Plant City	Hillsborough	Interconnect	13.5	9.45	$30,000,000	$0.63	$0.30
Plant City NSE, Plant City and others	Hillsborough	Rehydrate/Wetland/NSE	2.5	2.5	$2,500,000	$0.20	$0.30
Water Purification Potable Reuse, City of Tampa and Tampa Bay Water	Hillsborough	Purification	20	18	$161,200,000	$1.76	$0.30
Industrial Reclaimed Exchange (Lithia springs), Hillsborough County	Hillsborough	Exchange	1	1	$8,060,000	$1.59	$0.30
Reuse Expansion Hillsborough County South County System 2016–2035, Hillsborough County	Hillsborough	System Expansion/Rehydrate Wetland/NSE	6	4.2	$48,360,000	$2.27	$0.30
Plant City to Zephyrhills Interconnect, City of Zephyrhills and Plant City	Hillsborough/ Pasco	Interconnect	1	0.7	$8,060,000	$2.27	$0.30
Reuse Expansion Plant City WWTP 2016–2035, Plant City	Hillsborough	System Expansion	1	0.7	$8,060,000	$2.27	$0.30
Two Rivers Ranch Reuse 2016–2035, Plant City	Hillsborough	System Expansion	1	0.7	$8,060,000	$2.27	$0.30
Recharge Plant City/ Dover WUCA 2025, Hillsborough County	Hillsborough	Rehydrate/Wetland/NSE	7.5	7.5	$31,000,000	$0.81	$0.30
Interconnect with Tampa/ Hillsborough County East 2016–2035, City of Tampa and	Hillsborough	Interconnect	32	TBD	$84,000,000	TBD	$0.30

Option Name and Entity	County	Type	Supply (mgd)	Benefit (mgd)	Capital Cost	Cost/ Benefit	O&M/ Benefit
Hillsborough County							
Tampa By-pass Canal Augmentation 2016–2035, City of Tampa	Hillsborough	Rehydrate/Wetland/NSE	20	20	$161,200,000	$1.59	$0.30
Tampa Bay Water and Others Master Plan	Hillsborough	Plan	TBD	TBD	$150,000	TBD	TBD
Reuse Expansion Tampa/Current WWTP TECO Bayside 2016–2035, City of Tampa	Hillsborough	System Expansion	1	1	$8,060,000	$1.59	$0.30
Reuse Expansion Tampa/Current WWTP South Reuse Expansion 2016–2035, City of Tampa	Hillsborough	System Expansion	1	0.7	$8,060,000	$2.27	$0.30
Tampa Bay Water Purification Project 2016–2035, Tampa Bay Water, City of Tampa, Hillsborough County, Pasco County, Pinellas County, City of St. Petersburg, City of New Port Richey	Hillsborough	Purification	25	TBD	TBD	TBD	$0.30
Tampa Bay Water Aquifer Recharge-2016-2035, Tampa Bay Water and others	Hillsborough/ Pasco	Rehydrate	22	22	$234,000,000 to $406,000,000	TBD	$0.33-$1.96
Interconnect Forest Lakes Estates/Zephyrhills WWTP 2016–2035, City of Zephyrhills	Pasco	Interconnect	0.23	0.16	$1,853,800	$2.28	$0.30
Reuse Expansion Seven Springs (FGUA) WWTP 2016–2035, FGUA Utility	Pasco	System Expansion	0.7	0.49	$5,642,000	$2.27	$0.30
Reuse Expansion Jasmine Lakes WWTP 2016–2035, Jasmine Lakes Utility	Pasco	System Expansion	0.22	0.15	$1,773,200	$2.33	$0.30
Reuse Expansion Zephyrhills WWTP 2016–2035, City of Zephyrhills	Pasco	System Expansion	1	0.7	$8,060,000	$2.27	$0.30
Reuse Expansion Pasco/NPR System 2016–2035, Pasco County and City of New Port Richey	Pasco	System Expansion	1.2	0.8	$9,672,000	$2.38	$0.30
Reuse Expansion Travelers Rest 2016–2035, Travelers Rest	Pasco	System Expansion	0.02	0.01	$161,200	$3.17	$0.30
Reuse Expansion in Palm Terrace Gardens 2016–2035, Florida Water Services	Pasco	System Expansion	0.1	0.07	$806,000	$2.27	$0.30
Pinellas County Potable Reuse Purification, Pinellas County and Tampa Bay Water	Pinellas	Purification	10	9	$80,600,000	$1.76	$0.30
Reuse Expansion Clearwater 2016–2035, City of Clearwater	Pinellas	System Expansion	2.5	1.75	$20,150,000	$2.27	$0.30
Clearwater Potable Reuse Purification 2016–2035, City of Clearwater	Pinellas	Purification	2.5	2.25	$20,150,000	$1.76	$0.30

Option Name and Entity	County	Type	Supply (mgd)	Benefit (mgd)	Capital Cost	Cost/ Benefit	O&M/ Benefit
Reuse Expansion Dunedin 2016–2035, City of Dunedin	Pinellas	System Expansion	1.75	1.22	$14,105,000	$2.28	$0.30
Largo Potable Reuse Purification 2016–2035, City of Largo	Pinellas	Purification	5	4.5	$40,300,000	$1.76	$0.30
Reuse Expansion Mid-County WWTP 2016–2035, Mid-County Service, Inc.	Pinellas	System Expansion	0.5	0.35	$4,030,000	$2.27	$0.30
Reuse Expansion Pinellas County North System 2016–2035, Pinellas County (supplies from other systems)	Pinellas	System Expansion	0.5	0.35	$4,030,000	$2.27	$0.30
Reuse Expansion St. Petersburg System 2023–2035, City of St. Petersburg	Pinellas	System Expansion	5	3.5	$40,300,000	$2.27	$0.30
St. Petersburg Potable Reuse Purification 2025–2035, City of St. Petersburg and Tampa Bay Water	Pinellas	Purification	10	9	$80,600,000	$1.76	$0.30
Reuse Expansion Tarpon Springs System 2016–2035, City of Tarpon Springs	Pinellas	System Expansion	0.8	0.56	$6,448,000	$2.27	$0.30
Totals: 41 Options			**230.49**	**135.26**	**$1,393,345,400 to $1,565,345,400**	**$1.92**	**$0.30**

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

1.0 Reclaimed/Recharge Options

Reclaimed/Recharge Option #1. Aquifer Recharge

- Entity Responsible for Implementation: Tampa Bay Water

This project concept involves recharging the Floridan aquifer with highly treated reclaimed water and a remote groundwater withdrawal for potable supply such that a net benefit to Floridan aquifer levels is achieved. This aquifer recharge could be achieved by installing UFA recharge wells or surficial rapid infiltration basins. Reclaimed water from the City of Tampa's Howard F. Curren Advanced Wastewater Treatment Plant could be a major supply source for the recharge locations. In 2009, Tampa Bay Water performed preliminary analysis to further determine the feasibility of aquifer recharge as part of the Surface & Recharge Water Projects; this preliminary work identified areas feasible for aquifer recharge. It is estimated that an aquifer recharge project could take up to 13 years to complete pilot testing, design, permitting, construction and obtaining the resulting groundwater supply credits.

