2020 Regional Water Supply Plan

Executive Summary

April 2020

Southwest Florida Water Management District

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For further information regarding this plan, please contact the Water Supply Section at:

2379 Broad Street
Brooksville, FL 34604-6899
(352) 796-7211 or
(800) 423-1476 (Florida Only)

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Southwest Florida Water Management District

2020 Regional Water Supply Plan

This report is produced by the Southwest Florida Water Management District

April 2020 – Public Review Draft

District Project Manager: Joseph Quinn, AICP

District Contributors

Anthony Andrade
Ron Basso, P.G.
Mike Bray
April Breton
Miurel Brewer
Joel Brown
Mike Cacioppo
Cortney Cameron
Donna Campbell
Jake Cuarta
Corey Denninger, GISP
Don Ellison, P.G.
Randy Emberg
Carole Estes, P.G.
John Ferguson, P.G.
Mark Fulkerson, Ph.D., P.E.
Frank Gargano
Yonas Ghile
Jim Golden, AICP
Mohamed Hersi
Mary Margaret Hull, APR
Doug Leeper
Tamera McBride, P.G.
Lisann Morris, P.E., PMP
Cassidy Hampton
Mike Hancock, P.E.
Jerry Harding
Darrin Herbst, P.G.
Jay Hoecker, PMP
Ashlee Hollifield
Thomas Kiger, P.E.
Luke LeMond, P.G.
Josh Madden
Lydia Manos
Cara Martin, APR
Jeremy McKay
Jason Patterson
Ryan Pearson
Robert Peterson, P.G.
Amy Poxson
Dennis Ragosta
Patricia Robertshaw
Cindy Rodriguez
Danielle Rogers
Carmen Sanders
George Schlutermann, P.G.
Andrea Shamblin
Virginia Singer
Claire Stapley
Susanna Martinez Tarokh
Chris Tumminia
Don Weaver
Jeff Whealton, P.W.S.
Brent White
Kevin Wills
Marra Wood
Lei Yang
Allen Yarbrough
Chris Zajac

Other Contributors

Wade Trim, Inc.
Sarah Mastison
Brad Cornelius, AICP, CPM
Amanda Warner, AICP

This report is available online at: WaterMatters.org/RWSP
You may send a request for a printed copy to info@watermatters.org

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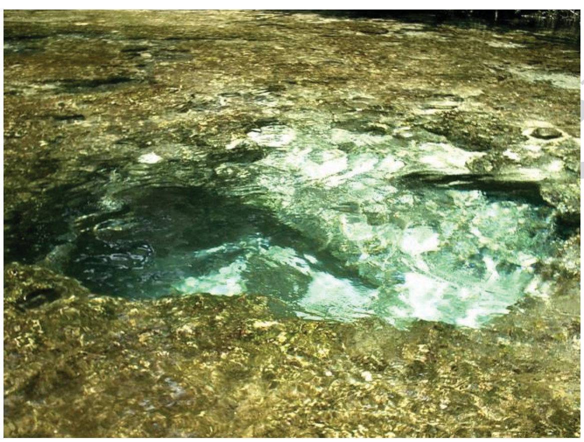
Chapter 1. Introduction

The 2020 Regional Water Supply Plan (RWSP) is an assessment of projected water demands in the Southwest Florida Water Management District (District) and potential sources of water to meet those demands for the period from 2015 through 2040. 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 (see Figure 1). The RWSPs for each planning region contain the following chapters: Chapter 1, Introduction; Chapter 2, Resource Protection Criteria; Chapter 3, Demand Estimates and Projections; Chapter 4, Evaluation of Water Sources; Chapter 5, Overview of Water Supply Development Options; Chapter 6, Water Supply Projects Under Development; Chapter 7, Water Resource Development Component; and Chapter 8, Overview of Funding Mechanisms. This Executive Summary also contains a list of Guiding Principles outlining strategies to meet water supply demand throughout the planning period.

The purpose of the RWSP is to provide a framework for future water management decisions in the District. The 2020 RWSP for the four planning regions shows that water supply demands for all use sectors can be met through 2040. It also shows natural systems can be restored or sustained using a combination of alternative water sources, fresh groundwater and water conservation measures. The RWSP also identifies a variety of potential water supply options and associated costs for developing alternative sources. The options are not intended to represent the District's most preferable options for water supply development. However, they are provided as reasonable concepts that water users in the planning region can pursue to meet their water supply needs. Additionally, the RWSP provides information to assist water users in developing funding strategies to construct water supply projects. The District previously completed RWSPs in 2001, 2006, 2010 and 2015 that included the Southern, Heartland and Tampa Bay planning regions. The 2010 update included the District's Northern Planning Region for the first time.



Springs are a major economic resource for the Northern Planning Region

Statutory Requirements for Water Supply Planning

The requirement for regional water supply planning originated from legislation passed in 1997 that 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 the District's RWSP has been prepared pursuant to these provisions. Regional water supply planning requirements were amended as a result of the passage of Senate Bill 444 during the 2005 Florida legislative session. The bill strengthened requirements for the identification and listing of water supply development projects. In addition, the legislation intended to foster better communications among water planners, local government planners and local utilities. Local governments are now permitted to develop their own water supply assessments, which the water management districts (WMDs) are required to consider when developing their RWSPs. Finally, a trust fund was created that provides the WMDs with state matching funds to support the development of alternative water supplies by local governments, water supply authorities and other water users.

Connection to Central Florida Water Initiative (CFWI)

Since 2011, the District has been working with public water supply utilities, the St. Johns River and South Florida WMDs, DEP, Florida Department of Agriculture and Consumer Services (FDACS), and multiple stakeholders on the CFWI, which includes portions of Lake county, all of Polk county, and all or parts of four other counties in central Florida outside of the District (see Figure 2). This is an area where the WMDs have previously determined, through water supply planning efforts and real-time monitoring, that groundwater availability is limited. The CFWI mission is to help protect, develop, conserve and restore central Florida's water resources by collaborating to address central Florida's current and long-term water supply needs. The CFWI is led by a Steering Committee that includes a public water supply utility representative, a Governing Board member from each of the three WMDs, and representatives from DEP and FDACS. The Steering Committee oversees the CFWI process and provides guidance to the technical teams and technical oversight/management committees that are developing and refining information on central Florida's water resources. The Steering Committee has guided the technical and planning teams in the development of the CFWI RWSP, which ensures the protection of water resources and related natural systems and identifies sustainable water supplies for all water users in the CFWI region through 2040. Those efforts, which are reflected in this 2020 RWSP update for the Heartland and Northern planning regions, will lead to adoption of new rules and management strategies. More detailed information concerning the CFWI is available on the CFWI website at http://cfwiwater.com/planning.html.

Connection to Growth Management and Local Government Comprehensive Plans

Consistent with Section 373.709(8)(a), F.S., within six months following approval or amendment of a RWSP, the District is to notify each local government covered by the RWSP of that portion of the plan relevant to the local government. Within one year after the notification, each local government is required to provide to the District notification of any alternative water supply projects or options that it has developed or intends to develop; an estimate of the quantity of water to be produced by each project; and the status of project implementation, including development of the financial plan. The information is updated annually in a progress report provided to the District. If an entity does not intend to develop an alternative water supply project option identified in the RWSP, the local government is to propose, within one year after notification, another alternative water supply project option sufficient to address the demands within the local government's jurisdiction; and to provide an estimate of the quantity of water to be produced by the project and the status of project implementation. The local government has the option to request that the District consider a project not included in the RWSP.

Within 18 months after Governing Board approval of a RWSP, Section 163.3177(6)(c)3., F.S., requires that local governments in the planning region update their comprehensive plans. These updates must incorporate a work plan detailing alternative and traditional water supply projects, including conservation and reuse, within the local government's jurisdiction, covering at least a 10-year planning period.

Agency Coordination/Public Outreach

The RWSP was developed in an open public process, in coordination and cooperation with staff from other WMDs, water supply authorities, the DEP and FDACS, and representatives from utilities, agriculture, various industries, and environmental organizations.

The District actively involved stakeholders in the RWSP planning process by facilitating public workshops in the Brooksville, Sarasota, and Tampa service offices and at the Department of Agriculture and Consumer Services offices in Bartow. The District conducted and recorded interactive webcasts at all public workshops, and involved its standing advisory committees (public supply, agricultural, industrial, well drillers, green industry and environmental) and advisory groups (environmental resource permit and water use permit). Additionally, District staff facilitated presentations to a number of professional organizations and community groups.

District staff also involved other affected parties in the development of the RWSP. This involvement included coordinating methods for projecting water demands and assisting with the identification of potential options for water supply development. The District's RWSP webpage was updated to provide public drafts of the entire document, advertise public webinars and workshops, and solicit comments from the public and interested parties.

Overall, the District conducted a variety of outreach activities to inform and engage the public and stakeholders on development of the 2020 RWSP. These activities included public webinars and workshops, stakeholder meetings, and presentations at District advisory committees and other local and regional forums between June 2018 and September 2020. These outreach activities provided the opportunity to explain the draft RWSP, collect input on major plan components, and develop water resource and water supply project options.

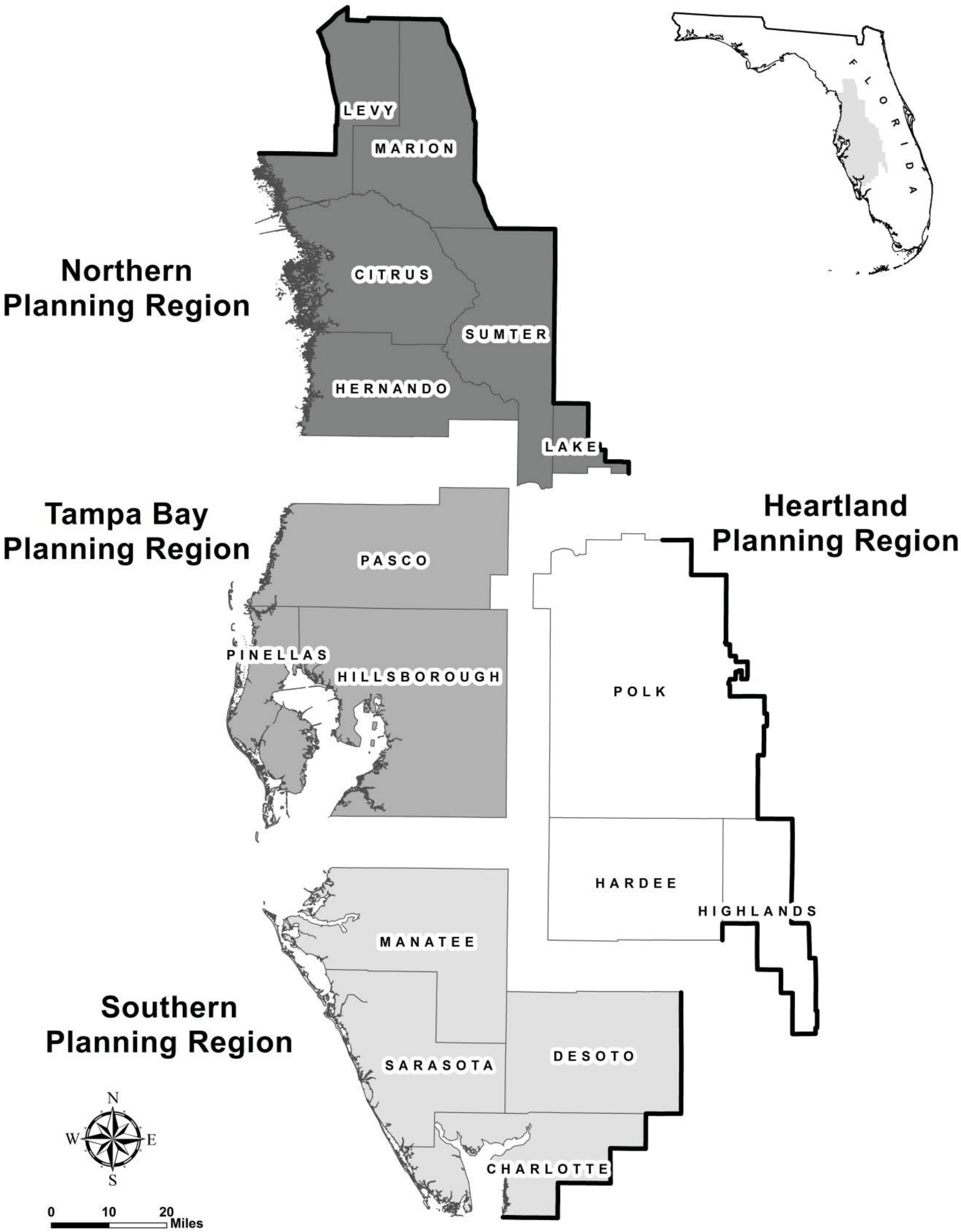


Figure 1. *Location of the District's four water supply planning regions*

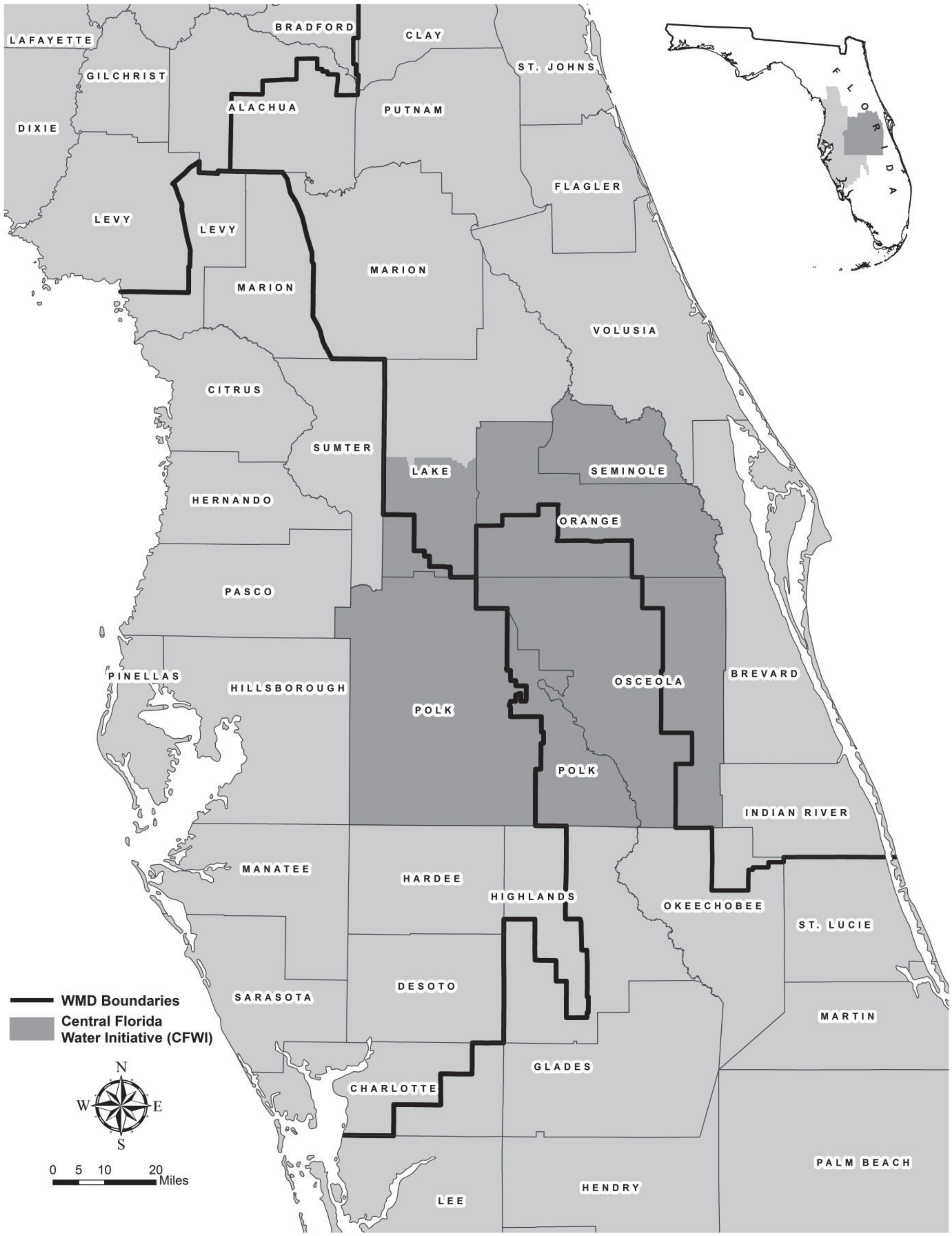


Figure 2. *Location of the Central Florida Water Initiative Area*

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Chapter 2. Resource Protection Criteria

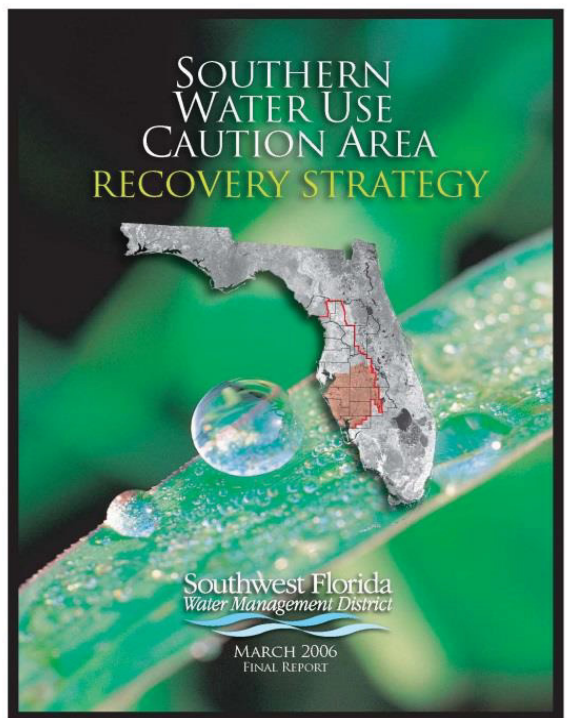
This chapter addresses the primary strategies the District employs to protect water resources, which include minimum flows and levels (MFLs), water use caution areas (WUCAs), prevention and recovery strategies, reservations, and climate change.