The project concept shown in Table 5-9, below, consists of two different potential configurations from TBW's Long Term Water Supply Plan Update (2013).

Table 5-9. *Aquifer Recharge options quantity/costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
22	$234,348,000-$406,463,000	TBD	$2.41-$5.58	TBD

Section 4. Surface Water/Stormwater Options

The Hillsborough River/Tampa Bypass Canal (TBC) system has been an important source of water supply for the City of Tampa. Since 2002, TBW has also utilized this system to help meet regional water demands. In 2007, the completion of the studies necessary to determine minimum flows showed that additional water was available from the system, especially at higher flows. In 2012, TBW expanded its use of the system as a part of System Configuration II. Since 2003, TBW has utilized the Alafia River as a potable water supply source. Based on the evaluation of the Alafia River's flows, additional water supply could be developed from the river during high-flow periods. Table 5-10 is a list of surface water/stormwater options that could be developed in the planning region.

Table 5-10. *List of surface water/stormwater options for the Tampa Bay Planning Region*

Option Water Body and Entity Responsible for Implementation	User Group	Avg Annual Yield (mgd)	Intake Capacity (mgd)	Capital Cost ($1,000/mgd)	Unit Cost ($1,000/ gal)	Annual O&M ($1,000)	Storage Method/Level of Treatment	Distribution Method
Pasco County								
None								
Pinellas County								
Lake Seminole Pinellas County Utilities	Urban reuse	1	9	5,645	2.07	285	Off-stream, ASR/1	Distributed to reuse system
Lake Tarpon Pinellas County Utilities	Urban reuse	3.7	37	14,026	4.94	2,327	ASR/2	Distributed to reuse system, or salinity barrier, or potable use
Hillsborough County								
S. Prong of Alafia River TBD	PS	5.8	12	30,797	7.06	Included in Unit Cost	Reservoir	Piped to adjacent treatment plant(s) for public supply
N. Prong of Alafia River TBD	PS	5.2	14	30,814	7.06	Included in Unit Cost	Reservoir	Piped to adjacent treatment plant(s) for public supply
Alafia River (Confluence of the North and South prongs) TBD	PS	13.2	18	31,148	7.14	Included in Unit Cost	Reservoir	Piped to adjacent treatment plant(s) for public supply
Channel A Hillsborough County Water Resource Services	Urban reuse	1	9	20,211	6.59	715	Off-stream reservoir, ASR/3	Piped to Hillsborough County's reuse system

1.0 Surface Water/Stormwater Options

Surface Water/Stormwater Option #1. Surface Water

- Entity Responsible for Implementation: Tampa Bay Water

This project includes options to expand TBW's enhanced surface water system using the Alafia River and Bullfrog Creek as two potential surface water sources. The Alafia expansion component of this project would include increasing the existing Alafia river pump station capacity to withdraw additional mid- to high-range flows from the river. A new withdrawal facility and pumping station would also be required on Bullfrog Creek to capture mid- to high-range flows.

Additional surface water treatment capacity may be necessary to treat the raw surface water that would be brought into the regional system. This raw water could be treated at a new surface water treatment facility in Hillsborough County, or at the expanded City of Tampa water treatment facility. Raw and finished water pipelines would be required to take the water to the treatment plant and to transmit the water to an appropriate location in TBW's regional transmission system. Additional storage in a potential second regional reservoir could also be included in the project.

The project concept costs shown in Table 5-11 consists of seven different potential configurations from TBW's Long Term Water Supply Plan Update (2013).

Table 5-11. *Surface Water option costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
0.3-17.3	$11,559,000-$612,514,000	TBD	$3.93-$12.85	$1.13-$2.06

Issues:

- Monitor any regulatory rule affecting levels of fluoride in drinking water and determine if additional treatment requirements or blending options may affect the overall cost, reliability and quantity of additional surface water supply.
- Understanding and designing the project based on the quantity of water available from Bullfrog Creek, consistent with a future minimum flow for the creek.

2.0 System Interconnect/Improvement Options

TBW has developed a number of system interconnect/improvement projects that are critical components of their regional system. The projects involve the construction of pipelines, treatment plants and booster pumping stations. Development of these types of projects will facilitate the regionalization of potable water supplies by providing transmission of water from areas of supply to areas of demand. The projects will also increase the rotational and reserve capabilities and provide redundancy of water supplies during emergency conditions.

Section 5. Brackish Groundwater Desalination

Brackish groundwater is considered to be a viable source of water supply that can be obtained from the UFA in certain areas in the planning region. Requests for brackish groundwater withdrawals will be evaluated similarly to requests for fresh groundwater withdrawals because all withdrawals, regardless of quality, cannot impact or delay the recovery of a stressed MFL water resource. Since publication of the 2010 RWSP, three additional brackish groundwater projects have been completed or are near completion in Pinellas County by the cities of Oldsmar, Clearwater, and Tarpon Springs.

Brackish Groundwater Option #1. Town of Belleair Water Treatment Plant Improvements

- Entity Responsible for Implementation: Town of Belleair

The Town of Belleair's water system consists of a conventional groundwater WTP and wellfield permitted for 1.16 mgd annual average. The wellfield's water quality has experienced increasing chloride levels, and may exceed drinking water standards within five to 10 years. The Town is investigating multiple options to maintain its potable supply including regional imports, innovative wellfield management strategies, and the addition of a reverse osmosis (RO) system at the existing facility to improve quality. The capital and O&M project costs shown in Table 5-12 are from a draft preliminary engineering report prepared for the town in 2014. The costs assume the addition of a RO system with 1 mgd annual average capacity (1.5 mgd peak design) and an injection well system for concentrate disposal. The facility's existing supply wells, storage tanks, and distribution pumps would be utilized.