Minimum Flows and Levels (MFLs)

A water resource MFL is the limit at which additional withdrawals would be significantly harmful to water resources or the ecology of the area. The District implements established MFLs primarily through its water supply planning, water use and environmental resource permitting programs, and by funding water resource and water supply development projects that are part of a recovery strategy. The District establishes and annually updates a list of priority ground and surface waters for which MFLs will be set. Numerous factors are considered in determining which water resources are included, such as the importance of the water resources to the state or region; the existence of, or potential for, significant harm to occur; the required inclusion of all first-magnitude springs and all second-magnitude springs within state or federally- owned lands purchased for conservation purposes; the availability of historic hydrologic records; the possibility that the water resource may be developed as a water supply; and the value of developing an MFL for regulatory purposes.

Water Use Caution Areas (WUCAs)

WUCAs are areas requiring regional action to address cumulative water withdrawal concerns that are causing or may cause adverse impacts to the water and related land resources or the public interest (Rule Chapter 40D-2.801, Florida Administrative Code (F.A.C.)). To determine whether an area should be declared a WUCA, the District considers factors that include the quantity and quality of water available for use from groundwater and surface water sources; the health of environmental systems such as wetlands, lakes, streams, estuaries, fish and wildlife or other natural resources; and lake stages or surface water rates of flow. In response to continuing resource concerns, the District established the Northern Tampa Bay Water Use Caution Area (NTBWUCA), the Southern Water Use Caution Area (SWUCA) and its Most Impacted Area (MIA), and the Dover/Plant City Water Use Caution Area (Dover/Plant City WUCA) (see Figure 3).



To achieve adopted MFLs, recovery strategies have been developed for each WUCA

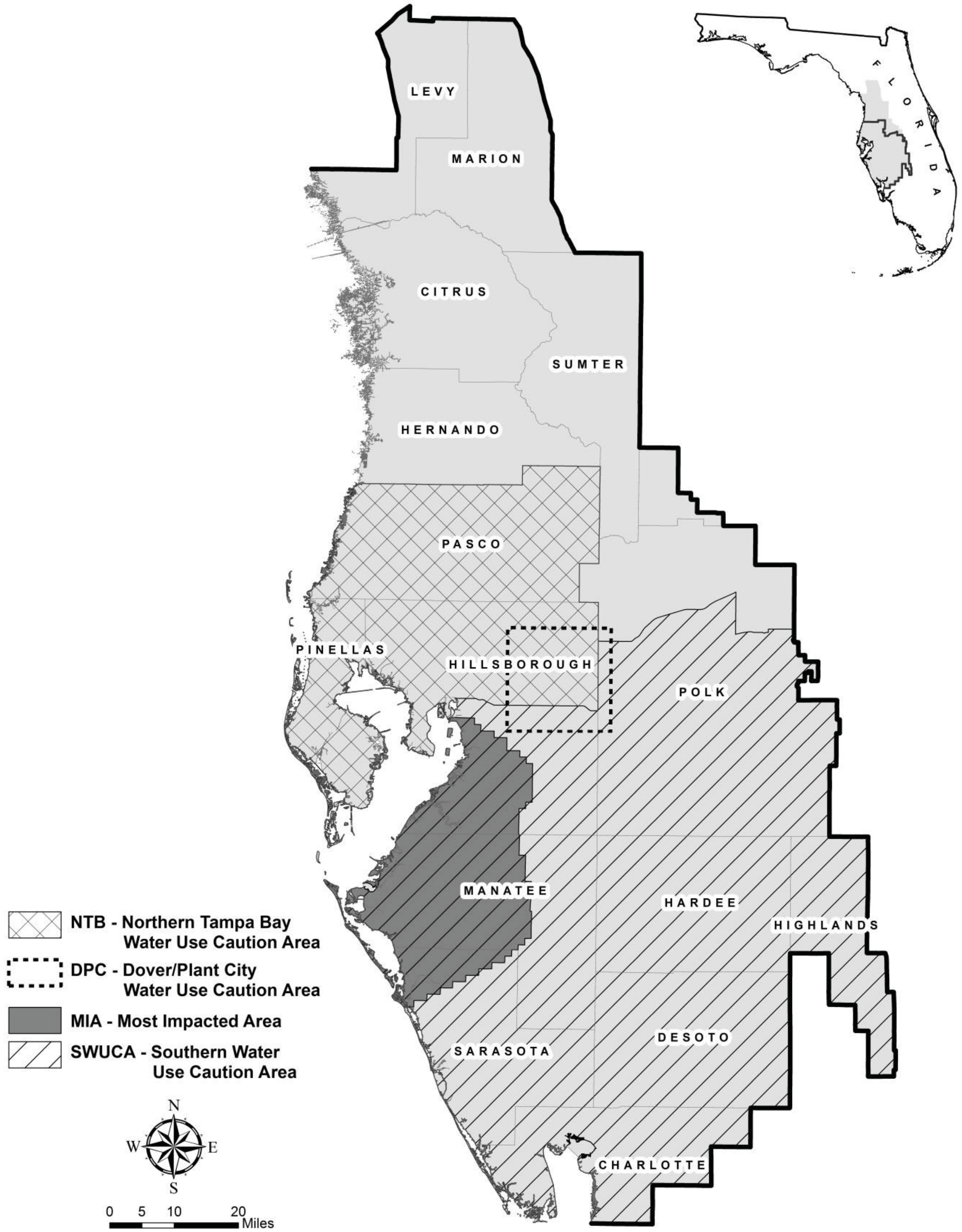


Figure 3. *Location of the District's water use caution areas and the MIA of the SWUCA*

Prevention and Recovery Strategies

Section 373.0421(2), F.S., requires that a recovery strategy be developed if the existing flow or level in a water resource is below an established MFL, or development of a prevention strategy if an existing flow or level is projected to fall below established MFLs within 20 years. To date, the District has developed several recovery plans for achieving adopted MFLs. Regional plans were developed for the NTBWUCA and SWUCA; and recovery strategies were developed for the lower Alafia and Hillsborough rivers and the Dover/Plant City WUCA. Regulatory components of the recovery strategies for water resources in these areas are incorporated into District rules (Rule Chapter 40D-80, F.A.C.) and outlined in District reports.

To address the effects of water resource impacts in the NTBWUCA, the District took several important actions, including the establishment of MFLs for cypress wetlands, lakes, rivers and the Upper Floridan aquifer (UFA); entering into an agreement with Tampa Bay Water (TBW) and its member governments to reduce groundwater withdrawals; and working toward recovery in areas where water resources are impacted. The SWUCA recovery strategy, adopted in 2006, provides a plan for reducing the rate of saltwater intrusion in the UFA, restoring low flows to the upper Peace River, and restoring lake levels by 2025 while ensuring sufficient water supplies and protecting the investments of existing water use permittees. The Lower Hillsborough River recovery strategy is a plan to develop a number of projects that will supply quantities of water sufficient to meet the river's established minimum flow. The Lower Alafia River recovery strategy requires major industrial water users to augment the river with groundwater to prevent their use of surface water from exceeding the established MFL. The recovery strategy for the Dover/Plant City WUCA requires reduction of groundwater withdrawals used for frost/freeze protection.

Reservations

Section 373.223(4), F.S., authorizes reservations of water from use by permit applicants for the protection of fish and wildlife or public health and safety. The District will consider establishing a reservation of water when a District water resource development project will produce water needed to achieve adopted MFLs. Reservations of water will be established by rule.

Climate Change

Climate change may affect water supply sources and will be factored into evaluations of supplies to meet future demand. It also has the potential to change patterns of demand and could be an important consideration in demand projections. Changes in the nature of supply and demand may also necessitate infrastructure adaptation, which can be costly. However, as information is generated, existing and proposed water sources and projects will be evaluated to determine their feasibility and desirability. For these reasons, the District has assumed a "monitor and adapt" approach toward climate change. The District will continue to actively monitor current research projects, both locally and nationally, interpret the results, and initiate appropriate actions deemed necessary to protect our water resources against the effects of climate change. For further information, see the climate change section in the Resource Protection Criteria chapter of each planning region's RWSP.

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Chapter 3. Demand Estimates and Projections

This chapter presents the analysis of water demand for each water use sector in the District through 2040. The analysis includes the District's methods and assumptions used in projecting water demand for each county, the demand projections in five-year increments and a discussion of important trends in the data. The multiagency-produced demand estimates and projections for the CFWI region are noted.

Water demand has been projected for the following sectors for each county in the District: public supply (PS), agriculture (AG), industrial/commercial (I/C), mining/dewatering (M/D), power generation (PG), and landscape/recreation (L/R). FDACS prepared Florida Statewide Agricultural Irrigation Demand (FSAID5) projections through 2040. For an explanation of the District's integration of the FSAID5 for AG demand projections, see Appendix 3-1.

Table 1 summarizes the projected changes in demand for the average rainfall (5-in-10) condition for each water use sector in the District in five-year increments during the planning period. The table shows that the overall increase in water supply demand for the planning period for all use categories and for restoration of natural systems is 209.83 million gallons per day (mgd); a 19.9 percent increase over the quantity used in the 2015 base year.

Table 1. *Summary of the projected demand by planning region (5-in-10) (mgd)*

Water Use Category	Planning Period						Change 2015-2040	
	2015	2020	2025	2030	2035	2040	mgd	%
Heartland Planning Region								
Public Supply	81.93	92.06	99.02	104.78	110.21	115.10	33.17	40.5%
Agriculture	155.74	152.36	149.35	146.93	146.56	143.79	-11.95	-7.7%
I/C & M/D	47.30	52.60	53.00	66.10	63.40	60.60	13.30	28.1%
Power Gen.	7.62	9.94	10.00	10.07	10.13	10.21	2.59	34.0%
Landscape/Rec.	9.67	10.10	10.51	10.84	11.16	11.44	1.77	18.3%
Region Total	**302.26**	**317.06**	**321.88**	**338.72**	**341.46**	**341.14**	**38.88**	**12.9%**
Northern Planning Region								
Public Supply	89.20	98.65	106.77	113.68	120.23	125.98	36.78	41.2%
Agriculture	18.44	20.17	21.65	23.18	24.95	26.71	8.27	44.8%
I/C & M/D	6.35	6.52	6.70	6.87	7.03	7.19	0.84	13.2%
Power Gen.	2.94	1.80	1.85	1.96	2.08	2.21	-0.73	-24.8%
Landscape/Rec.	14.96	16.09	17.31	18.38	19.37	20.23	5.27	35.3%
Region Total	**131.89**	**143.23**	**154.28**	**164.07**	**173.66**	**182.32**	**50.43**	**38.2%**
Southern Planning Region								
Public Supply	101.71	109.42	116.59	122.74	128.05	132.49	30.78	30.3%
Agriculture	105.05	105.58	106.48	107.52	108.55	109.65	4.60	4.4%
I/C & M/D	6.09	7.13	7.19	10.59	10.62	10.65	4.56	74.9%
Power Gen.	3.60	3.69	3.92	4.17	4.40	4.64	1.04	28.9%
Landscape/Rec.	18.50	19.21	20.04	20.75	21.37	21.91	3.41	18.4%
Region Total	**234.95**	**245.03**	**254.22**	**265.77**	**272.99**	**279.34**	**44.39**	**18.9%**
Tampa Bay Planning Region								
Public Supply	304.53	325.88	346.36	364.39	379.09	391.99	87.46	28.7%
Agriculture	48.11	46.12	44.18	42.35	40.45	38.16	-9.95	-20.7%
I/C & M/D	18.66	26.11	26.31	13.77	13.94	14.12	-4.54	-24.3%
Power Gen.	0.26	0.34	0.35	0.36	0.37	0.38	0.12	46.2%
Landscape/Rec.	14.16	14.89	15.57	16.19	16.71	17.2	3.04	21.5%
Region Total	**385.72**	**413.34**	**432.77**	**437.06**	**450.56**	**461.85**	**76.13**	**19.6%**
Districtwide Totals								
Public Supply	577.37	626.01	668.74	705.59	737.58	765.56	188.19	32.6%
Agriculture	327.34	324.23	321.66	319.98	320.51	318.31	-9.03	-2.8%
I/C & M/D	78.40	92.36	93.20	97.33	94.99	92.56	14.16	18.1%
Power Gen.	14.42	15.77	16.12	16.56	16.98	17.44	3.02	20.9%
Landscape/Rec.	57.29	60.29	63.43	66.16	68.61	70.78	13.49	23.6%
Districtwide Total	**1,054.82**	**1,118.66**	**1,163.15**	**1,205.62**	**1,238.67**	**1,264.65**	**209.83**	**19.9%**

Notes: Summation and/or percentage calculation differences occur due to rounding. Values match the 5-in-10 scenarios provided in Table 3-6 of the HPR, SPR, and TBPR volumes and Table 3-5 in the NPR volume.

Chapter 4. Evaluation of Water Sources

This chapter outlines the District's investigations to quantify the amount of water that is potentially available from all sources of water within each planning region to meet demands through 2040. Sources of water that were evaluated include surface water, stormwater, reclaimed water, seawater, brackish groundwater, 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, stormwater, and reclaimed water.

Table 2 summarizes the potential availability of water from each source and the potential for water conservation measures to reduce demand through 2040 in each of the planning regions. The table shows that approximately 78 mgd is available from fresh groundwater and approximately 307 mgd is available from other permitted sources or alternative water supply options. The table also shows that water conservation measures have the potential to reduce demand by approximately 98 mgd. The total water supply availability and potential for water conservation to reduce demand in the District through 2040 is approximately 788 mgd. When compared to the projected 2040 additional demand of 209.83 mgd (see Table 1), it can be concluded that the available water supplies and conservation measures are sufficient to meet the 2040 projected demands.

Water demand will be met differently in each planning region. The following is a general overview of how the projected water demands in each planning region are likely to be met with the identified sources.

Heartland Planning Region

The 2015 to 2040 increase in water demand in the Heartland Planning Region is projected to be 38.88 mgd. As of 2020, it is estimated that 30.89 mgd in existing permitted quantities were potentially available, however, these quantities may be limited due to resource constraints within the planning region. The remaining 7.99 mgd of demand will be supplied in part by reclaimed water projects or growth in existing facilities, as well as agricultural and non-agricultural conservation projects under development (see Table 3). In addition, the development of regional alternative water supply and transmission systems, such as the Polk Regional Water Cooperative's Southeast and West Polk brackish water wellfield projects, are anticipated to help improve water supply reliability and assist with environmental restoration. Additional water supply options through 2040 include up to 23.77 mgd of reclaimed water, 8.70 mgd of non-agricultural water conservation, and 8.06 mgd of agricultural water conservation (see Table 2).

Northern Planning Region

The 2015 to 2040 increase in demand in the Northern Planning Region is projected to be 50.43 mgd. As of 2020, it is estimated that at least 31 percent of that demand (15.86 mgd) has either been met or will be met by existing permitted quantities. The remaining 34.55 mgd will be supplied in part by 5.40 mgd of reclaimed water projects or growth in existing facilities, as well as agricultural and non-agricultural conservation projects under development (see Table 3), leaving approximately 29.15 mgd of demand unmet. Computer groundwater flow modeling using the Northern District model has demonstrated that groundwater is available to meet demand to 2040, if conservation and reuse initiatives are also utilized to reduce demands. Additional demand reductions can be achieved through identified and future project options including a total of 5.67 mgd of reclaimed water, 10.87 mgd of non-agricultural water conservation, and 3.25 mgd of agricultural water conservation (see Table 2). While the availability of fresh groundwater from the UFA can be prolonged by maximizing conservation and reclaimed water benefits, future groundwater availability will be dependent on achieving MFLs for the Withlacoochee River and springs systems.

Southern Planning Region

The 2015–2040 increase in water demand in the Southern Planning Region is projected to be 44.39 mgd. As of 2020, it is estimated that most or all of this demand has been or can be met by existing permitted quantities of 141.69 mgd. Reclaimed water projects or growth in existing facilities, combined with agricultural and non-agricultural conservation projects under development will add an additional 10.53 mgd for water supply or resource benefit (see Table 3). The continued development of regional water supply and transmission systems will enable utilities to meet public supply needs from multiple sources. Reductions in agricultural water use through Facilitating Agricultural Resource Management Systems (FARMS) projects will continue to be very significant for the planning region in order to meet the demands of agriculture and environmental restoration for the SWUCA Recovery Strategy. Other potential project options for additional water supply could include up to 23.90 mgd of reclaimed water, 7.67 mgd of non-agricultural water conservation, and 14.06 mgd of agricultural water conservation that could be developed by 2040 (see Table 2).

Tampa Bay Planning Region

The 2015 to 2040 increase in water demand in the Tampa Bay Planning Region is projected to be 76.13 mgd. As of 2020, it is estimated that most or all of this demand has either been met or will be met by existing permitted quantities of 104.27 mgd. Infrastructure improvement projects are necessary in some instances to fully utilize these resources, with Tampa Bay Water identifying such projects as part of its 2018 Long-term Master Water Plan update. Reclaimed water projects or growth in existing facilities, combined with agricultural and non-agricultural conservation projects under development will add an additional 12.55 mgd for water supply or resource benefit (see Table 3). Other potential project options could include up to 104.07 mgd of reclaimed water, 40.19 mgd of non-agricultural water conservation, and 4.78 mgd of agricultural conservation (see Table 2). A projected reduction in agricultural demand by 9.95 mgd in the planning region could be permanently retired to help achieve the saltwater intrusion minimum aquifer level and/or used to allow development of a limited amount of fresh groundwater by mitigation.