Table 5-12. *Town of Belleair Water Treatment Plant option costs*

Project	Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/ 1,000 gallons
Water Treatment Plant Improvements (RO Treatment Systems)	1.0	$5,702,400	$3,802,000	$TBD	$0.45

Section 6. Seawater Desalination

There are two seawater desalination options within the planning region that would be co-located with an existing industrial facility, where a discharge of concentrate byproduct into the Gulf of Mexico or Tampa Bay may be permittable. The sites include TBW's existing desalination facility on Tampa Bay in Hillsborough County and the Anclote Power Plant on the Gulf of Mexico in southern Pasco County. The conceptual costs have been updated by TBW for the 2013 Long-Term Master Water Plan.

Seawater Desalination Option #1. Tampa Bay Seawater Desalination Plant Expansion (Big Bend)

- Entity Responsible for Implementation: Tampa Bay Water

Seawater desalination plant

This project concept is for a 10 mgd expansion of the Tampa Bay Seawater Desalination Plant located in Southern Hillsborough County. The existing desalination plant utilizes the Tampa Electric Company's Big Bend Power Station cooling water as its seawater supply source from Tampa Bay. The cooling water from the Power Plant is also used to dilute desalination concentrate before being returned to the Bay.

The expansion of the existing desalination plant would require additional water to be diverted from the Big Bend Power Plant cooling water system to the reverse osmosis plant. Supply and finished water pipelines were originally sized to accommodate a 10 mgd expansion. Therefore, this option would take advantage of the previously installed pipeline capacity. An additional 10 million gallons per day of treated water from the reverse osmosis plant would be delivered to the Tampa Bay Regional Surface Water Treatment Plant for blending prior to distribution. The pretreatment and chemical facilities would be modified to accommodate the expansion. Additional reverse osmosis treatment trains would be added to the existing system to provide the additional capacity.

The conceptual base cost estimate below is only for components not previously constructed, such as additional conventional pretreatment and RO treatment similar to the existing installation. Additional expansion components may be required, pending a more thorough design evaluation; including enhanced pretreatment, additional post-treatment, additional solids handling, expanded cooling water pumping and piping additions, and intake and concentrate piping replacement. The calculated project costs shown in Table 5-13 are in 2013 dollars.

Table 5-13. *TBW Big Bend Desalination option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
10	$216,100,000	$21,600,000	$8.11	$4.00

Seawater Desalination Option #2. Gulf Coast Seawater Desalination Project (Anclote Power Plant)

- Entity Responsible for Implementation: Tampa Bay Water

This option is for the development of a seawater desalination plant that would be co-located with the Anclote Power Plant in southwestern Pasco County. The power plant is coal-fired, and has a rating of 1,006 megawatts. The site location offers the advantages of the power plant's pre-filtered cooling water, which would serve as source water for the desalination plant, and a large volume of discharged cooling water for dilution of concentrate. Use of existing infrastructure would allow for a modification of the existing Florida Department of Environmental Protection (DEP) industrial wastewater discharge permit, or establishment of a new discharge permit for the desalination process. Additionally, the diluted concentrate would be discharged within Class III waters of the state, outside of the Pinellas County Aquatic Preserve Outstanding Florida Waters (OFW), which would simplify the waste concentrate discharge permitting process. Finished water would be delivered to the regional point of connection in northeast Pinellas County.

The project option has been previously evaluated for a seawater desalination plant with a capacity of 25 mgd. The TBW update introduces an alternate phased expansion approach that would have an initial capacity of 9 mgd. Costs shown in Tables 5-14 and 5-15 are in 2013 dollars and include the cost for raw water supply and waste discharge pipelines, RO treatment, and finished water delivery system.

Table 5-14. *TBW Anclote Power Plant Desalination Project option costs – full expansion*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
25	$551,100,000	$22,044,000	$7.00	$3.00

Table 5-15. *TBW Anclote Power Plant Desalination Project option costs – phased expansion*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
9 (Phase 1)	$262,200,000	$29,100,000	$9.00	$4.00
Expand to 21 (Phase 2)	$252,200,000	$21,020,000	$7.00	$3.00

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Chapter 6. Water Supply Projects Under Development

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

The demand projections presented in Chapter 3 show that approximately 87.57 mgd of new water supply will need to be developed during the 2015–2035 planning period to meet demand for all use sectors in the planning region. As of 2015, it is estimated that at least 23 percent of that demand (20.34 mgd) has either been met or will be met by projects that meet the above definition of being "under development." In addition, it is probable that additional water supplies are being developed by various entities in the planning region outside of the District's funding programs.

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

Projects under development in the planning region include major expansions of the water supply systems for Tampa Bay Water (TBW); brackish groundwater desalination in Tarpon Springs, Clearwater and Oldsmar; development and expansion of reclaimed water systems, including certain elements of the Tampa Bay Regional Reclaimed Partnership Initiative; aquifer storage and recovery (ASR) systems for both potable and reclaimed water; and conservation projects for public supply and agriculture.

Section 1. Water Conservation

1.0 Non-Agricultural Water Conservation Projects

1.1 Indoor Water Conservation Projects

Since 2010, the District has cooperatively funded the distribution of approximately 7,124 ultra low-flow or high-efficiency fixtures. These programs have cost the District and cooperating local governments a combined $1,119,176 and have yielded a potable water savings of approximately 176,950 gallons per day. Table 6-1 provides information on indoor water conservation projects under development in the planning region.

Table 6-1. *Indoor water conservation projects under development*

Cooperator	Project Number	General Description	Savings (gpd)	Devices and Rebates	Total Cost[1]	District Cost	$/1,000 gal Saved
Pasco County	N232	Toilet Rebate	33,215	1,244	$150,847	$75,423	$ 1.25
City of St. Petersburg	N239	Toilet Rebate	27,000	825	$150,000	$75,000	$ 1.53
FGUA	N245	Toilet Rebate	1,940	100	$17,529	$8,764	$ 2.48
East Pasco Water Coalition	N291	Toilet Rebate	3,559	132	$19,116	$9,558	$ 1.48
City of St. Petersburg	N330	Toilet Rebate	17,901	879	$143,209	$71,605	$ 2.20
City of St. Petersburg	N409	Toilet Rebate	2,241	112	$44,276.72	$22,138	$ 5.43
FGUA	N410	Toilet Rebate	5,385	210	$30,444	$15,222	$ 1.55
City of New Port Richey	N427	Toilet Rebate	1,014	40	$4,198.70	$2,099	$ 1.14
Pasco County	N466	Toilet Rebate	3,700	144	$19,972	$9,986	$ 1.00
City of St. Petersburg	N498	Toilet Rebate	16,929	868	$145,583	$72,792	$ 1.48
City of St. Petersburg	N517	Toilet Rebate	16,632	700	$100,000	$50,000	$ 1.65
City of New Port Richey	N544	Toilet Rebate	1,911	80	$12,000	$6,000	$ 1.73
Pasco County	N553	Toilet Rebate	13,956	550	$80,000	$40,000	$ 1.58
New Port Richey	N593	Toilet Rebate	1,911	80	$12,000	$6,000	$ 1.73
City of Port Richey	N603	Toilet Rebate	1,444	60	$10,000	$5,000	$ 1.90
City of St. Petersburg	N655	Toilet Rebate	14,256	600	$100,000	$50,000	$ 1.93
Pasco County	N662	Toilet Rebate	13,956	500	$80,000	$40,000	$ 1.58
Total			**176,950**	**7,124**	**$1,119,176**	**$559,588**	**$ 1.65**[2]

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

1.2 Outdoor Water Conservation Projects

Since 2010, the District has cooperatively funded 1,418 rain sensor rebates and landscape and irrigation evaluations. These programs have cost the District and cooperating local governments a combined $345,188 and have yielded a potable water savings of approximately 141,969 gallons per day. Table 6-2 provides information on outdoor water conservation projects that are under development. Table 6-3 provides information on irrigation research projects under development.

Table 6-2. *Outdoor water conservation projects under development*

Cooperator	Project Number	General Description	Savings (gpd)	Sensors/ Audits	Total Cost[1]	District Cost	$/1,000 gal Saved
City of St. Petersburg	N160	Landscape/ Irrigation Evaluation	35,000	532	$100,000	$50,000	$ 2.22
Harbor Bay CDD	N321	Weather-Based Controller	25,236	7	$50,000	$25,000	$ 1.32
City of St. Petersburg	N408	Landscape/ Irrigation Evaluation	40,637	579	$95,188	$47,594	$ 1.56
City of St. Petersburg	N538	Landscape/ Irrigation Evaluation	41,096	300	$100,000	$50,000	$ 1.62
Total			**141,969**	**1,418**	**$345,188**	**$172,594**	**$ 1.70**[2]

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

Table 6-3. *List of irrigation research projects under development*

Cooperator	Project Number	General Description	Total Cost	District Cost
University of Florida (IFAS), Pinellas	B187	Soil Moisture Sensor Research	$519,010	$519,010
University of Florida (IFAS), Pinellas	B252	Soil Moisture Sensor Research	$450,000	$450,000
University of Florida (IFAS)	B283	Landscape Irrigation Water Use	$1,187,000	$1,187,000
University of Florida (IFAS)	B284	Acceptable Deficit Irrigation of Turfgrass	$440,000	$440,000
Total			**$2,596,010**	**$2,596,010**

2.0 Agricultural Water Conservation Projects

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

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

The District provides funding for IFAS to investigate a variety of agricultural issues that involve water conservation. These include, but are not limited to, development of tailwater recovery technology, determination of crop water use requirements, evaluation of alternative irrigation methods, field irrigation scheduling, and frost/freeze protection. IFAS conducts the research and then promotes the results to the agricultural community. In 2010, the District had 20 active IFAS research projects covering both urban landscape issues and agricultural commodity issues. Since then, the District has funded an additional 22 projects. During this time, the District has funded research on strawberries, citrus, tomatoes, potatoes, peaches, biofuel grasses, turf grass, peppers, blueberries, and various landscape and nursery ornamental plants and trees. Of the 42 research projects, 30 have been completed. Completed projects include eight projects dealing with urban landscape issues and 22 involving various agricultural commodities. While the research projects are not specific to each planning region, they are specific to a commodity group that has a strong presence in each region. The research will help develop best management practices that will conserve water District wide. Specific benefits to the planning region are dependent on the commodities dominant in that planning region. The 12 ongoing projects are described in Table 6.4.

The District funds IFAS water conservation research and education projects for many types of agricultural commodities, such as strawberries

Table 6.4 *List of agricultural water conservation research projects*

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

[1] Projects affecting several planning regions. The outcome of research projects can benefit all planning regions

Section 2. Reclaimed Water

1.0 Reclaimed Water Projects - Research, Monitoring and Education

Continued support of reclaimed water research and monitoring is central to maximizing reclaimed water use and increasing benefits. The District assists utilities in exploring opportunities for increased utilization of reclaimed water and supports applied research projects, which not only include innovative treatment and novel uses of reclaimed water, but also nutrient and constituent monitoring. Table 6-5 is a list, description and summary of the benefits and costs that have been, or will be, realized by the 46 reclaimed water projects currently under development. It is anticipated that these projects will be online by 2020. Table 6-6 includes general descriptions and a summary of 10 research projects for which the District has provided more than $1,026,000 in funding. The District has also committed to developing a comprehensive reclaimed water education strategy. All reclaimed water construction projects funded by the District require education programs that stress the value and benefits of efficient and effective water use, regardless of the source. To provide reclaimed water information to a broader audience, the District has developed a web page, which is one of the top internet sources of reuse information, including GIS and other data. The District also produces reclaimed water publications that are offered to residents, utilities, engineering firms, environmental agencies and other parties interested in developing and expanding reclaimed water systems.