Table 2. *Potential additional water availability in the District from sources in each planning region through 2040 (mgd)*

Planning Region	Surface Water		Reclaimed Water	Desalination		Fresh Groundwater		Water Conservation		Total
	Permitted Unused	Available Unpermitted	Post-2015 Benefits[4]	Seawater	Brackish Groundwater[1]	Surficial and Intermediate	Upper Floridan Permitted Unused	Public Supply	Agricultural[5]	
Heartland	0.46	4.20	23.77	0.00	0.00	1.60	30.43	8.70	8.06	77.22
Northern[2, 3]	0.54	49.70	5.67	15.00	0.00	0.00	15.86	10.87	3.25	100.89
Southern	106.56	88.10	23.90	40.00	14.91	12.50	7.72	7.67	14.06	315.42
Tampa Bay	91.50	6.40	104.07	35.00	2.44	4.80	5.53	40.19	4.78	294.71
Total	**199.06**	**148.40**	**157.41**	**90.00**	**17.35**	**18.90**	**59.54**	**67.43**	**30.15**	**788.24**

[1] The Brackish Groundwater quantities shown include permitted but currently unused capacity. Additional quantities from identified project options will require evaluation similar to fresh groundwater.
[2] Groundwater quantities shown only include permitted but unused groundwater from the UFA. The Northern Planning Region is the only region where groundwater from the UFA will be available in quantities sufficient to meet the 2040 demand, provided existing and anticipated local impacts are mitigated or avoided. It is anticipated that the District's efforts to aggressively promote and develop reclaimed water and conservation will significantly reduce the amount of groundwater needed to meet the projected demand.
[3] Fresh Groundwater does not include quantities potentially available from the LFA in portions of the planning region. These quantities will be further evaluated in future updates of this RWSP for the Northern Planning Region.
[4] Post-2015 reclaimed water benefits estimated at 75% utilization and 75% efficiency. 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.
[5] These values represent conservation potential (gains in efficiency). There is an estimated potential 23.98 mgd District-wide for AWS (tailwater recovery) ag projects based on extrapolation from historical FARMS participation.

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Chapter 5. Overview of Water Supply Development Options

The water supply development component of the RWSP requires the District to identify water supply options from which water users in each planning region can choose to meet their individual needs. In addition, the District is required 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 District include surface water, stormwater, reclaimed water, seawater desalination, brackish groundwater desalination, fresh groundwater and conservation. 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.

A brackish groundwater treatment facility constructed in Clearwater with cooperative funding by the District

Where applicable, water supply options developed through regional planning efforts conducted by Polk County, TBW, the Withlacoochee Regional Water Supply Authority, and the Peace River Manasota Regional Water Supply Authority (PRMRWSA) are incorporated into the RWSP for each planning region. 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 efforts. 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, could be implemented by individual utilities, farmers or other permittees. It is anticipated that users will choose an option or combine elements of different options that best fit their needs for water supply development, 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 technical assessments to provide the necessary support for developing the option. See Chapter 5 in each planning region's respective RWSP for a complete listing of water supply development options in the District.

The CFWI is identifying both traditional source water availability and additional alternative water supply development options for the collaborative planning region, including those portions of Polk and Lake counties within the District. These options include use of brackish groundwater, surface water, reclaimed water, and water management strategies such as conservation. The CFWI RWSP may contain additional information regarding the water supply options available to those counties.

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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 planning regions. Projects under development are those the District is co-funding and either (1) were completed since the year 2015, the base year for the 2020 RWSP; (2) are in the planning, design or construction phase; or (3) are not yet in the planning phase, but are at least partially funded through the 2020 fiscal year (FY). Below are brief summaries of the planning regions' water supply projects under development. The anticipated benefits from the numerous reclaimed water and conservation projects are provided in Table 3. See Chapter 6 in each planning region's respective RWSP for a complete listing of water supply projects under development in the District.

The District provides funding for IFAS to investigate a variety of agriculture/ urban issues that involve water conservation. There are 10 ongoing IFAS research and education projects under development that will result in water savings throughout the District. These projects involve best management practices to increase the efficiency of water use. The total cost of these projects is approximately $1.7 million.

Heartland Planning Region

The PRWC is continuing with conceptual and preliminary design activities for the development of two Lower Floridan aquifer (LFA) brackish groundwater wellfield projects. The Southeast Wellfield and West Polk Wellfield projects will collectively provide up to 45 mgd of alternative water supply to serve the PRWC's member governments, helping to reduce reliance on increasingly constrained Upper Floridan aquifer sources.

Reclaimed water supply projects in the planning region include 10 that are under development and another six which are estimated to experience supply growth. These projects are projected to supply 20.45 mgd of reclaimed water, resulting in 15.69 mgd of potable-quality water benefits at a total cost of more than $122 million.

Non-agricultural water conservation projects in the region include a total of 13 that are under development. These projects involve toilet rebates, rain sensors, irrigation evaluations, advanced metering analytics, line looping (to reduce flushing), Florida Water Star rebates, and demand management planning. These projects will save more than 599,918 gallons per day (gpd) at a cost of approximately $2,496,790. These savings are more than double those of the prior 5-year period. There are eight agricultural water conservation/water development type projects within the region. The combined water resource benefits of these projects are expected to be 440,000 gpd and have a District cost share of approximately $1,450,951.

Northern Planning Region

Reclaimed water supply projects include three under development and another six that are estimated to experience additional future supply growth. These projects will supply more than 6.45 mgd of reclaimed water that will result in 5.07 mgd of potable-quality water benefits at a total cost of approximately $16 million.

Non-agricultural water conservation projects include 16 that are under development in the planning region. These projects involve toilet rebates, rain sensor replacements, smart irrigation controllers, and irrigation evaluations. The projects will save more than 280,059 gpd at a cost of approximately $989,580.

There are two agricultural water conservation/water development type projects underway within the region. The combined water resource benefits of these projects are expected to be 50,000 gpd and have a District cost share of approximately $510,247.

Southern Planning Region

The PRMRWSA is continuing the development of its Regional Integrated Loop System, which includes a series of transmission pipelines to regionally transfer and deliver water from existing and future alternative supplies to demand centers within its four-county service area. Three of the loop system phases are complete (Phases 1A, 2, 3A). As part of the PRMRWSA's 2020 Integrated Water Supply Master Plan Update, project phasing was revised to improve sharing of capacity and utilize existing infrastructure.

Reclaimed water storage tank completed as part of a project in the Southern Planning Region

Reclaimed water supply projects include five under development and another two that are estimated to experience additional future supply growth. These projects will supply 8.23 mgd of reclaimed water and provide 7.12 mgd of potable-quality water benefits at a total cost of approximately $16 million.

A total of 15 non-agricultural water conservation projects are under development in the planning region. These projects, which include toilet rebates, line looping (to reduce flushing), and soil moisture sensors will save in excess of 361,389 gpd at a cost of approximately $3,099,389.

There are 31 agricultural water conservation/water development type projects within the region. The projects combined water resource benefits are expected to be 3,049,000 gpd and have a District share of approximately $7,724,705.

Tampa Bay Planning Region

The planning region includes 22 reclaimed water supply projects under development and at least one other that is estimated to experience additional future supply growth. When complete, these projects will supply approximately 14 mgd of reclaimed water, resulting in 12 mgd of potable-quality water benefits at a total cost of approximately $103 million.

A total of 24 non-agricultural water conservation projects are under development in the planning region. These projects include toilet rebates, landscape irrigation evaluations, soil moisture sensors, satellite-based leak detection, and an irrigation system upgrade for a golf course. The projects will save nearly 818,998 gpd at a cost of approximately $2,955,987. These savings are more than double those of the prior 5-year period.

There are 12 agricultural water conservation/water development type projects within the region. The combined water resource benefits of these projects are expected to be 530,000 gpd and have a District share of approximately $2,143,200.

Table 3. *Reclaimed water and water conservation benefits from projects that meet the District's definition of being under development*

Planning Region	Reclaimed Water (mgd)	Water Conservation (mgd)		Total (mgd)
	Post-2015 Benefits	Non-Agriculture	Agriculture[1]	
Heartland	15.69	0.599	0.437	16.726
Northern	5.07	0.280	0.050	5.400
Southern	7.12	0.361	3.049	10.530
Tampa Bay	11.82	0.819	0.530	13.169
Total	**39.70**	**2.059**	**4.066**	**45.825**

[1] The FARMS projects calculated were specific projects of the FARMS water resource development program that were budgeted from 2015 through 2019. Benefits were calculated from anticipated savings.

Chapter 7. Water Resource Development Component

The intent of water resource development components described in this chapter is to enhance the amount of water available for water supply development. The District classifies water resource development projects into two broad 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. The second category includes projects that meet the more narrow statutory definition of water resource development, i.e., “regional projects designed to create from traditional or alternative sources an identifiable, quantifiable supply of water for existing and/or future reasonable-beneficial uses.”

The data collection and analysis activities conducted by the District support the health of natural systems and the development of water supplies. The activities include a comprehensive hydrologic conditions monitoring program to assemble information on key indicators as rainfall, surface and groundwater levels and water quality, and stream flows. Data collected allows the District to gage changes in the health of water resources, monitor trends, identify and analyze existing or potential resource problems, develop programs to correct existing problems, and prevent future problems from occurring. The data collection also supports District flood control structure operations, water use and environmental resource permitting and compliance, MFL status evaluation, recovery strategies, modeling of surface water and groundwater systems, and numerous resource evaluations and reports.

Agricultural water supply projects use conservation strategies to increase efficiency and restore water resources

The District has 20 projects that meet the definition of water resource development. These projects include (1) alternative water supply research, restoration and pilot projects that further the development of innovative technologies to produce water from alternative sources and achieve hydrologic restoration; (2) agricultural water supply/environmental restoration projects including the FARMS Program that employ agricultural water conservation strategies to increase the water use efficiency of agricultural operations; and (3) projects to restore minimum flows to impacted water resources. Districtwide, these 20 projects will produce or conserve a minimum of 78 mgd at a total cost of approximately $150 million.

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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 development projects proposed by the District and its cooperators to meet the water supply demand projected through 2040 and to restore MFLs to impacted natural systems.

To estimate capital costs to meet the portion of the 2040 demand that is not yet under development, the District compiled a list of large-scale water supply development projects. The water supply produced from these large-scale water supply development projects, combined with the water supply to be produced from numerous reclaimed water and conservation projects currently under development, will meet approximately 65 percent of the projected demand.

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 the RWSP for each planning region. Finally, a significant portion of this remaining demand is in the Northern Planning Region. It is anticipated that most of this demand will be met with fresh groundwater from the UFA. To determine the availability of funding to cover the costs of developing alternative water projects, the capital cost of the potential large-scale projects discussed above is compared to the amount of funding that will be generated through 2040 by the various District, state, and federal funding mechanisms.

Water Utility Funding

Water supply development funding has primarily been, and will remain, the responsibility of water utilities and water authorities. Demand increases generally result 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, development impact fees, base and minimum charges, and volume charges. 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, but they may also contribute to source development, treatment, and transmission construction cost debt service. Volume charges contribute to source development, treatment, transmission debt service, and operation and maintenance. Financing through volume-related charges is the most economically efficient means to finance new water supply development. Volume charge financing provides consumers and businesses the greatest degree of direct control over water-related costs and a direct incentive to conserve.

Community development districts 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. Regional water supply authorities are also special water supply districts and are typically funded through fixed and variable charges to the utilities they supply, although they have the ability to levy taxes with county/municipal approval. All of the above have the ability to issue secure construction bonds backed by revenues from fees, rates, and charges.

District and State Funding

A variety of potential funding sources, such as the District's Cooperative Funding Initiative and District Initiatives, the state's Water Protection and Sustainability Trust Fund, and the state's

Springs Initiative were evaluated to create a projection of funding that could be used for water supply and water resource development projects. The results of this evaluation found that a minimum of $2.66 billion could potentially be generated or made available to fund those projects necessary to meet projected water supply demands through 2040 and to restore MFLs for impacted natural systems. This figure may be conservative, since it is not possible to determine the amount of funding that may be available in the future from the federal government and state of Florida legislative appropriations.

Evaluation of Project Costs to Meet Projected Demand

Of the 231.4 mgd of projected demand increases during the 2015–2040 planning period necessary to meet the demand for all users and to restore MFLs for impacted natural systems, it is estimated that 46 mgd, or 20 percent of the demand, either has been met or will be met by reclaimed water and conservation projects that are under development. The total District share of cost for the projects currently under development including regional transmission, ASR, and brackish groundwater treatment systems is $490 million.

To generate an estimate of the capital cost of projects that need to be developed to meet the additional demand, the District compiled a list of large-scale water supply development projects that have been proposed by the Peace River Manasota Regional Water Supply Authority, Tampa Bay Water, and Polk Regional Water Cooperative that will produce an additional 100 to 105 mgd of new water supply and provide regional transmission capacity. These projects, as well as their estimated costs and quantities of water they will produce, are listed in Table 5. The total estimated cost of the 100 to 105 mgd of water supply that will be produced by these projects ranges from $1.50 to $1.57 billion.

For the Northern Planning Region, no major water supply development projects are proposed for development by the Withlacoochee Regional Water Supply Authority through 2040, as traditional sources, conservation, and reclaimed water initiatives are projected to meet demands in the region. Because the District does not fund fresh groundwater projects, matching financial resources may only need to be generated by the District for reclaimed water and conservation projects in the Northern Planning Region.

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

The conservative estimate of $2.66 billion in cooperator and District financial resources that will be generated through 2040 for funding is sufficient to meet the projected $1.50 to $1.57 billion total cost of the large-scale projects listed in Table 5. In addition to these resources, state and federal funding sources may also assist with the remaining and high-end costs for future alternative water supply projects and water conservation measures where fresh groundwater resources are limited. It may also serve as a reserve for the development of projects to replace water supplies that may be reduced as the result of the establishment or revision of MFLs. These financial projections are subject to economic conditions that may affect the level of District ad-valorem tax revenue and the availability of state and federal funding; however, such conditions may similarly affect future water demand increases.

For a complete discussion of funding options, see Chapter 8 in each planning region.

Table 4. *Proposed large-scale water supply and water resource development projects to be completed by 2040 (millions of $)*

Project	Entity to Implement	Quantities (mgd)	Capital Costs
Peace River Facility Surface Water System Expansion and Regional Reservoir	PRMRWSA	15	$208
Regional Loop System and ASR Projects	PRMRWSA	10	$189
Flatford Swamp Hydrologic Restoration	TBD	10	$44-96
Southeast Wellfield and West Polk County Lower Aquifer Deep Wells	PRWC	45	$650
Big Bend Desalination	TBW	10-12.5	$244
Enhanced Surface Water Expansion from Alafia River	TBW	10-12.5	$88
New Regional Feed Line to Balm Area	TBW	N/A	$76-97
Subtotal Southern Planning Region		**35**	**$441-493**
Subtotal Heartland Planning Region		**45**	**$650**
Subtotal Tampa Bay Planning Region		**20-25**	**$408-429**
Total – Districtwide		**100-105**	**$1,499-1,572**

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Guiding Principles

The analysis provided in the RWSP is based on a number of important principles that will guide the District's strategies to meet water supply demand through 2040. The principles that follow take into account statutory directives, the hydrologic conditions in the planning regions, existing and potential impacts to natural systems, the characteristics of water user groups, and other factors.

An emphasis on water conservation

Conservation is considered to be a potential source of water for all major use types. Future water demand is projected based on current water use efficiencies. If efficiency is increased through conservation, future demand will be offset and reduced. Conservation is strongly recommended for all users; however, special emphasis is placed on public supply use in the Northern Planning Region, which has tremendous potential for water savings. Regarding agricultural demand, the District, in cooperation with the FDACS, has developed the FARMS Program to promote agricultural water conservation. The FARMS Program is a cost-share reimbursement program aimed at the implementation of best management practices that conserve water and improve water quality.

An emphasis on reclaimed water

Reclaimed water is an important resource that can help meet future demands in all use sectors. The District's goals are to utilize 75 percent of all reuse flows and to achieve a 75 percent offset of potable sources. To meet these goals, the District will emphasize water-conserving rate structures, wet-weather storage, and system augmentation where appropriate.

Regional cooperation in water supply planning

The District promotes regional approaches to water supply planning and development. The benefits of regional systems include economies of scale, better ability to manage environmental impacts, improved system reliability, operational flexibility and emergency backup capability. Larger regional systems are also able to take advantage of conjunctive use, wherein both groundwater and alternative sources are available and can be managed to mimic natural hydrologic cycles. The primary vehicles for regional cooperation in the District are the CFWI, Polk Regional Water Cooperative and the three regional water supply authorities whose jurisdictions correspond closely with the four planning regions. The RWSP was developed in close coordination with these entities.

Focus on alternative sources

Because three of the four planning regions are subject to MFL recovery strategies due to the effects of groundwater withdrawals, the RWSP focuses on alternative water sources, including surface water, brackish groundwater, seawater desalination, reclaimed water and water conservation. Fresh groundwater supplies are available in the Northern Planning Region and could continue to meet demand beyond the 20-year planning period if the region's considerable potential for reuse and conservation is realized.

Meeting future demand through land-use transitions

In the SWUCA, land uses such as agriculture and mining are being displaced by residential and commercial land uses. It is anticipated that the water needs of these new land uses will be met predominately by alternative supplies, such as harvesting and storing the wet-season flow of rivers, reclaimed water and conservation. Because the land uses being replaced rely almost entirely on groundwater, there will be a net reduction in groundwater use. While a portion of this groundwater will be retired to help meet MFLs, the remainder can be used to meet the demands of development in areas where access to alternative supplies is limited.

The role of constraints such as MFLs

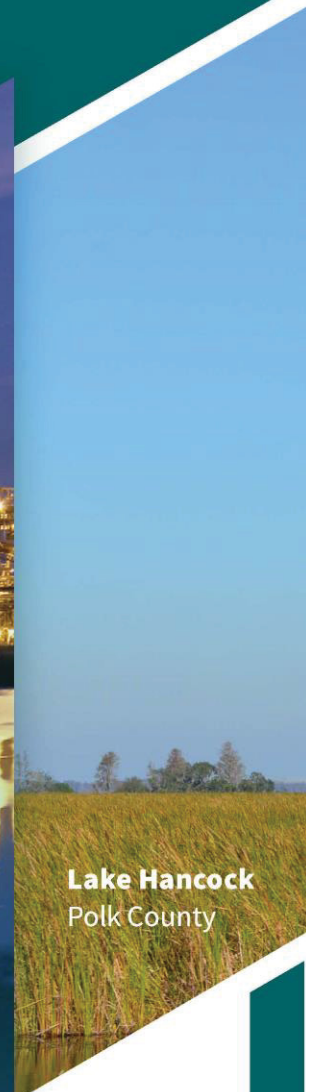
In three of the four planning regions, some water resources are not meeting their established minimums. In these areas, it will be necessary to continue implementation of MFL recovery strategies while also identifying potential water supply options to meet future demands. In the Northern Planning Region, it is anticipated that water resources will generally meet their MFLs as they are set. Thus, in the Northern Planning Region, the District's focus is on preventing resource impacts as water demand increases and as additional supplies are developed through 2040.

Weeki Wachee River

2020 Regional Water Supply Plan

Heartland Planning Region

April 2020



Southwest Florida Water Management District

The Southwest Florida Water Management District (District) does not discriminate on the basis of disability. This nondiscrimination policy involves every aspect of the District's functions, including access to and participation in the District's programs, services and activities. Anyone requiring reasonable accommodation, or would like information as to the existence and location of accessible services, activities, and facilities, as provided for in the Americans with Disabilities Act, should contact Donna Kaspari, Sr. Performance Management Professional, at 2379 Broad St., Brooksville, FL 34604-6899; telephone (352) 796-7211 or 1-800-423-1476 (FL only), ext. 4706; or email ADACoordinator@WaterMatters.org. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1-800-955-8771 (TDD) or 1-800-955-8770 (Voice). If requested, appropriate auxiliary aids and services will be provided at any public meeting, forum, or event of the District. In the event of a complaint, please follow the grievance procedure located at WaterMatters.org/ADA.

2020 Regional Water Supply Plan
Heartland Planning Region

Public Review Draft

April 2020

For further information regarding this plan, please contact the Water Supply Section at:

2379 Broad Street
Brooksville, FL 34604-6899
(352) 796-7211 or
(800) 423-1476 (Florida Only)

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Southwest Florida Water Management District

2020 Regional Water Supply Plan

This report is produced by the Southwest Florida Water Management District

April 2020 – Public Review Draft

District Project Manager: Joseph Quinn, AICP

District Contributors

Anthony Andrade
Ron Basso, P.G.
Mike Bray
April Breton
Miurel Brewer
Joel Brown
Mike Cacioppo
Cortney Cameron
Donna Campbell
Jake Cuarta
Corey Denninger, GISP
Don Ellison, P.G.
Randy Emberg
Carole Estes, P.G.
John Ferguson, P.G.
Mark Fulkerson, Ph.D., P.E.
Frank Gargano
Yonas Ghile
Jim Golden, AICP
Mohamed Hersi
Mary Margaret Hull, APR
Doug Leeper
Tamera McBride, P.G.
Lisann Morris, P.E., PMP
Cassidy Hampton
Mike Hancock, P.E.
Jerry Harding
Darrin Herbst, P.G.
Jay Hoecker, PMP
Ashlee Hollifield
Thomas Kiger, P.E.
Luke LeMond, P.G.
Josh Madden
Lydia Manos
Cara Martin, APR
Jeremy McKay
Jason Patterson
Ryan Pearson
Robert Peterson, P.G.
Amy Poxson
Dennis Ragosta
Patricia Robertshaw
Cindy Rodriguez
Danielle Rogers
Carmen Sanders
George Schlutermann, P.G.
Andrea Shamblin
Virginia Singer
Claire Stapley
Susanna Martinez Tarokh
Chris Tumminia
Don Weaver
Jeff Whealton, P.W.S.
Brent White
Kevin Wills
Marra Wood
Lei Yang
Allen Yarbrough
Chris Zajac

Other Contributors

Wade Trim, Inc.
Sarah Mastison
Brad Cornelius, AICP, CPM
Amanda Warner, AICP

This report is available online at: WaterMatters.org/RWSP
You may send a request for a printed copy to info@watermatters.org

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List of Abbreviations

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

GOES	Geostationary Operational Environmental Satellites
GPD	Gallons per Day
GPF	Gallons per Flush
GPM	Gallons per Minute
GRP	Gross Regional Product
HET	High Efficiency Toilets
HPR	Heartland Planning Region
HRWUCA	Highlands Ridge Water Use Caution Area
I-4	Interstate 4
I/C	Industrial/Commercial
IFAS	Institute of Food and Agricultural Sciences
IPCC	Intergovernmental Panel on Climate Change
IPE	Independent Performance Evaluation
L/R	Landscape/Recreation
LFA	Lower Floridan aquifer
LHR	Lower Hillsborough River
MAL	Minimum Aquifer Level
MALPZ	Minimum Aquifer Level Protection Zone
MCU I	Middle Confining Unit I (1)
MCU II	Middle Confining Unit II (2)
M/D	Mining/Dewatering
MFL	Minimum Flows and Levels
MGD	Million Gallons per Day
MG/L	Milligrams per Liter
MIA	Most Impacted Area
NERUSA	Northeast Regional Utility Service Area
NGVD	National Geodetic Vertical Datum
NHARP	North Hillsborough Aquifer Recharge Program
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTB	Northern Tampa Bay
NTBWUCA	Northern Tampa Bay Water Use Caution Area
O&M	Operation and Maintenance
OFW	Outstanding Florida Water
PG	Power Generation
PRMRWSA	Peace River Manasota Regional Water Supply Authority
PRIM	Peace River Integrated Model
PRMRWSA	Peace River Manasota Regional Water Supply Authority
PRWC	Polk Regional Water Cooperative
PS	Public Supply
PSI	Pounds per Square Inch
QWIP	Quality of Water Improvement Program
RC&D	Florida West Coast Resource Conservation and Development Council
RIB	Rapid Infiltration Basin
RPC	Regional Planning Council
RO	Reverse Osmosis
ROMP	Regional Observation and Monitor-well Program

RWSP	Regional Water Supply Plan
SERUSA	Southeast Regional Utility Service Area
SFWMD	South Florida Water Management District
SHARE	South Hillsborough Aquifer Recharge Expansion
SHARP	South Hillsborough Aquifer Recharge Program
SHP	Stormwater Harvesting Program
SJRWMD	St. Johns River Water Management District
SMS	Soil Moisture Sensor
STAG	State and Tribal Assistance Grants
SWCD	Soil and Water Conservation District
SWCFGWB	Southern West-Central Florida Groundwater Basin
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management Program
SWIMAL	Saltwater Intrusion Minimum Aquifer Level
SWUCA	Southern Water Use Caution Area
TBC	Tampa Bypass Canal
TBW	Tampa Bay Water
TDS	Total Dissolved Solids
TECO	Tampa Electric Company
TMDL	Total Maximum Daily Loads
TWA	Tohopekaliga Water Authority
UFA	Upper Floridan aquifer
ULFT	Ultra Low-Flow Toilet
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geologic Survey
WISE	Water Incentives Supporting Efficiency
WMD	Water Management District
WMIS	Water Management Information System
WMP	Watershed Management Program
WPSPTF	Water Protection and Sustainability Program Trust Fund
WQMP	Water Quality Monitoring Program
WRAP	Water Resource Assessment Project or West-Central Florida Water Restoration Action Plan
WRD	Water Resource Development
WSD	Water Supply Development
WTP	Water Treatment Plant
WUCA	Water Use Caution Area
WUP	Water Use Permit
WUWPD	Water Use Well Package Database
WWTP	Wastewater Treatment Plant
ZLD	Zero Liquid Discharge

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Chapter 1. Introduction

The Regional Water Supply Plan (RWSP) for the Southwest Florida Water Management District (SWFWMD or District) is an assessment of projected water demands and potential sources of water to meet these demands for the period from 2020 through 2040. The RWSP has been prepared in accordance with the Florida Department of Environmental Protection's (FDEP) 2019 Format and Guidelines for Regional Water Supply Planning. The RWSP consists of four geographically based volumes that correspond to the District's four designated water supply planning regions: Northern, Tampa Bay, Southern, and Heartland (Figure 1-1). This volume is the 2020 RWSP update for the Heartland Planning Region, which includes Hardee County and the portions of Polk and Highlands counties within the District. The District completed RWSPs in 2001, 2006, 2010, and 2015 that included the Heartland Planning Region.

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

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

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

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

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

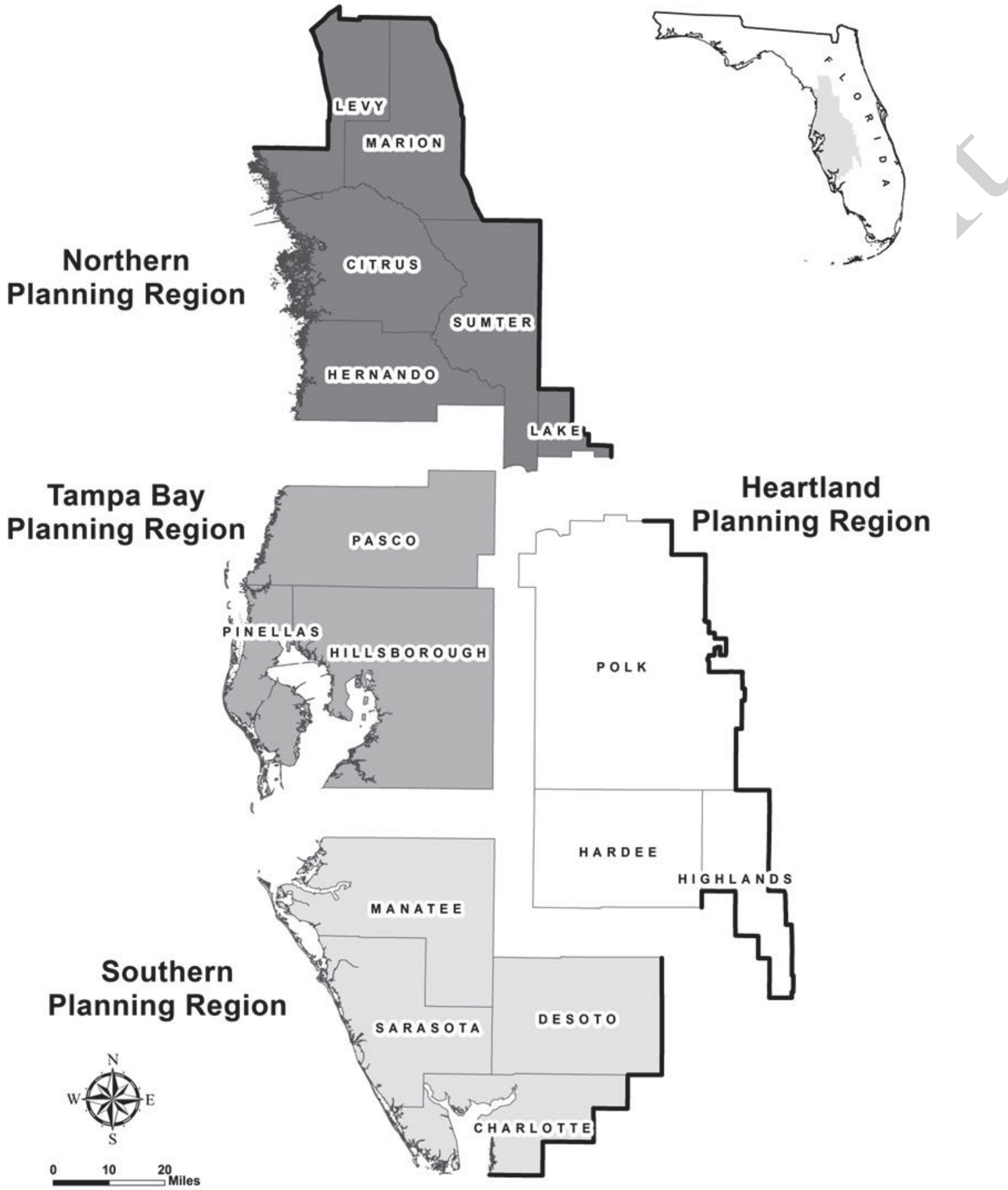


Figure 1-1. *Location of the four water supply planning regions within the District*

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

The following describes the content of the Heartland Planning Region RWSP. Chapter 1, Introduction, contains an overview of the District's accomplishments in implementing the water supply planning objectives of the 2015 RWSP; description of the land use, population, physical characteristics, hydrology, and geology/hydrogeology of the area; and a description of the technical investigations that provide the basis for the District's water resource management strategies. Chapter 2, Resource Protection Criteria, addresses the resource protection strategies that the District has implemented or is considering implementing, including water use caution areas (WUCAs) and the District's minimum flows and levels (MFLs) program. Chapter 3, Demand Estimates and Projections is a quantification of existing and projected water supply demand through the year 2040 for public supply, agricultural, industrial/commercial, mining/dewatering, power generation, landscape/recreation users, and environmental restoration. Chapter 4, Evaluation of Water Sources, is an evaluation of the future water supply potential of traditional and alternative sources in the planning region. Chapter 5, Water Supply Development Component, presents a list of alternative and traditional WSD options for local governments and utilities, including surface water and stormwater, reclaimed water, water conservation, and fresh and brackish groundwater. For each option, the estimated amount of water available for use and the estimated cost of developing the option are provided. Chapter 6 is an overview of WSD projects that are currently under development and receiving District funding assistance. Chapter 7, Water Resource Development Component, is an inventory of the District's ongoing data collection and analysis activities and water resource projects that are classified as water resource development (WRD). Chapter 8, Overview of Funding Mechanisms, provides an estimate of the capital cost of WSD and WRD projects proposed by the District and its cooperators to meet the water supply demand projected through 2040 and to restore MFLs to impacted natural systems. An overview of mechanisms available to generate the necessary funds to implement these projects is also provided.

Part B. Accomplishments Since Completion of the 2015 Regional Water Supply Plan

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

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

1.0 Alternative Water Supply

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

2.0 Water Conservation

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

In the agricultural water use sector, the District's primary initiative for water conservation is the Facilitating Agricultural Resource Management Systems (FARMS) Program. Established in 2003 in partnership with the Florida Department of Agriculture and Consumer Services (FDACS), FARMS is a cost-share reimbursement program for production-scale best management practices to reduce groundwater use and improve water quality. To date, more than 194 operational projects Districtwide are providing a groundwater offset of more than 27 million gallons per day (mgd). An additional nine projects in the planning, design, or construction phase are expected to yield another 0.98 mgd of offset. Within the Heartland Planning Region, FARMS has funded 41 operational projects providing nearly 4 mgd of offset with another 3 projects under construction that are expected to yield an additional 0.37 mgd.

3.0 Reclaimed Water

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

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

Section 2. Support for Water Supply Planning

In 2008, the District, the South Florida Water Management District (SFWMD), and Polk County entered into a cooperative funding agreement to develop the Polk County Comprehensive Water

Supply Plan. The emphasis of the plan was on identifying and quantifying viable water supply sources, particularly alternatives to fresh groundwater, through 2030. The results of this effort were incorporated into the 2010 and 2015 RWSPs and the District budgeted funds to cooperatively fund implementation of water supply projects identified in the plan. More recently, the District has supported the development of the Polk Regional Water Cooperative (PRWC) and funded PRWC alternative water supply projects designed to meet the future demands of member utilities in Polk County through 2040. These efforts reflect and incorporate the work completed as part of the Central Florida Water Initiative (CFWI). Additional information concerning the CFWI is provided in Section 5, Regulatory and Other Initiatives.

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

Section 3. Minimum Flows and Levels Establishment

1.0 Established Minimum Flows and Levels

The MFLs established in the planning region during or since 2015 and as of July 19, 2019, include new or reevaluated MFLs for lakes Aurora, Clinch, Crooked, Damon, Eagle, Easy, Eva, Hancock, Jackson, Letta, Little Lake Jackson, Lotela, Lowery, McLeod, Starr, and Wailes. The District continues to re-evaluate and establish new MFLs per the Priority List and Schedule for the Establishment of Minimum Flows, Minimum Water Levels, and Reservations (see Chapter 2, Part B, and Appendix 2-1).

2.0 Minimum Flows and Levels Recovery Initiatives

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

In 2018, the District completed its second five-year assessment of the SWUCA recovery strategy (SWFWMD, 2018). The purpose of the five-year assessment, which is required by rule, is to evaluate and assess the recovery in terms of resource trends, trends in permitted and used quantities of water, and completed, ongoing, and planned projects. The assessment provides the information necessary to determine progress in achieving recovery and protection goals, and allows the District to revise its approach, if necessary, to respond to changes in resource conditions and issues. Results from the second five-year assessment indicate the District continues to make progress toward recovery, but challenges to full recovery by 2025 remain.

Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing WRD projects designed to augment or preserve existing flows and water levels.

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

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

Since the 1970s, the Quality of Water Improvement Program (QWIP) has prevented waste and contamination of water resources (both groundwater and surface water) by reimbursing landowners for plugging abandoned or improperly constructed artesian wells. The program focuses on the southern portion of the District where the UFA is under artesian conditions, creating the potential for mineralized water to migrate upward and contaminate other aquifers or surface waters. The program reimburses approximately 200 well-pluggings per year and more than 6,800 have been reimbursed since inception. In the Heartland Planning Region, 734 well-pluggings have been reimbursed since the QWIP program began.

A related effort, now part of the FARMS Program, involves the rehabilitation (or back-plugging) of agricultural irrigation wells to improve water quality in groundwater and surface waters and improve crop yields. The program initially targeted the Shell Creek, Prairie Creek, and Joshua Creek watersheds to decrease the discharge of highly mineralized water into Shell Creek, the City of Punta Gorda's municipal water supply. The program has retrofitted 85 wells as of September 2018, with 63 of these in the target watersheds. One well was completed in the Heartland Planning Region.

Section 5. Regulatory and Other Initiatives

Since 2011, the District has been working with public water supply utilities, the St. Johns River Water Management District (SJRWMD) and SFWMD, FDEP, FDACS, and multiple stakeholders on the CFWI, which includes portions of Polk and Lake counties and all or parts of four other counties in central Florida outside of the District (see Figure 2). This is an area where the WMDs have previously determined, through water supply planning efforts and real-time monitoring, that groundwater availability is limited. The CFWI mission is to help protect, develop, conserve, and restore central Florida's water resources by collaborating to address central Florida's current and long-term water supply needs. The CFWI is led by a Steering Committee that includes a public water supply utility representative, a Governing Board member from each of the three WMDs, and representatives from FDEP and FDACS. The Steering Committee oversees the CFWI process and provides guidance to the technical teams and technical oversight/management committees that are developing and refining information on central Florida's water resources. The Steering Committee has guided the technical and planning teams in the development of the CFWI RWSP 2020 update, which ensures the protection of water resources and related natural systems and identifies sustainable water supplies for all water users in the CFWI region through 2040. Those efforts, which are reflected in this 2020 RWSP update for the Heartland Planning Region, will lead to adoption of new rules and management strategies. More detailed information concerning the CFWI is available on the CFWI website at http://cfwiwater.com/planning.html.