Reclaimed water facility in Hillsborough County

Table 6-5. *List of reclaimed water projects under development in the Tampa Bay Planning Region*

Cooperator	General Project Description	Reuse Produced	(mgd) Benefit	Customer (#) Storage	Customer (#) Type	Customer (#) Total	Costs Total	Costs District[1]	Costs $/1,000 gallons[2]
Hillsborough County									
Hillsborough County	Aquifer Recharge SHARP (N287)	NA	NA	730	NA	NA	$2,765,000	$1,382,500	NA
Hillsborough County	Study N601	NA	NA	NA	NA	NA	$325,000	$162,500	NA
Hillsborough County	Transmission N652	0.3	0.15	0	Res	500	$2,700,000	$1,350,000	$3.54
Temple Terrace	Study N471	NA	NA	NA	NA	NA	$100,000	$50,000	NA
City of Plant City	Study N552	NA	NA	NA	NA	NA	$40,000	$20,000	NA
City of Plant City	Trans/Pump L816	0.55	0.4	0	Rec,GC, Com	8	$6,126,000	$3,192,730	$3.02
Pasco County									
Pasco County	Interconnect H041	0	0	0	NA	NA	$3,137,308	$1,507,796	NA
Pasco County	Interconnect H055	0	0	0	NA	NA	$18,600,000	$9,920,000	NA
Pasco County	Storage H056	0	0	500	NA	NA	$39,200,000	$12,915,980	NA
Pasco County	Pump/Store/Trans/Inter H067	0	0	0	NA	0	$13,118,493	$6,855,246	NA
Pasco County	Nat Treatment H092	5	5	0	NA	NA	$16,443,782	$8,221,891	
Pasco County	Master Plan N380	0	0	0	NA	NA	$180,000	$90,000	NA
Pasco County	Trans N429	0.07	0.04	0	Res	93	$200,000	$100,000	$0.98
Pasco County	Trans N442	0.5	0.38	0	GC	2	$600,000	$300,000	$0.31
Pasco County	Trans N462	0.25	0.18	0	GC	1	$200,000	$100,000	$0.22
Pasco County	Treatment N470	0.47	0.47	0	Ind	1	$1,800,000	$900,000	$0.75
Pasco County	Pump N524	0	0	0	NA	A/A	$250,000	$125,000	NA
Pasco County	Trans N464	0	0	0	NA	NA	$1,980,000	$990,000	NA

Cooperator	General Project Description	Reuse Produced	(mgd) Benefit	Customer (#)			Costs		
				Storage	Type	Total	Total	District[1]	$/1,000 gallons[2]
Pasco County	Transmission L729	1.05	0.53	0	Res,Rec	1,749	$1,410,000	$705,000	$0.52
Pasco County	Recharge N666	5	5	NA	NA	NA	$33,600,000	$16,800,000	$1.32
Pasco County	Transmission N670	0.42	0.25	0	Res, Com	388	$1,221,660	$610,830	$0.96
Pasco County	Store N649	0	0	5	NA	NA	$2,000,000	$1,000,000	NA
Pasco County	Trans N630	0.25	0.19	0	Ag	1	$200,000	$100,000	$0.21
Pasco County	Transmission N629	0.1	0.06	0	GC	1	$400,000	$200,000	$1.31
Pasco County	Trans N547	0.43	0.26	0	Res	725	$1,266,600	$933,300	$0.96
Pasco County	Trans/Store N157	0.05	0.03	0.32	Rec	1	$900,000	$450,000	$5.91
FGUA	Transmission/ Store N370	0.45	0.22	3	Res, Com	2	$2,400,000	$1,200,000	$2.15
City of Zephyrhills	Treatment/ Recharge N672	TBD	TBD	0	NA	NA	$9,330,000	$5,640,000	NA
City of New Port Richey	Transmission N461	0.08	0.06	0	Rec	1	$428,000	$214,000	$1.40
City of Dade City	Trans/Store/Pump L823	0.5	0.3	2	Rec	1	$3,844,440	$1,952,030	$2.52
Pinellas County									
Pinellas County	ASR K682[1]	0	0	0	NA	NA	$656,520	$328,260	NA
Pinellas County	ASR K422[1]	NA	NA	NA	NA	NA	$949,589	$474,794	NA
City of Clearwater	Transmission L254	0.45	0.28	0	Res,Rec, GC	289	$2,499,362	$1,439,871	$1.76
City of Clearwater	Study N179	0	0	0	NA	NA	$3,072,500	$1,536,250	NA
City of Clearwater	Transmission L810	0.31	0.16	0	Res	500	$3,288,048	$1,644,024	$4.05
City of Clearwater	Trans N561	0.08	0.04	0	Res	145	$1,500,000	$750,000	$7.38
City of Clearwater	Transmission N095	0.55	0.31	0	Res,Rec, Com	766	$3,306,421	$1,653,210	$2.10
City of Clearwater	Transmission N169	0.2	0.1	0	Res,Com	310	$2,204,050	$1,102,025	$4.34

Cooperator	General Project Description	Reuse	(mgd)	Customer (#)			Costs		
		Produced	Benefit	Storage	Type	Total	Total	District[1]	$/1,000 gallons[2]
City of Clearwater	Purification/ Recharge N665	2.4	2.4	0	City	1	$28,580,000	$14,290,000	$2.35
City of Clearwater	Trans/Store/Pump L695	0.52	0.3	5	Res,Com	612	$10,835,448	$6,217,224	$7.11
City of Dunedin	Pump/ Storage N555	0	0	2	NA	NA	$1,760,000	$880,000	NA
City of Oldsmar	Trans/Telemetry L821	0.07	0.04	0	Res	148	$667,000	$371,500	$3.28
City of Oldsmar	ASR N398	NA	NA	90	NA	NA	$1,741,724	$870,862	NA
City of Oldsmar	ASR Exploratory N212	NA	NA	TBD	NA	NA	$337,427	$168,713	NA
City of Tarpon Springs	Pump/ Store N494	0	0	5	NA	NA	$4,569,994	$2,284,997	NA
City of Tarpon Springs	Plan N258	0	0	0	0	NA	$100,000	$50,000	NA
Total	**46 Projects**	**20.59**	**17.56**	**1,342.32**	**0**	**6,248**	**$231,254,366**	**$112,260,533**	**$2.30**

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

Table 6-6. *Reclaimed water research projects under development in the District*

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

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

Section 3. Surface Water/Stormwater

1.0 Surface Water/Stormwater Projects

Surface Water/Stormwater Project #1. Tampa Bay Water System Configuration II

The Tampa Bay Water System Configuration II project expanded the capacity of TBW's Regional Surface Water Treatment Plant from 72 to 99 mgd. The project also expanded the pumping and distribution capacity of existing infrastructure to capture additional flows from the Hillsborough River and Tampa Bypass Canal (TBC), which allows more water to be captured and stored in the C. W. Bill Young Regional Reservoir when flows are available. The project was completed in 2011 on time and under budget at a total cost of $225.5 million. The District co-funded eligible project costs and administered the State funding provided from Community Budget Issue Requests and the Water Protection and Sustainability Trust Fund.

Table 6-7. *Tampa Bay Water System Configuration project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
25	$225,533,565	$126,878,428	$6,200,000	$3.50

The System Configuration II project consisted of six enhancement components and four additional system interconnections:

- *Expansion of the Tampa Bay Regional Surface Water Treatment Plant.* The expansion increased the rated capacity of the water treatment plant from 72 mgd to a firm capacity of 99 mgd.
- *Expansion of the TBW Regional High Service Pump Station.* The pump station capacity was increased from 120 mgd to approximately 135 mgd to accommodate the additional supply from the treatment plants.
- *Expansion of the TBC Pump Station.* The TBC Pump Station withdraws and pumps raw water from the TBC to the water treatment plant for treatment or to the C. W. Bill Young Regional Reservoir (via the repump station) for storage.
- *Expansion of the Repump Station.* The Repump Station is located downstream of the Alafia River Pump Station and boosts the pressure during water capture. The capacity of the Repump Station was increased from 130 to 180 mgd to accommodate the TBC Pump Station expansion.
- *South-Central Hillsborough Intertie Booster Pump Station.* The station is equipped with two 3,000-horsepower pumps, was installed west of the existing Alafia River Pump Station, and increases raw water delivery to the Reservoir.
- *Offstream Reservoir Pump Station.* The pump station was constructed near the reservoir and contains four 400-hoursepower variable frequency drive pumps that increase the amount of water delivered from the reservoir to the expanded water treatment plant.
- *Northwest Hillsborough Interconnect Pipeline.* The new pipeline delivers supply from the TBW regional system to the Northwest Hillsborough Water Treatment Plant. The plant was previously dependent on supply from the local wellfield. The pipeline allows alternative supplies from the regional system to be delivered to the service area.
- *South-Central Hillsborough Infrastructure Improvements.* The improvements enabled alternative water supplies from the TBW regional system to be delivered to the South-Central Hillsborough service area. The service area was dependent on groundwater from the South-Central wellfield.
- *Morris Bridge Booster Pump Station Improvements.* Improvements allow the pump station's original design capacity to be maintained as regional system pressures increases alternative supply deliveries in the southeastern portion of system.
- *Cypress Creek Pump Station Expansion.* The capacity was increased from 150 to 165 mgd by installing additional pumps to handle the increasing demands on the regional system.
- *West Pasco Infrastructure Improvement Project.* The improvements allow additional sources of water to serve the Starkey and North Pasco wellfields by interconnecting them to the regional system. Reductions in groundwater pumping will assist Starkey and North Pasco wellfield's environmental recovery.

Section 4. Brackish Groundwater Desalination

Brackish Groundwater Project #1. City of Oldsmar Reverse Osmosis (RO) Water Supply

The City of Oldsmar RO Water Supply project consisted of a new RO treatment facility to produce 2.0 mgd of potable water. The project utilizes local supply from the Tampa and Upper Suwannee groundwater zones. The project provides the City of Oldsmar with an alternative water source to importing water from Pinellas County Utilities, reducing demands on the TBW regional system. The project included final design and construction of 12 production wells at six sites, the treatment facility, and an injection disposal well. This project was completed in January 2013.

Table 6-8. *Oldsmar RO Water Supply project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
2.0	$18,712,705	$9,146,460	$9,360,000	$2.43

Brackish Groundwater Project #2. Tarpon Springs Alternative Water Supply

The Tarpon Springs Alternative Water Supply project consists of the design and construction of a brackish groundwater wellfield, RO treatment facilities, and seawater discharge infrastructure. The City is also developing an injection well, without District funding, as an alternate concentrate disposal method. The facility is designed to produce 5 mgd of potable water on an annual average basis. The project will use locally available brackish groundwater from the Upper Floridan aquifer (UFA), generally from upper production zones situated approximately 120 feet below the surface. The water supply produced by the project will replace imported water that the City purchases from Pinellas County Utilities, reducing demands on the TBW regional system. The project is scheduled for completion mid-2015.

Table 6-9. *Tarpon Springs Alternative Water Supply project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
5.0	$42,388,676	$20,141,895	$8,477,735	$2.39

Brackish Groundwater Project #3. City of Clearwater Brackish Facility at Water Treatment Plant #2

The City of Clearwater Brackish Facility project includes the design and construction of a brackish groundwater treatment facility with the capacity to produce up to 5.0 mgd of potable water supply on an annual average basis. This is the city's second RO facility and it is located in the southeast portion of the City's service area. Project components include pilot plant testing, brackish wellfield construction, design and construction of treatment facilities, and an injection disposal well. The water supply produced by the project will replace imported supplies that the City purchases from Pinellas County Utilities, reducing demands on the TBW regional system. The project is scheduled for completion in February 2015.

Table 6-10. *Clearwater Brackish Facility at WTP #2 project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
5.0	$42,200,000	$15,216,890	$8,440,000	$3.18

Section 5. Aquifer Storage and Recovery (ASR) Projects

There are three reclaimed water ASR projects under development in the Tampa Bay Planning Region.

Reclaimed Water ASR Project #1. City of Oldsmar ASR (N398 & N212)

The City of Oldsmar ASR project involves construction of a reclaimed water ASR that will enable the continued expansion of Oldsmar's reuse system. The recharge/recovery rate noted in the construction permit is anticipated to be 1 mgd. This reclaimed water ASR will significantly reduce the amount of reclaimed water currently disposed into Old Tampa Bay and will increase the seasonal availability of reclaimed water. The storage capacity of the reclaimed water ASR will be determined during cycle testing. This project consists of design, permitting, construction and testing of one ASR well completed in the Suwannee Limestone. The project includes the installation of monitor wells, permanent well pumps, temporary and permanent piping, monitoring equipment and other appurtenances, and complete modifications to an in-ground tank to be used during testing. This ASR will use an aquifer storage zone that is not an underground source of drinking water as defined by the DEP in Rule 62-528, Florida Administrative Code (F.A.C.). The ASR zone will be 10,000 mg/l TDS or greater. The project is scheduled for completion in 2017.

Table 6-11. *Oldsmar ASR (N398 & N212) project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
TBD	$1,741,724	$870,862	TBD	TBD

Reclaimed Water ASR Project #2. Pinellas County Lake Tarpon Test Well ASR (K422)

The Pinellas County Lake Tarpon Test Well ASR project consisted of design, permitting, construction and testing of a surface water ASR system to augment the county's reclaimed water system. The project involved drilling of an ASR well and associated monitoring wells at approximately the same time the arsenic mobilization issue was discovered. The project scope was modified to include an additional treatment process to remove dissolved oxygen (DO). Pilot testing of the DO removal process wasn't successful due to fouling of the equipment by the elevated dissolved organic matter in the lake water. Work on the project was stopped and the project was closed out due to the fouling of the DO removal system. The ASR well and monitoring well still exist and could be utilized at some future date.