Part C. Description of the Heartland Planning Region

Section 1. Land Use and Population

The Heartland Planning Region is characterized by a diversity of land-use types (Table 1-1), ranging from urban built-up areas in central Polk County and Lakeland, to predominantly agricultural land uses in Hardee County. Significant phosphate mining activities, primarily in Polk and Hardee counties, also occur in the region. However, mining operations are moving southward further into Hardee and DeSoto counties as phosphate reserves at existing mines are depleted. The population of the planning region is projected to increase from approximately 729,124 in 2015 to 992,036 in 2040 (Appendix 3-3). This is a gain of approximately 262,912 new residents, a 36 percent increase over the base year population. The majority of this population growth will be due to net migration.

Table 1-1. *Land-use/land cover in the Heartland Planning Region (2017)*

Land-Use/Land Cover Type	Acres	Percent
Urban and Built-Up	252,216.74	15.33
Agriculture	515,575.55	31.34
Rangeland	71,312.17	4.33
Upland Forest	113,822.74	6.92
Water	96,533.61	5.87
Wetlands	349,982.38	21.28
Barren Land	1,862.97	0.11
Transportation, Communications, Utilities	19,608.05	1.19
Industrial and Mining	224,126.12	13.62
Total	**1,645,040.33**	**100.00**

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

Section 2. Physical Characteristics

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

Section 3. Hydrology

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

1.0 Rivers

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

2.0 Lakes

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

Peace River near Bartow in Polk County

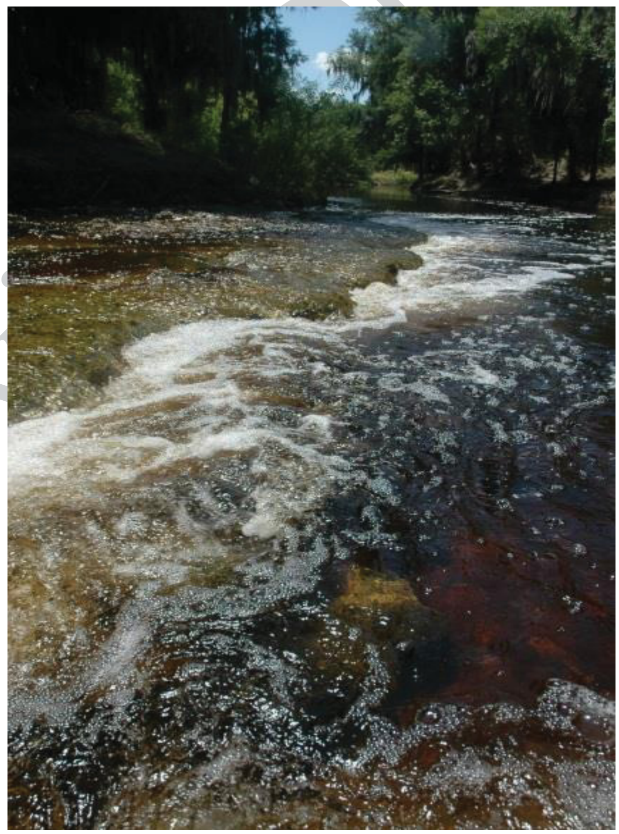
The Winter Haven Chain of Lakes is a priority water body of the Surface Water Improvement and Management (SWIM) Program and is composed of 19 interconnected lakes. The chain is made up of two major groups with five in the northern chain and 14 in the southern chain, spanning a watershed area of 32 square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

3.0 Springs

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

4.0 Wetlands

Prior to significant development, approximately 54 percent of Florida was covered by wetlands. However, due to drainage and development, only approximately 30 percent of the state currently remains covered by wetlands. Wetlands can be grouped into saltwater and freshwater types. Saltwater wetlands do not exist in the planning region due to its inland location. Freshwater wetlands are common in inland areas of Florida. Hardwood-cypress swamps and marshes are two major freshwater wetland systems. Both systems are found either bordering lakes and rivers or standing alone as isolated wetlands. The hardwood-cypress swamps are forested systems with water at or above land surface for a considerable portion of the year. Marshes are typically shallower systems vegetated by herbaceous plants rather than trees. These freshwater wetlands are the predominant type of wetland in the planning region and play a significant role in the health and flow of several major river systems.



Peace River near Wauchula in Hardee County

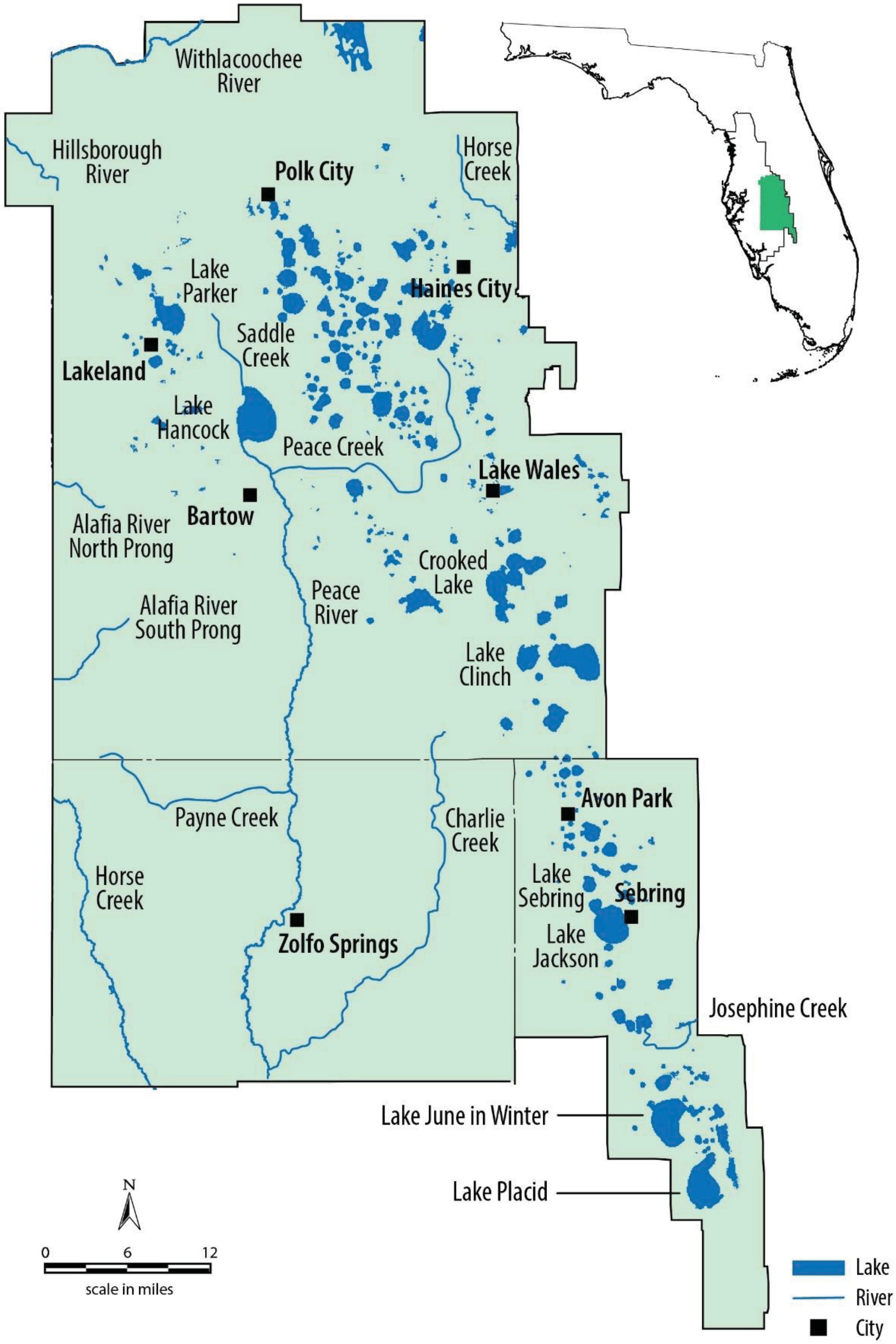


Figure 1-2. *Major hydrologic features in the Heartland Planning Region*

Section 4. Geology/Hydrogeology

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

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


Green Swamp

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

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

The Middle Confining Unit 2 (MCU II) of the Floridan aquifer lies near the base of the Avon Park Formation (Miller, 1986). It is composed of evaporate minerals such as gypsum and anhydrite, which occur as thin beds or as nodules within dolomitic limestone that overall has very low permeability. Middle Confining Unit 2 (MCU II) is generally considered to be the base of the freshwater production zone of the aquifer, except in the extreme eastern portion of Polk County. In this area, MCU II is absent and the Lower Floridian aquifer (LFA) is present, which contains fresh water. This LFA on the eastern side of Polk County lies below another middle confining unit called Middle Confining Unit 1 (MCU I) (Miller, 1986). It is located in the upper portion of the Avon Park Formation and is comprised of tight, dense, carbonate rock. Middle Confining Unit 1 (MCU I) is only located in eastern Polk County. The base of the Floridan aquifer system occurs at more than 2,000 feet below land surface near the top of the Cedar Keys Formation where evaporate minerals form the basal confining unit (Miller, 1986).

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

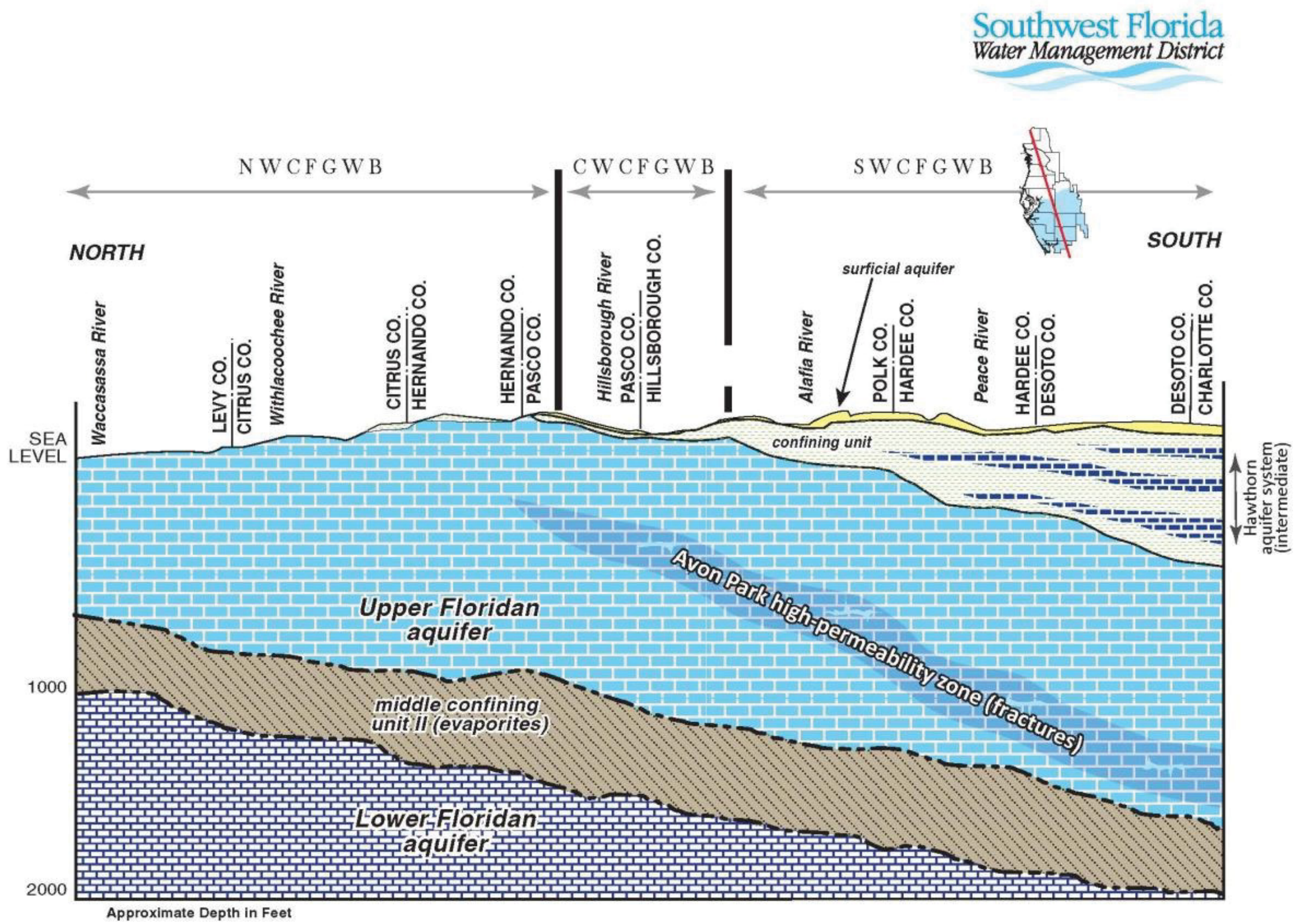


Figure 1-3. *Generalized north-south geologic cross section through the District*

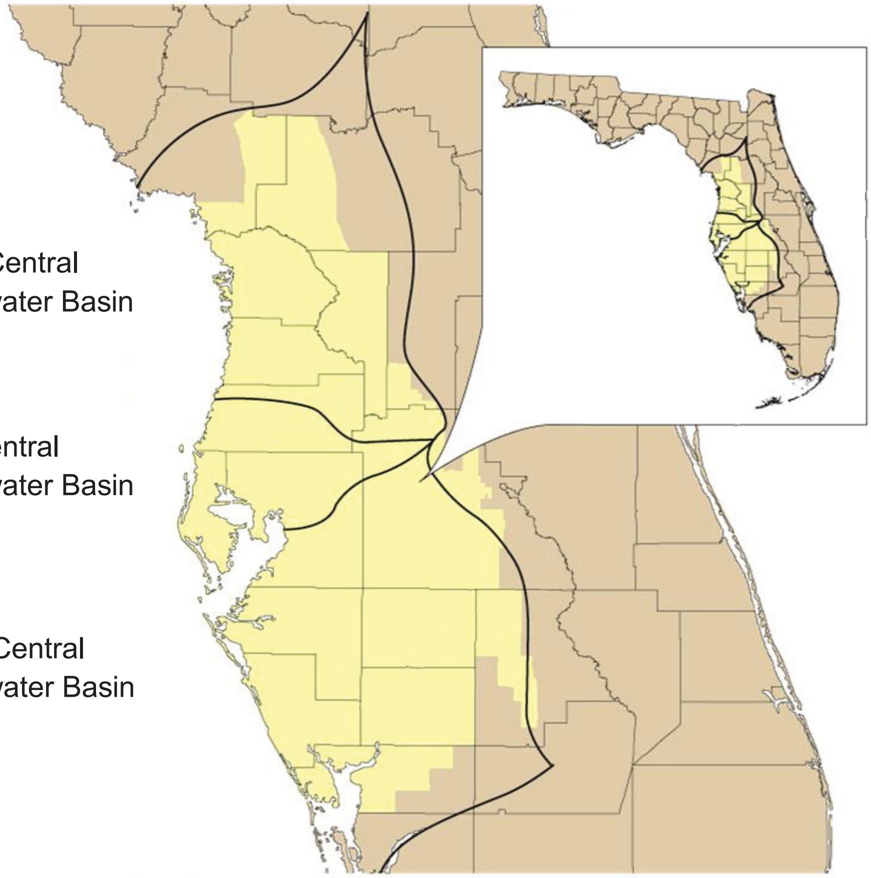


Figure 1-4. *The District and the West-Central Florida Groundwater Basins*

Part D. Previous Technical Investigations

The 2020 RWSP builds on a series of cornerstone technical investigations that were undertaken by the District and the USGS beginning in the 1970s. These investigations provide District staff with an understanding of the complex relationships between human activities (i.e., surface water and groundwater usage and large-scale land-use alterations), climactic cycles, aquifer/ surface water interactions, aquifer and surface hydrology, and water quality. Investigations conducted in the Heartland Planning Region and in areas adjacent to it are listed by categories and briefly outlined below.

Section 1. Water Resource Investigations

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

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

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

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

The District established MFLs for several water bodies in the SWUCA and adopted a SWUCA Recovery Strategy (SWFWMD, 2006a) to address depressed aquifer levels causing saltwater intrusion along the coast, reduced flows in the upper Peace River, and lower lake levels in areas of Polk and Highlands counties. A five-year assessment of the recovery strategy for FY2007 to 2011 was completed in 2013 (SWFWMD, 2013), with the second five-year assessment for FY2012 to FY2016 completed in 2018 (SWFWMD, 2018). The District continues to work with key stakeholders and the public to the development and implementation of recovery options within the SWUCA.

The CFWI is a collaborative approach to study whether the Floridan aquifer system is reaching its sustainable limits of use and exploring the need to develop additional water supplies. The CFWI area includes Orange, Osceola, Seminole, Polk, and southern Lake counties. It is a multi-District effort that includes the St. Johns River, South Florida, and Southwest Florida WMDs. Additionally, stakeholders, such as the FDEP and FDACS, regional public water supply utilities, and others are participating in this collaborative effort that builds on work started for a prior effort called the Central Florida Coordination Area. The 2020 CFWI RWSP details current work within the CFWI Planning Area focused on the development of water resources, water supply projects and regulatory components of the initiative necessary to meet projected water demands through 2040.