Table 6-12. *Lake Tarpon Test Well ASR (K422) project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
0	$949,588	$474,794	NA	NA

Reclaimed Water ASR Project #3. Pinellas County South Cross ASR (K682)

The Pinellas County South Cross ASR was a project to convert three existing Class I injection wells to ASR wells to provide seasonal storage of up to 3 mgd of reclaimed water from Pinellas County's South Cross Bayou Water Reclamation Facility. The project included three phases: 1) back plugging and aquifer testing of the three existing injection wells; 2) permitting, infrastructure evaluation and replacement, well integrity testing and cycle testing of the three ASR wells; and 3) operational permitting of the three ASR wells. Based on cycle testing results, the County determined that its goal to use the ASR wells for diurnal storage and withdrawal was not feasible and the project was closed out.

Table 6-13. *South Cross ASR (K682) project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
0	$656,520	$328,260	NA	NA

Section 6. Aquifer Recharge Projects

Notable indirect AR projects being pursued in the planning region include the Pasco County Reclaimed Water for Natural System Treatment and Restoration project located in central Pasco County and the City of Zephyrhills Advanced Wastewater and Reuse Recharge Project. Pasco County is moving forward with ongoing feasibility investigations and plans for design and construction of recharge basins. The Pasco County Reclaimed Water for Natural System Treatment and Restoration project is expected to provide between 2 to 5 mgd of potential recharge within constructed wetlands in an area of central Pasco County that has experienced chronically low water levels due to groundwater withdrawals. The City of Zephyrhills, as part of the FY2015 Springs Initiative, is planning to upgrade their existing wastewater treatment plant to Advanced Wastewater Treatment (AWT) standards. Water produced from the AWT plant will be used to recharge wetlands and provide for indirect AR with reduced nutrient loading.

In the case of direct AR projects, the City of Clearwater (Table 6-14) is moving ahead with a new initiative using state-of-the-art water treatment technology and injection systems to recharge a brackish water interval of the UFA in northeast Pinellas County with 3 mgd of purified reclaimed water that meets all potable drinking water standards. Project benefits include an increase in local aquifer levels, reduced saline water intrusion, and the potential to provide for additional water supply production at existing city facilities. The water will be chemically adjusted prior to recharge to control arsenic mobilization. This direct AR project is currently undergoing design and permitting and the treatment plant and injection wells will be constructed at the City's Northeast Water Reclamation Facility.

Other applications of direct AR that are being investigated by Hillsborough County involve recharge of excess reclaimed water that may provide benefits in the form of saltwater intrusion barriers along the coast of Tampa Bay near Apollo Beach. If these projects are properly located, they have the potential to slow or reverse salt water intrusion rates.

Table 6-14. *List of Direct Aquifer Recharge projects under development in the Tampa Bay Planning Region*

Project Site	Status[1]	Final System Goal		Approximate Cooperative Funding Total Project Costs (District Share Is Half of Reported Costs)
		Storage Volume (mgd)	Total Number of Wells	
Purified Reclaimed Water Aquifer Injection				
City of Clearwater – Groundwater Replenishment	Design and permitting in progress.	1	1	Full design and permitting = $1,554,000
	Final system. Construction permit issued and treatment system / injection well construction complete.	3	4[2]	Full construction = $12,736,000

[1] Desktop feasibility and site assessment/pilot testing completed. Design and permitting are in progress for the full scale project development
[2] Number of wells designed for injection wellfield includes one backup well. Wells will be designed to inject close to 1 mgd per well.

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Chapter 7. Water Resource Development Component

This chapter addresses the legislatively required water resource development activities and projects that are conducted primarily by the District. The intent of water resource development projects is to enhance the amount of water available for regional-beneficial uses and for natural systems.

Section 373.019, Florida Statues (F.S.), defines water resource development as:

> *"Water resource development" means the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation, and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and groundwater recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities"* (Subsection 373.019[24], F.S.).

The District is primarily responsible for implementing water resource development; however, additional funding and technical support may come from state, federal, and local entities.

Part A. Overview of Water Resource Development Efforts

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

Section 1. Data Collection and Analysis Activities

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

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

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

1.0 Hydrologic Data Collection

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

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

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

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

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

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

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

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

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

2.0 Minimum Flows and Levels Program

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

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

3.0 Watershed Management Planning

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

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

4.0 Quality of Water Improvement Program (QWIP)

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

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

5.0 Stormwater Improvements: Implementation of Storage and Conveyance BMPs

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

Section 2. Water Resource Development Projects

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

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

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

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

1.0 Alternative Water Supply Research, Restoration and Pilot Projects

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

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

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

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

2.0 Facilitating Agricultural Resource Management Systems (FARMS) Projects

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

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

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

As of August 2015, there were 173 approved FARMS projects including 47 in the Tampa Bay Planning Region and 21 frost-freeze protection projects in the Dover/Plant City WUCA. The projects are projected to have a cumulative groundwater offset of 25.5 mgd Districtwide and 2.74 mgd for the projects within the Tampa Bay Planning Region. The projected offset for the frost-freeze protection projects (post-January 2010) within the Dover/Plant City WUCA is 43 mgd per freeze event.

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

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

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

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

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

Table 7-3. *Specific FARMS cost-share projects within the Tampa Bay Planning Region that were funded post-FY2010*