Section 2. Unites States Geologic Survey Hydrologic Investigations

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

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

Investigation Type	Description
Completed Investigations	
Groundwater	Regional Groundwater Flow System Models of the SWFWMD, Highlands Ridge WUCA, and Hardee and DeSoto Counties
	Hydrogeologic Characterization of the Intermediate Aquifer System
	Hydrogeology and Quality of Groundwater in Polk County
	Hydrogeology and Quality of Groundwater in Highlands County
	Aquifer Test Simulation
	Optical Borehole Imaging Data Collection of Lower Floridan Aquifer Wells in Polk County
	Sources and Ages of Groundwater in the Lower Floridan Aquifer in Polk County
Surface Water	Effect of Karst Development on Peace River Flow
	Hydrologic Budget of Lake Starr
	Hydrologic Budget of Lake Lucerne
	Lake Stage Statistics Assessment to Enhance Lake Minimum Level Establishment
	Charlie Creek Watershed Hydrologic Characterization
	Primer on Hydrogeology and Ecology of Freshwater Wetlands in Central Florida
	Factors Affecting Water Levels in the Central Florida Coordination Area
	Upper Hillsborough River Study on Surface and Groundwater Interactions and Water Quality
	Measuring Urban Evapotranspiration in Central Florida and Preparing Statewide Model
	Methods to Define Storm Flow and Base Flow Components of Total Stream Flow in Florida Watersheds
Groundwater and Surface Water	Use of Groundwater Isotopes to Estimate Lake Seepage in the Northern Tampa Bay (NTB) and Highlands Ridge Lakes
	Effects of Development on the Hydrologic Budget in the SWUCA
	Surface and Groundwater Interaction in the Upper Hillsborough River Basin
Data Collection	Nitrate and Pesticides in Ridge Lakes of Polk and Highlands Counties
Ongoing Investigations/Data Collection Activities	
Data Collection	Minimum Flows and Levels Data Collection
	Surface Water, Groundwater, Evapotranspiration, and Water Quality Data Collection
	Statewide LiDAR Mapping
	Mapping Actual Evapotranspiration Over Florida Model Support
	Statewide Geostationary Operational Environmental Satellites (GOES) Evapotranspiration (ET) Project

Section 3. Water Supply Investigations

Water Supply investigations for the planning region were initiated in the 1960s as part of the U.S. Army Corps of Engineers' (USACE) Four River Basins project. The Four River Basins project began as a flood control project developed in response to severe coastal and inland flooding caused by Hurricane Donna in September 1960. The District was formed in 1961 to help implement this federal project, which led to development of several large control structures including the Tampa Bypass Canal (TBC), the Lake Tarpon and Tsala Apopka Outfalls, and the Masaryktown Canal. Following a period of drought conditions in the mid-1960s that led to numerous dry well complaints, along with findings of project-related ecological studies, there was an apparent need for a broader-based approach to water management than just flood control. The scope of the Four River Basins project was expanded into a more comprehensive effort to assess water resources in the region and determine ways to utilize excess surface water and groundwater for regional water supply solutions. The revised approach led to changes for the TBC design to allow surface water transfers to the City of Tampa, the use of land preservations for water recharge and natural flood attenuation, and the cancellation of other structural projects that would have greatly altered environmental resources.

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

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

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

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

The District's 2010 and 2015 RWSP updates extended the planning horizons to 2030 and 2035, respectively, and included four regional volumes covering all counties of the District. It was concluded that the Northern Planning Region demand for water through 2035 could be met with fresh groundwater; however, the need for additional fresh groundwater supplies could be minimized through the use of available reclaimed water and implementation of comprehensive water conservation measures. This could result in averting impacts such as those witnessed in other regions. For the three remaining planning regions, both the 2010 and 2015 RWSPs adopted several AWS options that were developed or are currently under development by the respective regional water supply authorities in those regions.

Section 4. Minimum Flows and Level Investigations

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

USGS gauge site on river

Section 5. Modeling Investigations

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

1.0 Groundwater Flow Models

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

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

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

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

The District-Wide Regulatory Model (DWRM) was developed to produce a regulatory modeling platform that is technically sound, efficient, reliable, and has the capability to address cumulative impacts. The DWRM was initially developed in 2003 (Environmental Simulations, Inc., 2004). It is mainly used to evaluate whether requested groundwater withdrawal quantities in WUP applications have the potential to cause unacceptable impacts to existing legal users, off-site land uses, and environmental systems on an individual and cumulative basis. The DWRM Versions 1, 2, 2.1, and 3 (Environmental Simulations, Inc., 2004, 2007, 2011, 2014) incorporate Focused Telescopic Mesh Refinement (FTMR), which was developed to enable DWRM to be used as a base model for efficient development of smaller scale sub-models (FTMR models). The FTMR uses a fine grid around a well or group of wells and increasing grid spacing out to the edge of the model. It was specifically designed to enhance WUP analysis. DWRM Version 3 simulates groundwater flow of the entire District using a quasi-3D conceptualization of the Modular finite Difference Groundwater Flow Model code (MODFLOW-2005). DWRM3 simulates groundwater flow in the surficial, intermediate, UFA, and LFA. DWRM3 supports current regulatory functions as a core business process addressed in the District's Strategic Plan (SWFWMD, 2014).

2.0 Saltwater Intrusion Models

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

In support of establishing a minimum aquifer level to protect against saltwater intrusion in the most impacted area (MIA) of the SWUCA, a fully three-dimensional, solute transport model of the ETB area was developed in 2002 by HydroGeoLogic, Inc. (HydroGeoLogic, Inc., 2002). The model encompassed all of Manatee, Sarasota, and the southern half of Hillsborough and Pinellas counties and simulated flow and transport in the UFA. The model was calibrated from 1900 to 2000, although there is only water quality data for the period from 1990 to 2000. The model was used to derive estimates of the number of wells and amount of water supply at risk to future saltwater intrusion under different pumping scenarios.

3.0 Integrated Surface Water/Groundwater Models

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

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

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Chapter 2. Resource Protection Criteria

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

Part A. Water Use Caution Areas

Section 1. Definitions and History

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

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

In the late 1980s, the District determined that certain interim resource management initiatives could be implemented to help prevent existing problems in the water resource assessment project (WRAP) areas from getting worse prior to the completion of each WRAP. As a result, in 1989, the District established three WUCAs: Northern Tampa Bay (NTBWUCA), Eastern Tampa Bay (ETBWUCA), and Highlands Ridge (HRWUCA). For each of the initial WUCAs, a three-phased approach to water resource management was implemented, including: (1) short-term actions that could be put into place immediately, (2) mid-term actions that could be implemented concurrent with the ongoing WRAPs, and (3) long-term actions that would be based upon the results of the WRAPs. In addition to the development of conservation plans, cumulative impact analysis-based permitting and requiring withdrawals from stressed lakes to cease within three years, the District developed management plans for each WUCA to stabilize and restore the water resources in each area through a combination of regulatory and non-regulatory efforts.

One significant change that occurred as a result of the implementation of the management plans was the designation of the most impacted area (MIA) in the ETBWUCA. The MIA consists of the coastal portion of the SWUCA in southern Hillsborough, Manatee, and northern Sarasota counties. Within this area, no increases in permitted groundwater withdrawals from the Upper Floridan aquifer (UFA) were allowed and withdrawals from outside the area could not cause further lowering of UFA levels within the area. The ETBWUCA and HRWUCA were superseded in 1992 by the establishment of the SWUCA, which encompasses the entire southern portion of the District. The NTBWUCA was expanded in 2007 to include an additional portion of northeastern Hillsborough County and the remainder of Pasco County. In 2011, the District established the Dover/Plant City WUCA in eastern Hillsborough and western Polk counties following impacts from intense frost/freeze protection withdrawals. The District has not declared a WUCA in the Northern Planning Region; however, the St. Johns River Water Management District (SJRWMD) has declared a priority water resource caution area adjacent to the District boundary in Lake and Marion counties.

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

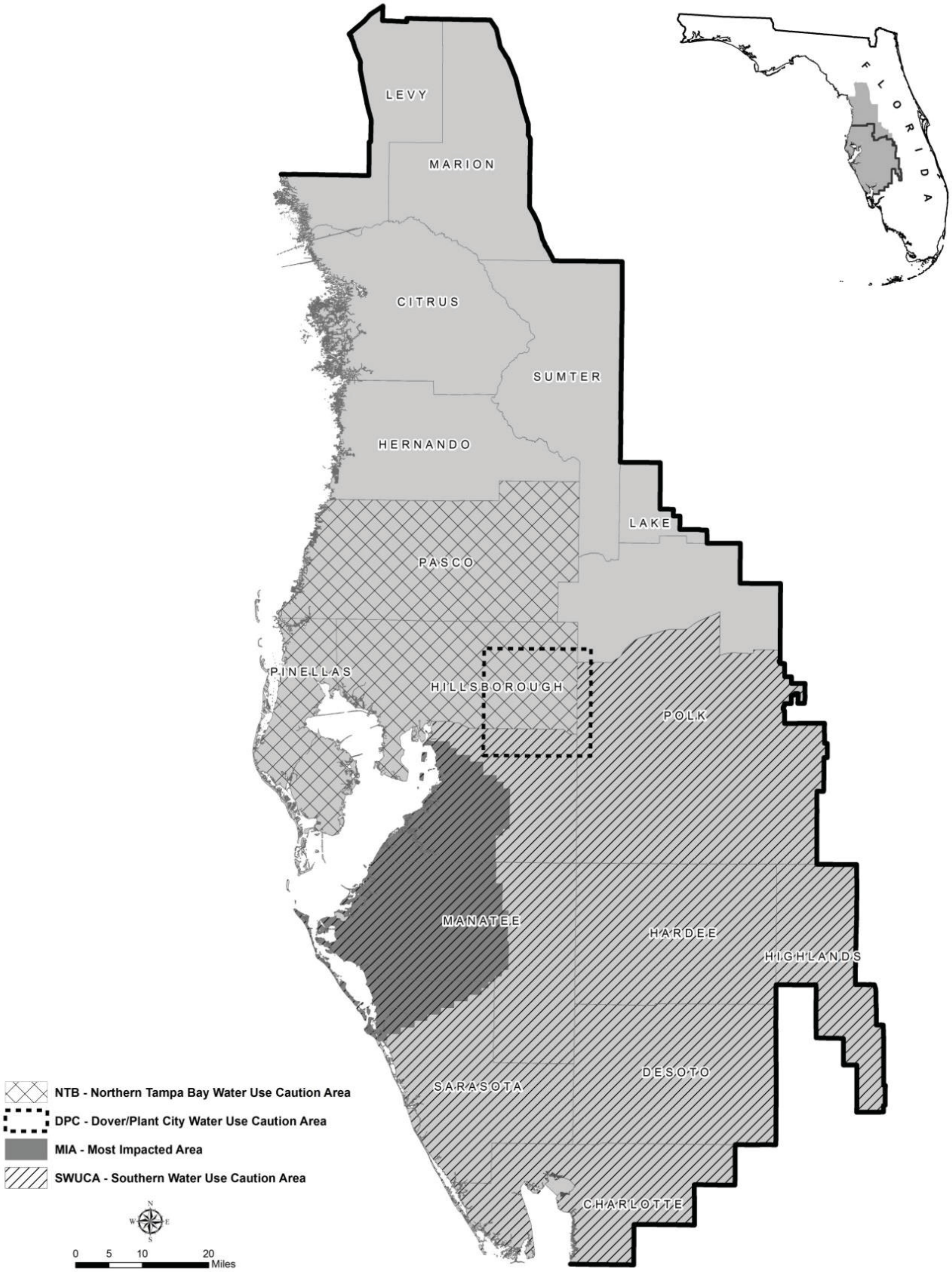

Figure 2-1. *Location of the District's water use caution areas and the MIA of the SWUCA*

1.0 Southern Water Use Caution Area

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

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

In 1998, the District initiated a reevaluation of the SWUCA management strategy and, in March 2006, established minimum "low" flows for the upper Peace River, minimum levels for eight lakes along the Lake Wales Ridge in Polk and Highlands counties, and a saltwater intrusion minimum aquifer level (SWIMAL) for the UFA in the MIA of the SWUCA. Since most, if not all, of these water resources were not meeting their established MFLs, the District adopted a recovery strategy for the SWUCA in 2006 (SWFWMD, 2006). As part of the strategy, the status of District monitoring efforts are reported to the Governing Board on an annual basis, and every five years a comprehensive review of the strategy is performed. Adjustments to the strategy will be made based on results of the ongoing monitoring and recovery assessments. In 2013, the District completed the first five-year review of the recovery strategy (SWFMWD 2013) that addressed the period from 2007 through 2011. Because adopted MFLs for many water bodies were still not being met, the District initiated a series of stakeholder meetings to review results of the technical assessments and identify potential recovery options.

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

MIA Options:

1. Continue monitoring
2. Update analytical tools
3. Promote water conservation initiatives
4. Expand FARMS
5. Expand beneficial reuse

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

Ridge Lakes Options:

1. Continue monitoring
2. Reevaluate established minimum lake levels
3. Evaluate options for individual lakes

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

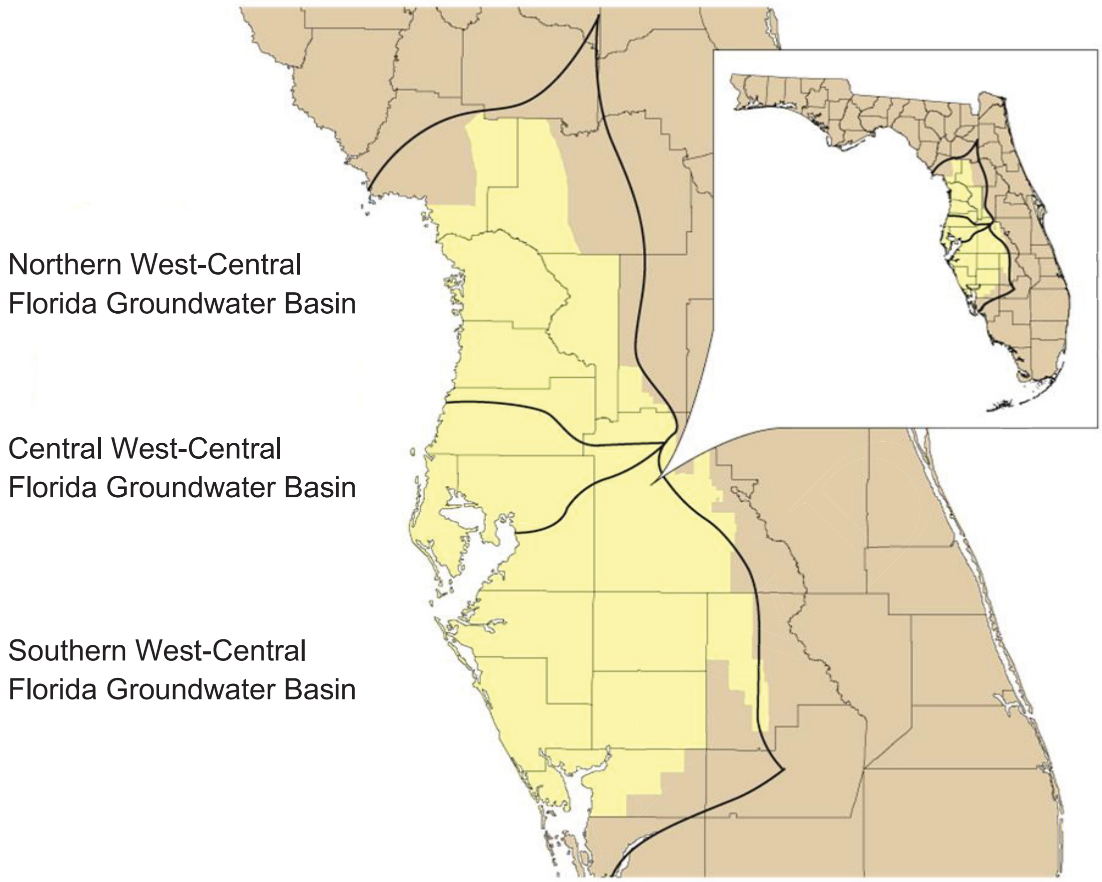

Figure 2-2. *Southwest Florida Water Management District and the West-Central Florida Groundwater Basins*

2.0 Dover/Plant City Water Use Caution Area

Groundwater withdrawals used for freeze protection of crops in the DPCWUCA between January 3, 2010, and January 13, 2010 resulted in UFA drawdown that contributed to a large number of sinkhole occurrences and more than 750 dry-well complaints from neighboring domestic-well owners. Agricultural users growing strawberries, citrus, blueberries, nursery ornamentals, as well as tropical fish farms at risk of frost/freeze damage and crop loss, are permitted to use Floridan aquifer groundwater withdrawals as the primary freeze protection method. During an unprecedented nine nights of freezing temperatures over eleven consecutive days in January 2010, withdrawals totaling nearly 619,000 gallons per minute (gpm) occurred for approximately 65 hours in the Dover/Plant City area and were followed by withdrawals at a rate of approximately 433,000 gpm for an additional 19 hours.

In 2011, based on impacts associated with these withdrawals, the District established the DPCWUCA. This WUCA extends over a 256 square mile area in northeast Hillsborough County and eastern Polk County, within portions of the NTBWUCA and the SWUCA (see Figure 2-1). Concurrent with the establishment of the DPCWUCA, the District adopted the Minimum Aquifer Level (MAL), Minimum Aquifer Level Protection Zone (MALPZ), and recovery strategy for the DPCWUCA.

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

Part B. Minimum Flows and Levels

Section 1. Definitions and History

Section 373.042 of the Florida Water Resources Act of 1972 (Chapter 373, F.S.), directs the Florida Department of Environmental Protection (FDEP) or the water management districts (WMDs) to establish minimum flows or minimum water levels, i.e., MFLs, for priority water bodies using the best available information. The minimum flow for a given watercourse is defined by statute as the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. The minimum water level of an aquifer or surface waterbody is similarly defined by statute as the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area.

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

Section 2. Priority Setting Process

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

- Importance of the water bodies to the state or region.

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

The updated priority list and schedule is submitted to FDEP for approval by November 15th each year and, as required by statute, is published in the District's Consolidated Annual Report. The District's current priority list and schedule is also posted on the District website and is included in the Chapter 2 Appendix to this RWSP.

Section 3. Technical Approach to Minimum Flows and Levels Establishment

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

The District's technical approach for MFLs development assumes that alternative hydrologic regimes may exist that differ from historic conditions but are sufficient to protect water resource features from significant harm. For example, consider a historic condition for an unaltered river or lake system with no groundwater or surface water withdrawal impacts. A new hydrologic regime for the system would be associated with each increase in water use, from small withdrawals that have no measurable effect on the historic regime to large withdrawals that could substantially alter the regime. A threshold hydrologic regime may exist that includes water levels or flows that are lower or less than those of the historic regime, but which protects the water resources and ecology of the system from significant harm. This threshold regime could conceptually allow for water withdrawals, while protecting the water resources and ecology of the area. MFLs established based on such a threshold hydrologic regime may therefore represent minimum acceptable, rather than historic or potentially optimal, hydrologic conditions.

1.0 Scientific Peer Review

Section 373.042(4), F.S., permits affected parties to request independent scientific peer review of the scientific and technical data and methodologies used to establish MFLs. In addition, the District or FDEP may decide to voluntarily subject MFLs to independent scientific peer review, based on guidelines provided in Rule 62-40.473, F.A.C.

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

Section 4. Established and Proposed Minimum Flows and Levels

Figure 2-3 depicts priority MFLs water resources that are in or partially within the Heartland Planning Region. A complete list of water resources with established MFLs throughout the District is provided in the Chapter 2 Appendix to this RWSP.

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

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

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

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

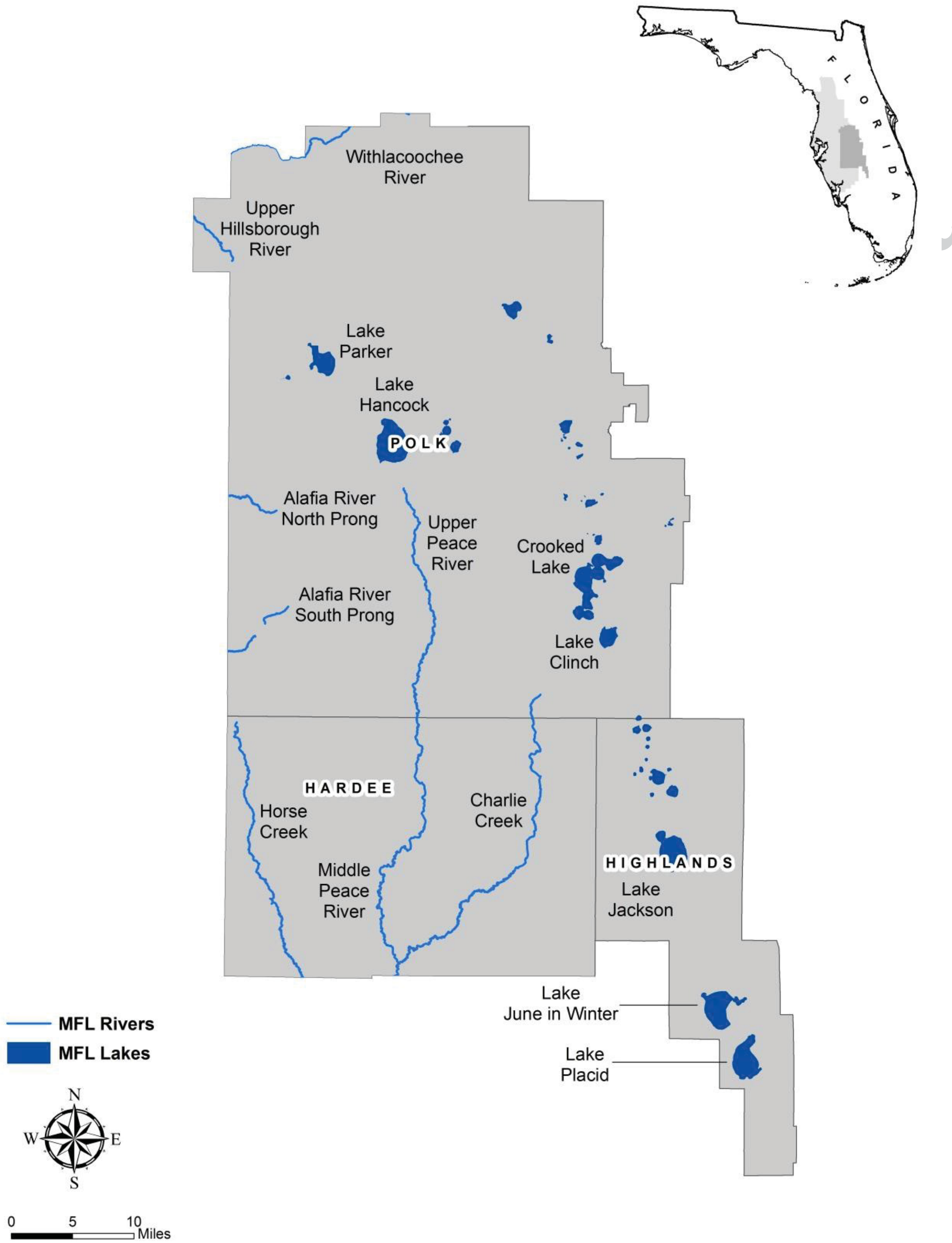

Figure 2-3. *MFL priority water resources in the Heartland Planning Region*

Part C. Prevention and Recovery Strategies

Section 1. Prevention Activities

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

In addition to water supply planning activities initiated by the District, other entities in the planning region are engaged in planning efforts that are coordinated with and complement those of the District. A goal of these efforts is to ensure that future water supply demands will be met without adversely impacting proposed or established MFLs. Additional water supply planning activities in the planning region are listed below.

Section 2. Recovery Strategies

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

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

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

1.0 Southern Water Use Caution Area

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

Resource recovery projects, such as the project to raise the levels of Lake Hancock for release to the upper Peace River during the dry season, are actively being implemented and considered. 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 SWUCA recovery strategy will be determined through continued monitoring of area resources. The District uses an extensive monitoring network to assess actual versus anticipated trends in water levels, flows, and saltwater intrusion. Additionally, the District assesses the cumulative impacts of factors affecting recovery. Information developed as part of these monitoring and assessment efforts is provided to the Governing Board on an annual and on a five-year basis. Results from two five-year assessment of the SWUCA recovery strategy (SWFWMD 2013, 2018), indicate the District continues to make progress toward recovery, but challenges to achieving full recovery by 2025 remain. Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing WRD projects designed to augment or preserve levels and flows.

2.0 Dover/Plant City Water Use Cation Area

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

Part D. Reservations

Reservations of water are established by rule and authorized as follows: "The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety…" (Section 373.223(4), F. S.).

In accordance with Rule 62-40.474, F.A.C., as exemplified by Rule 40D-2.302, F.A.C. for the SWUCA, the District will consider establishing a reservation of water when a District WRD project will produce water needed to achieve an adopted MFL. The rule-making process associated with reservation adoption allows for public input to the Governing Board in its deliberations about establishing a reservation, including, among other matters, the amount of water to be reserved and the time of year the reservation would be effective. When a reservation is established and incorporated into Rule 40D-2.302, F.A.C., only those water use withdrawals that do not reduce the reserved quantity can be evaluated for permitting.

For example, within the Heartland Planning Region, the District is planning to reserve water to aid in the recovery of MFLs in the upper Peace River. To address identified recovery needs for the river, the District has implemented a project to raise water levels in Lake Hancock and use this stored water to provide a significant portion of the flows necessary for meeting the river's MFLs. Rulemaking to reserve from permitting the quantity of water stored in the lake to support the recovery effort is scheduled for completion in 2020.

Part E. Climate Change

Section 1. Overview

Climate change has been a growing global concern for several decades. According to the Intergovernmental Panel on Climate Change (IPCC), the global mean average land and ocean temperatures have likely increased approximately 1.4 to 2.2°F from pre-industrial levels (IPCC, 2018). Such increases are driving a slow but persistent increase in sea levels and are altering precipitation regimes. These conditions will likely have local impacts including changes to natural habitats, encroachment of seawater into surface and groundwater resources, risk to public infrastructure, warmer temperatures that increase evaporation and impact agriculture, and changes to seasonal and annual rainfall patterns. Climate change is a global issue that requires international coordination and planning, although strategies for assessing vulnerabilities and developing adaptation plans are necessary on the local, regional, and statewide level.

In recent years, numerous agencies and organizations in Florida have developed initiatives to address climate change. Many of the state's Regional Planning Councils (RPCs) have pooled resources and are developing vulnerability assessments, climate adaptation plans, and post-disaster redevelopment plans for member communities. The Florida Department of Environmental Protection's Community Resilience Initiative provides planning tools and promotes collaboration among RPCs and coastal communities. The WMDs and other agencies participate in focus groups organized by RPCs, Florid Sea Grant, and other entities to consolidate climate information, develop consistent approaches to planning, and provide technical expertise when appropriate. Other participants in these initiatives include the National Weather Service; regional water supply authorities; state universities; and Florida Fish and Wildlife Conservation Commission, Department of Transportation, Department of Health, Department of Environmental Protection, and the Division of Emergency Management.

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

Section 2. Possible Effects

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

1.0 Sea Level Rise

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

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

One positive aspect is that sea level rise is projected to occur relatively slowly, although persistently, which allows time to thoroughly evaluate the impacts to natural resources and public infrastructure, plan and implement adaptation strategies, and continue to use most existing coastal infrastructure for several decades. The cost of initiating sea level rise planning or incorporating it into other existing efforts is relatively low compared to disaster recovery efforts.

2.0 Air Temperature Rise

The IPCC estimates that current green-house emission levels will cause mean global air temperatures to reach or stabilize at approximately 2.7°F above pre-industrial levels (1850-1900) by the end of this century, with greatest warming at inland and polar regions (IPCC, 2018). The impacts to southwest Florida will likely be more hot days and few cold days seasonally. Evaporation is likely to increase with a warmer climate, which could result in lower surface water levels and increased irrigation demand. Increased evaporation is likely to impact stormwater runoff, soil moisture, groundwater recharge, and reservoir storage losses (Bates et al., 2008). Additionally, higher air temperatures may exasperate algal blooms and declines in reservoir water quality that could raise treatment costs for potable water supply.

3.0 Precipitation Regimes and Storm Frequency

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

Warming temperatures in the Atlantic and Gulf of Mexico can increase the likelihood of intense tropical storms and hurricanes that can generate storm surge, strong winds, and heavily concentrated rainfall. Hurricane activity near Southwest Florida is statistically more common during AMO warm periods. Higher summer temperatures and humidity may also increase the frequency of local convective weather events, resulting in thunderstorms, higher peak surface water flows, and increased flooding in some areas (Groisman et al., 2005).

Section 3. Current Management Strategies

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

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

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

Section 4. Future Adaptive Management Strategies

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

- Armament. An armament strategy involves the erection of defensive barriers such as 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 AR systems, direct and indirect reuse, and reverse osmosis treatment options for these communities. The District would also have a role in assuring the transitional health of water bodies.
- Organized Retreat. An organized retreat strategy may involve the rezoning of property threatened by inundation, or transfer to public ownership, potentially through rolling easements or post-disaster development plans. Retreat strategies typically include ecological engineering projects to assist the transition of natural habitats that will also provide shelter to upland infrastructure.

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

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

Part F. Central Florida Water Initiative

Section 1. Formation

The Central Florida Water Initiative (CFWI) focuses on the CFWI Planning Area, which includes Orange, Osceola, Seminole, Polk, and southern Lake counties (Figure 2-4). The CFWI was undertaken to provide a coordinated approach for water management in a region where the boundaries of three water management districts intersect and where water withdrawals in one district may impact water resources and water users throughout the area. The District, along with SJRWMD, South Florida Water Management District (SFWMD), FDEP, Florida Department of Agriculture and Consumer Services (FDACS), regional public water supply utilities, and other stakeholders are collaborating on the initiative to develop a unified process to address current and long-term water supply needs in central Florida. The guiding principles of the CFWI are to:

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

Section 2. Central Florida Water Initiative Regional Water Supply Plan

The first ever multi-District RWSP was developed for the CFWI Planning Area in 2015. The plan focused on water demand estimates and projections, water resource assessments (based in part on groundwater modeling), and development of feasible water supply and WRD options that would meet future water supply needs in a manner that sustained water resources and related natural systems. For the 2015 CFWI RWSP, modeling results and groundwater availability assessments concluded that fresh groundwater resources alone could not meet future water demands in the CFWI Planning Area without resulting in unacceptable impacts to water resources and related natural systems. The assessments showed the primary areas that appeared to be more susceptible to the effects of groundwater withdrawals included the Wekiva Springs/River System, western Seminole and Orange counties, southern Lake County, the Lake Wales Ridge, and the portion of the SWUCA in Polk County. The evaluations also indicated that expansion of withdrawals associated with projected demands through 2035 could increase existing areas of water resource stress within the CFWI Planning Area. The 2015 CFWI RWSP identified 142 potential water supply development project options that could potentially provide up to 411 mgd of additional water supply, including maximized use of reclaimed water, increased water storage capacity, limited use of fresh and brackish groundwater, use of surface water, and use of desalinated seawater.

The CFWI Solutions Planning Team, consisting of representatives from the three WMDs, FDEP, FDACS, public supply utilities, the agricultural industry, environmental groups, business representatives, and regional leaders used the 2015 CFWI RWSP to further develop specific water supply projects through partnerships with water users. The final work product of the Solutions Planning Team was the CFWI 2035 Water Resources Protection and Water Supply Strategies document, which addressed the necessary financing, cost estimates, potential sources, feasibility and permitting analyses, identification of governance structure options, and potential recovery needs of the CFWI Planning Area. The 2020 CFWI RWSP is currently under development, with ongoing coordination occurring to ensure consistency is maintained between the CFWI RWSP and the District's RWSP. Because Polk County is part of the CFWI Planning Area, the demands and many of the projects listed in this 2020 RWSP are also reflected in the 2020 CFWI RWSP.

Lake Lotela in Highlands County

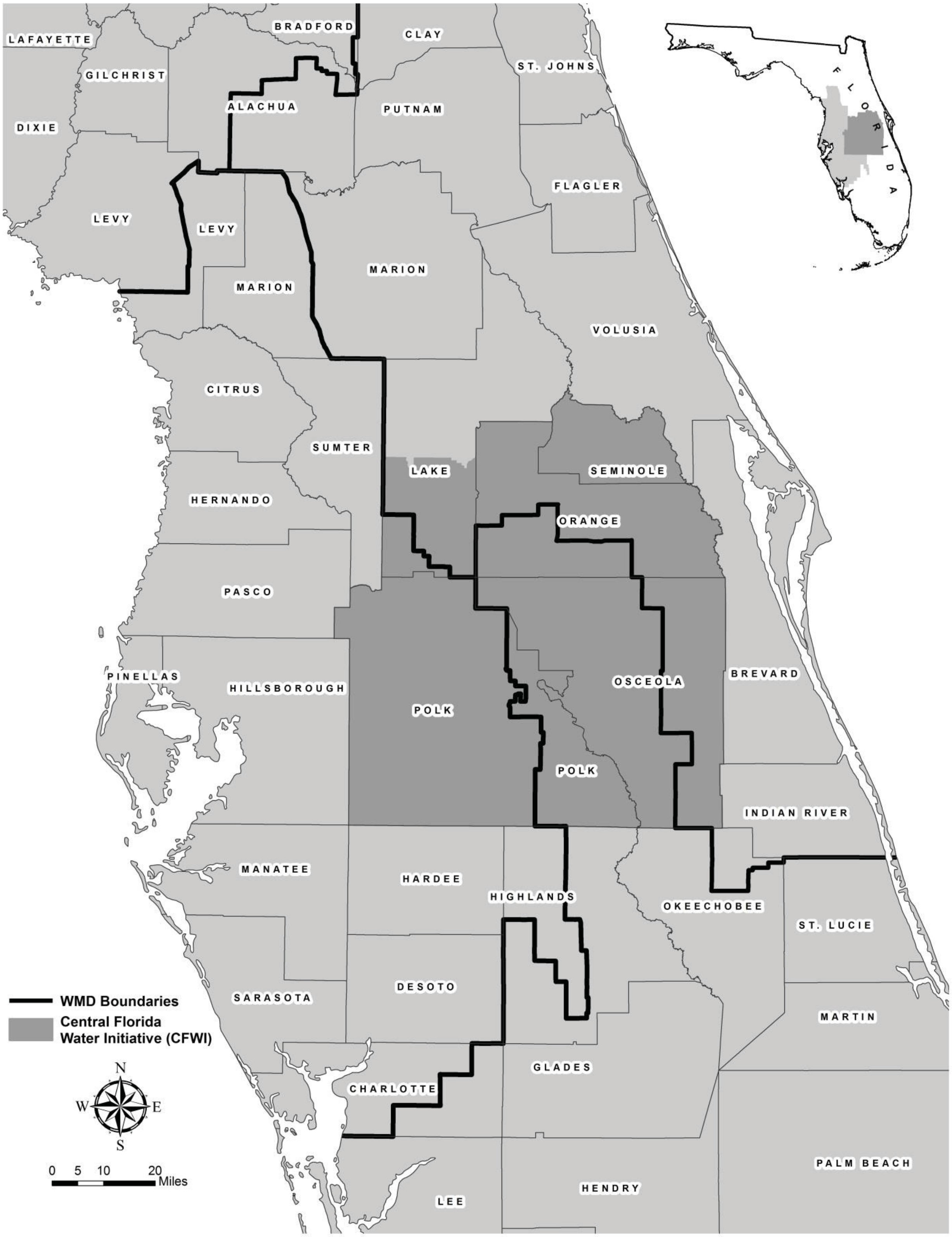

Figure 2-4. *Location of the Central Florida Water Initiative Area*

Chapter 3. Demand Estimates and Projections

This chapter is a comprehensive analysis of the demand for water for all use categories in the Heartland Planning Region for the 2015-2040 planning period. The chapter includes the methods and assumptions used in projecting water demand for each county, the demand projections in five-year increments, and an analysis and discussion of important trends in the data. The Southwest Florida Water Management District (District) projected water demand for the public supply (PS), agricultural (AG), industrial/commercial (I/C), mining/dewatering (M/D), power generation (PG), landscape/recreation (L/R) , and environmental restoration (ER) sectors for each county in the planning region. An additional water use sector, environmental restoration, comprises quantities of water that need to be developed and/or retired to meet established minimum flows and levels (MFLs). The environmental restoration demand could increase during the planning period based on the recovery requirements of MFLs established in future years. The methodologies used to project demand for each category are briefly summarized in this chapter and presented in greater detail in the Chapter 3 Appendix.

The demand projections represent those reasonable and beneficial uses of water that are anticipated to occur through the year 2040. The District determined 5-in-10 (average condition) and 1-in-10 (drought condition) demands for each five-year increment from 2015 to 2040 for each sector. The demand projections for counties located partially in other water management districts (WMDs) (Highlands and Polk) reflect only the anticipated demands in those portions located within the District's boundaries. Decreases in demand are reductions in the use of groundwater for the AG, I/C, M/D, and PG use categories. Increases in demand may be met with alternative sources and/or conservation and the retired groundwater quantities may be reallocated for mitigation of new groundwater permits for other use categories and/or permanently retired to help meet environmental restoration goals.