Project Description	Post 2010 exp. and mod budget	Benefit (mgd)	Priority Area
Alafia Berry Farms, LLC	$100,500	0.003	DPCWUCA
Aprile Properties, LLC	$101,242	0.033	DPCWUCA
Astin Farms, Inc. - South Farm and Karpee Road	$263,240	0.137	DPCWUCA
Barnwell Farms	$127,500	0.033	SWUCA
Baum, L.L.C.	$193,425	0.037	DPCWUCA
Berry Patches, Inc	$48,646	0.007	DPCWUCA
Berry Patches, Inc Phase 2	$26,358	0.063	DPCWUCA
Blues Berry Farm, LLC	$58,500	0.003	DPCWUCA
Brookdale Farms, LLC	$123,484	0.008	DPCWUCA
C. Dennis Carlton, Sr - Home Grove	$195,000	0.070	DPCWUCA
Carl Little	$11,000	0.036	NTBWUCA
Castillo Farms, LLC - Stafford Road	$24,980	0.003	DPCWUCA
Circle G Farm & Ranch, LLC	$130,500	0.131	DPCWUCA
Circle G Farm and Ranch - Phase 2	$149,186	0.085	SWUCA
CPM2, Inc.	$113,039	0.033	NTBWUCA
Duggal Farm	$90,248	0.040	SWUCA
Francis White Strawberries	$180,000	0.146	DPCWUCA
Frogmore Ranch, LLC	$291,000	0.068	NTBWUCA
Grange Hall Strawberries, LLC	$170,116	0.072	SWUCA
Gutierrez Farms	$34,323	0.003	SWUCA
Hopewell Business Center, LLC	$32,671	0.046	DPCWUCA
Loop Farms, LLC	$272,500	0.308	SWUCA
Loop Farms, LLC - Flowers Road	$381,850	0.191	SWUCA
Mathis Farms, Inc	$63,600	0.009	DPCWUCA
McLand, LLC	$74,492	0.021	DPCWUCA
Mont-Lest, LLC	$65,500	0.049	DPCWUCA
S and H Mathis, LLC	$24,223	0.010	DPCWUCA
San-Way Farms, Inc.	$150,484	0.097	SWUCA
Sewell Farms, LLC	$73,719	0.055	DPCWUCA
Sizemore Farms, Inc. - English Creek	$392,646	0.149	DPCWUCA
SRI 2, LLC	$173,350	0.050	NTBWUCA
Strawberry Red Ranch, LLC – Blackjack Road	$191,044	0.111	SWUCA
Sydney Farms, Inc. - Donini Farm	$110,500	0.146	DPCWUCA
Three Star Farms, Inc. - Walden Sheffield Road	$52,500	0.111	DPCWUCA
William and Mary Keene	$57,982	0.060	DPCWUCA
Winfred and Sue Harrell Investments, LLLP	$43,309	0.033	DPCWUCA
Total	**$ 4,592,657**	**2.457**	

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

3.0 Environmental Restoration and MFL Recovery Projects

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

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

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

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

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

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

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

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

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

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

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Chapter 8. Overview of Funding Mechanisms

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

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

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

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

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

Note: Summation differences occur due to decimal rounding

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

To prepare an estimate of the capital cost for projects needed to meet the portion of demand not yet under development, the District has compiled a list of large-scale WSD projects (Table 8-4). The District anticipates that a large portion of the remaining demand will be met through projects that users will select from the water supply options listed in Chapter 5 of this RWSP. A significant portion of water demand in the Northern Planning Region will be met with fresh groundwater available to the region.

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

Part A. Statutory Responsibility for Funding

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

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

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

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

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

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

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

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

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

1. *The project supports establishment of a dependable, sustainable supply of water which is not otherwise financially feasible;*
2. *The project provides substantial environmental benefits by preventing or limiting adverse water resource impacts, but requires funding assistance to be economically competitive with other options; or*

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

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

Part B. Funding Mechanisms

Section 1. Water Utilities

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

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

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

Between 2015 and 2035, new public water supply demand in the District will generate approximately $5.8 billion in one-time impact fees and recurring base and volumetric charges.

Table 8-2 illustrates the projected new customer revenues into water and wastewater revenues and into one-time impact fees, recurring base/minimum charges, and recurring volume-based charges. Although wastewater revenues support sewer system development, treatment, and transmission projects, these revenues may also be used to support capital expenditures on reclaimed water system development.

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

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

[1] Estimated in 2013 dollars.

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

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

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

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

Section 2. Water Management District

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

1.0 Cooperative Funding Initiative (CFI)

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

2.0 District Initiatives

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

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

Section 3. State Funding

1.0 The Springs Initiative

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

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

2.0 Water Protection and Sustainability Program

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

The funds are applied toward a maximum of 20 percent of eligible project construction costs. In addition, the Legislature has established a goal for each WMD to annually contribute funding equal to 100 percent of the state funding for alternative WSD assistance, which the District has exceeded annually. If funding is continued by the Legislature, the state's Water Protection and Sustainability Program could serve as a significant source of matching funds to assist in the development of alternative water supplies.

3.0 The Florida Forever Program

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

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

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

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

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

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

Section 4. Federal Funding

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

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

1.0 USDA Natural Resources Conservation Service (NRCS) programs

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

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

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

Section 5. Public-Private Partnerships and Private Investment

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

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

1.0 Public-Private Utility Partnerships

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

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

2.0 Cooperatives

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

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

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

Section 6. Summary of Funding Mechanisms

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

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

Section 1. Projection of Potentially Available Funding

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

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

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

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

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

Section 2. Evaluation of Project Costs to Meet Projected Demand

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

To develop an estimate of the capital cost of projects necessary to meet demand, the District compiled a list of large-scale WSD projects that have been proposed by the PRMRWSA, Tampa Bay Water, Tampa Electric Company, and Polk County that will produce up to 49 mgd of water supply within the 2035 planning horizon Districtwide. The estimated costs and the quantity of water they will produce are listed in Table 8-4. The categories shown each contain several projects that could be chosen for development to meet future needs. Many of these are alternative water supply projects that would be eligible for co-funding by the District. The table shows the estimated total cost of the 34 to 49 mgd of water supply that will be produced by these projects is up to $1.65 billion.

Between 1998 and 2011, Tampa Bay Water developed System Configurations I and II with cooperative funding assistance from the District. Within the 2035 planning horizon, Tampa Bay Water plans to commence development on System Configuration III to meet future needs. Tampa Bay Water's Long-Term Master Water Plan contains several projects that could be chosen for System Configuration III. Many of these are alternative water supply projects that would be eligible for co-funding by the District. They range from 10-25 mgd in capacity with capital cost estimates of between $216 and $612 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 8-4. *Proposed large-scale water supply and water resource development projects by 2035 (millions of $)*

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

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

The conservative estimate of $1.65 billion in cooperator and District financial resources that will be generated through 2035 (Table 8-3) for funding is sufficient to meet the projected $1.1 to $1.5 million total cost of the large-scale projects listed in Table 8-4. In addition, the $244 million portion of the cost of projects currently under development will require funding in the near-term. The State and Federal funding sources yet to be determined (Table 8-3) may assist with the remaining and high-end costs for future alternative water supply projects and water conservation measures where fresh groundwater resources are limited. These financial projections are subject to economic conditions that may affect the level of District ad-valorem tax revenue and the availability of federal and state funding; however, such conditions may similarly affect future water demand increases.

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