Key demand estimates and projection parameters include:

- Establishment of a base year: The year 2015 was agreed upon as a base year for the purpose of developing and reporting water demand projections. The data for the base year consist of reported and estimated usage for 2015; whereas, data for the years 2020 through 2040 are projected demands.
- Water use reporting thresholds: Minimum thresholds of water use within each water use category were agreed upon as the basis for projection.
- 5-in-10 versus 1-in-10: For reporting demand in average versus drought conditions, specific parameters were prescribed for at least a portion of the demand related to all water supply categories except I/C, M/D, and PG. In general, demand is reported for a 5-in-10 average annual effective rainfall condition and a 1-in-10 drought year condition (an increase in water demand having a 10 percent probability of occurring during any given year).

The projected demand represents the total amount of water required to meet reasonable and beneficial water needs through 2040. Total demand does not account for reductions that could be achieved by additional demand management measures. Water conservation and other sources are accounted for separately in Chapter 4, as a means by which demand can be met.

Part A. Water Demand Projections

Demand projections were developed for five sectors: (1) PS, (2) AG, (3) I/C, M/D, and PG, (4) L/R, and (5) 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 sector PS consists of four subcategories: (1) large utilities (permitted for 0.1 mgd or greater), (2) small utilities (permitted for less than 0.1 mgd), (3) domestic self-supply (individual private homes or businesses that are not utility customers that receive their water from small wells that do not require a water use permit (WUP)), and (4) additional irrigation demand (water from domestic wells that do not require a WUP and used for irrigation by residences that rely on a utility for indoor and other non-irrigation water needs).

2.0 Population Projections

2.1 Base Year Population

All WMDs agreed that 2015 would be the base year from which projections would be determined. The District calculated the 2015 population by extrapolating back from GIS Associates, Inc.'s 2016 population estimate. Utilities with permitted quantities less than 100,000 gallons per day are not required to report population or submit service area information. Subsequently, population was obtained from the last issued permit.

2.2 Methodology for Projecting Population

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

3.0 2015 Base Year Water Use and Per Capita Rate

3.1 Base Year Water Use

The 2015 PS base year water use for each large utility is derived by multiplying the average 2011–2015 unadjusted gross per capita rate by the 2015 estimated population for each individual utility. For small utilities, per capita information is found in the last issued permit. If no per capita information is available, the per capita is assumed to equal the average county per capita. Base year water use for small utilities is obtained by multiplying the per capita from the current permit by the 2015 estimated population from the last issued permit. Domestic self-supply (DSS) base year is calculated by multiplying the 2015 DSS population for each county by the average 2011-2015 residential countywide per capita water use.

4.0 Water Demand Projection Methodology

4.1 Public Supply

Water demand is projected in five-year increments from 2020 to 2040. To develop the projections, the District used the 2011–2015 average per capita rate multiplied by the projected population for that increment. An additional component of public water supply demand is water derived from domestic wells for irrigation. These wells have a diameter of less than 6 inches, do not require a WUP and are used for irrigation at residences that receive potable water for indoor use from a utility.

4.2 Domestic Self-Supply

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

5.0 Water Demand Projections

Table 3-1 presents the projected public supply water demand for the planning period. The table shows that public supply demand will increase by 33.17 mgd for the 5-in-10 condition and that 31.33 mgd, or 94 percent of the increase, will occur in Polk County.

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

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Hardee	2.00	2.12	2.01	2.13	2.02	2.14	2.03	2.15	2.04	2.16	2.05	2.17	0.05	0.05	2.5%	2.4%
Highlands	12.45	13.20	12.99	13.77	13.42	14.22	13.77	14.59	14.03	14.88	14.24	15.09	1.79	1.89	14.4%	14.3%
Polk	67.48	71.53	77.06	81.68	83.58	89.00	88.98	94.32	94.14	99.79	98.81	104.74	31.33	33.21	46.4%	46.4%
Total	**81.93**	**86.85**	**92.06**	**97.58**	**99.02**	**105.36**	**104.78**	**111.06**	**110.21**	**116.83**	**115.10**	**122.00**	**33.17**	**35.15**	**63.1%**	**40.5%**

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

6.0 Stakeholder Review

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

Section 2. Agriculture

1.0 Description of the Agricultural Water Use Sector

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

2.0 Water Demand Projection Methodology

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

Hardee County citrus

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

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

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

3.0 Water Demand Projections

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

Current average year demands are estimated at 155 mgd for 2015-2016 acreage levels. In 2040, the District projects that the projected decrease in acreage will result in a seven percent decrease in water demands to about 144 mgd. Most of the decrease in acreage will be in citrus, and FDACS does not forecast a dramatic shift to alternative crops. Citrus represents the largest crop by acreage in each of these counties, and the long-term response of the industry to citrus greening disease will likely drive water use trends in the Heartland Region. Additionally, northern Polk county has been experiencing increased development pressure, particularly along the I-4 corridor, which may also impact long term citrus production in urbanizing areas. Table 3-2 displays projected combined agricultural irrigation and non-irrigation demands for the 5-in-10 (average) and 1-in-10 (drought) conditions for the planning period.

4.0 Stakeholder Review

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

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

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Hardee	32.27	47.04	31.58	46.03	30.98	45.18	30.34	44.26	29.74	43.37	29.17	42.51	-3.10	-4.53	-9.6%	-9.6%
Highlands	41.64	61.96	39.95	59.44	38.01	56.57	35.92	53.45	35.46	52.76	33.01	49.1	-8.63	-12.86	-20.7%	-20.8%
Polk	81.83	119.94	80.83	118.48	80.36	117.79	80.67	118.24	81.36	119.25	81.61	119.62	-0.22	-0.32	-0.3%	-0.3%
Total	**155.74**	**228.94**	**152.36**	**223.95**	**149.35**	**219.54**	**146.93**	**215.95**	**146.56**	**215.38**	**143.79**	**211.23**	**-11.95**	**-17.71**	**-7.7%**	**-7.7%**

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

Section 3. Industrial/Commercial and Mining/Dewatering

1.0 Description of the Industrial/Commercial and Mining/Dewatering Water Use Sectors

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

2.0 Demand Projection Methodology

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

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

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

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

This methodology was used for all institutional, I/C, and M/D permits with one exception. As with the 2015 RWSP, The District consulted with the Mosaic Company to develop projections of I/C and M/D water demands associated with each of its processing facilities and mining operations. The objective was to better reflect the movement of pumpage across counties as their mines and demands shifted locations during the RWSP 20-year period of analysis. See Appendix 3-2 for more detail.

3.0 Water Demand Projections

Table 3-3 shows the projected I/C and M/D water demand for the planning period. The table shows an increase in demand for the planning period of 13.3 mgd, or 28.0 percent. For several years, the permitted quantity in the I/C and M/D sectors has been declining. Much of this reduction is due to revisions in the way permitted quantities for M/D are allocated by the District's water use permit bureau. Non-consumptive dewatering uses are no longer included in permitted quantities. Starting with the 2010 RWSP, demand projections were included for all 16 counties; whereas, earlier RWSPs included demand projections for only the 10 southern counties.

Additionally, mining quantities permitted for product entrainment were not included in the 2010 or 2015 demand projections because the District considers such quantities incidental to the mining process and not part of the actual water demand (i.e., the quantities necessary to conduct the mining operation).

For 2015, 47.3 mgd of all I/C and M/D water use quantities are located in the Heartland planning region, more than in any other region. Most of the phosphate mines and fertilizer plants in the District are located in the Heartland and Southern planning regions.

In accordance with the 2019 Format and Guidelines, the 5-in-10 and 1-in-10 demands are the same. The uses "are assumed to be reasonably the same in a 1-in-10-year drought event as in an average year (i.e., no significant demand variation)" (DEP et al., June 2019).

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

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Hardee	3.98	2.42	2.43	11.50	11.07	8.06	4.08	102.51%
Highlands	0.11	0.10	0.10	0.11	0.11	0.11	0.00	0.00%
Polk [2]	43.20	50.10	50.46	54.45	52.20	52.41	9.21	21.32%
Total	**47.29**	**52.62**	**52.99**	**66.06**	**63.38**	**60.58**	**13.29**	**28.10%**

Demand projections for the District's portion of Polk County are from Volume 2 of the Draft CFWI RWSP (March 2020). http://cfwiwater.com/planning.html

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

4.0 Stakeholder Review

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

Dragline at an active mine in the Heartland Planning Region

Section 4. Power Generation

1.0 Description of the Power Generation Water Use Sector

The PG uses within the District include water for thermoelectric power generation used for cooling, boiler make-up, or other purposes associated with the generation of electricity.

2.0 Demand Projection Methodology

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

3.0 Water Demand Projections

Table 3-4 shows the projected PG water demand for the planning period. The table shows an increase in demand for the planning period of 2.59 mgd, or 34.0 percent for both Polk County and the region. Several thermoelectric power plants are located within Polk County. The demand projections do not include reclaimed, seawater, or non-consumptive use of freshwater. In accordance with the 2009 Format and Guidelines, the 5-in-10 and 1-in-10 demands are the same. Power generation uses "are assumed to be reasonably the same in a 1-in-10-year drought event as in an average year (i.e., no significant demand variation)" (DEP et al., June 2009).

***Table 3-4**. Projected PG demand in the Heartland Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Hardee	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Highlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Polk [2]	7.62	9.94	10.00	10.07	10.13	10.21	2.59	33.99%
Total	**7.62**	**9.94**	**10.0**	**10.07**	**10.13**	**10.21**	**2.59**	**33.99%**

Demand projections for the District's portion of Polk County are from the Draft 2020 CFWI RWSP http://cfwiwater.com/planning.html

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

4.0 Stakeholder Review

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

Section 5. Landscape/Recreation

1.0 Description of the Landscape/Recreation Water Use Sector

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

2.0 Demand Projection Methodology

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

Based on comments from knowledgeable stakeholders that initial demand projections for golf may be too high, the District engaged the services of a respected golf industry consulting firm to develop county-level percentage changes in demand for 18-hole equivalent golf courses for each five-year period of the planning period. The percentage changes were then applied to the previous five-year period's pumpage, beginning with the 2015 baseline pumpage. The projected percentage changes were based on projected socioeconomic factors such as, household income and ethnicity, and golf play rates associated with those socioeconomic factors. In general, the new methodology produced smaller increases in projected demand.

Landscape and other recreation demands are based on population growth within each county. Water use for this sector is assumed to grow at the projected county-level percentage change in population. The five-year population percentage changes were calculated and then applied to the previous five-year period's pumpage, beginning with the baseline pumpage.

3.0 Water Demand Projections

Table 3-5 provides total projected L/R water demands for the planning period (both golf and other L/R demand). The table indicates an increase in demand of 1.78 mgd for the 5-in-10 condition, an increase of 18.4 percent from the baseline 2015 demand. While there have been regional and national concerns about long-term declines in golf participation rates, the District's tourism industry and demographics tend to favor increasing demand for golf in the Heartland Planning Region and throughout the District. The irrigation demand for golf courses is considerable and will continue to compete with other users of potable and non-potable supplies.

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

4.0 Stakeholder Review

The demand projection methodology, results and analyses were provided to the District's water use permitting staff and L/R use sector stakeholders for review and comment. The District's Agricultural and Green Industry Advisory Committee generally confirmed stable or decreasing water demands for golf as part of the L/R projections. Projections indicate a smaller percentage increase in demand from 2015 to 2040 than previously projected in the Heartland Planning Region.

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

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Hardee	0.29	0.38	0.29	0.38	0.29	0.38	0.29	0.38	0.29	0.38	0.29	0.38	0.00	0.00	0.00%	0.0.00%
Highlands	2.17	2.80	2.18	2.82	2.20	2.84	2.21	2.86	2.22	2.87	2.22	2.88	0.05	0.08	2.30 %	2.86%
Polk	7.21	9.25	7.63	9.78	8.02	10.27	8.34	10.67	8.65	11.06	8.93	11.42	1.72	2.17	23.85%	23.46%
Total	**9.67**	**12.43**	**10.10**	**12.98**	**10.51**	**13.49**	**10.84**	**13.90**	**11.16**	**14.31**	**11.44**	**14.67**	**1.77**	**2.24**	**18.30%**	**18.02%**

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

Section 6. Summary of Projected Change in Demand

Table 3-6 summarizes the projected change in demand, respectively, for the 5-in-10 and 1-in-10 conditions for all use categories in the planning region. Decreases in demand represent a reduction in the use of groundwater, which can be available for mitigation of new groundwater permits and/or permanently retired to help meet environmental restoration goals.

Table 3-6 shows that 38.9 mgd of additional water supply will need to be developed and/or existing use retired to meet demand in the planning region through 2040. Public supply water use will increase by 33.2 mgd over the planning period. Table 3-6 also shows an increase of 13.3 mgd in I/C and M/D water use, 2.6 mgd in PG water use, and 1.8 mgd in L/R water use. Agricultural water use is projected to decrease by 12.0 mgd over the planning period.

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

The agricultural sector includes cattle ranches and other farming operations

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

Water Use Category	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
PS	81.93	86.85	92.06	97.58	99.02	104.96	104.78	111.07	110.21	116.82	115.10	122.01	33.17	35.16	40.5%	40.5%
AG	155.74	228.94	152.36	223.95	149.35	219.54	146.93	215.95	146.56	215.38	143.79	211.23	-11.95	-17.71	-7.7%	-7.7%
I/C & M/D	47.30	47.30	52.60	52.60	53.00	53.00	66.10	66.10	63.40	63.40	60.60	60.60	13.30	13.30	28.1%	28.1%
PG	7.62	7.62	9.94	9.94	10.00	10.00	10.07	10.07	10.13	10.13	10.21	10.21	2.59	2.59	34.0%	34.0%
L/R	9.67	12.43	10.10	12.98	10.51	13.49	10.84	13.90	11.16	14.31	11.44	14.67	1.77	2.24	18.3%	18.0%
Total	**302.26**	**383.14**	**317.06**	**397.05**	**321.88**	**400.99**	**338.72**	**417.09**	**341.46**	**420.04**	**341.14**	**418.72**	**38.88**	**35.58**	**12.9%**	**9.3%**

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

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

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

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

Section 8. Comparison of Demands between the Regional Water Supply Plan 2015 and the 2020 Regional Water Supply Plan

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

Chapter 4. Evaluation of Water Sources

This chapter presents the results of investigations by the Southwest Florida Water Management District (SWFWMD or District) to quantify the amount of water that is potentially available from all sources of water within the planning region to meet demands through 2040. Sources of water that are evaluated include surface water, stormwater, reclaimed water, brackish groundwater desalination, fresh groundwater, and conservation. Aquifer storage and recovery (ASR) is discussed as a storage option with great potential to maximize the utilization of surface water and reclaimed water. Aquifer recharge (AR) is discussed as a method to directly or indirectly recharge groundwater. The amount of water that is potentially available from these sources is compared to the demand projections for the planning region presented in Chapter 3 and a determination is made as to the sufficiency of the sources to meet demand through 2040.

Part A. Evaluation of Water Sources

Fresh groundwater from the Upper Floridan aquifer (UFA) is currently by far the major source of supply for all use categories in the planning region. It is assumed that the principal source of water to meet the projected demands during the planning period will likely come from sources other than fresh groundwater. This assumption is based largely on the impacts of groundwater withdrawals on water resources in the SWUCA, discussed in Chapter 2, and previous direction from the Governing Board. Limited additional fresh groundwater supplies will be available from the surficial and intermediate aquifers, and from the UFA, subject to a rigorous, case-by-case permitting review. The Lower Floridan aquifer (LFA) has the potential to be a significant source of additional water in the northern and eastern portions of the planning region, and projects to evaluate this potential source are ongoing. Water from the LFA is likely to be brackish and is therefore considered to be an alternative or non-traditional source.

Water users throughout the region are increasingly implementing conservation measures to reduce their water demands. Such conservation measures enable water supply systems to support more users with the same quantity of water and hydrologic stress. However, the region's continued growth will require the development of additional alternative sources such as reclaimed water, brackish groundwater and surface water with off-stream reservoirs and/or ASR systems for storage. To facilitate the development of these projects, the District encourages partnerships between neighboring municipalities and counties for purposes of developing regionally coordinated water supplies. The following discussion summarizes the status of the evaluation and development of various water supply sources and the potential for those sources to be used to meet the projected water demand in the planning region.

Section 1. Fresh Groundwater

Fresh groundwater from the UFA is the principal source of water supply for all use categories in the planning region and is considered a traditional source. In 2017, approximately 95 percent (279 mgd) of the 292 mgd of water (including domestic self-supply) used in the planning region was from groundwater sources. Approximately 30 percent (82 mgd) of the fresh groundwater used was for public supply (PS) (permitted and domestic self-supply). Fresh groundwater is also withdrawn from the surficial and intermediate aquifers for water supply, but in much smaller quantities. The following is an assessment of the availability of fresh groundwater in the surficial, intermediate, and UFAs in the planning region.

1.0 Surficial Aquifer

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

The remaining 10 percent is divided among public supply, recreational, and industrial/mining use (Basso, 2009). Annual average water use from permitted withdrawals in the surficial aquifer in 2014 was 13.5 mgd, with 93 percent (12.5 mgd) occurring in Highlands County and 7 percent (1.0 mgd) in Polk County. Small, unpermitted quantities are also withdrawn from the aquifer for lawn watering or individual household use. The quantity of water for these uses was estimated to total 4 mgd in Hardee, Highlands, and Polk counties in 2014.

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

2.0 Intermediate Aquifer System

The intermediate aquifer system, i.e., the Hawthorn aquifer system, is located between the surficial aquifer and the UFA. It is not present over much of the planning region, including the northern half of Polk County and the Lake Wales Ridge. Where it is present, water in the intermediate aquifer system is generally of sufficient quality and quantity for domestic self-supply (DSS) indoor use/outdoor irrigation and recreational uses. Annual average water use from permitted withdrawals in the intermediate aquifer system in 2014 was 3.8 mgd, with 53 percent (2.0 mgd) occurring in Hardee County, 37 percent (1.4 mgd) occurring in Polk County, and 10 percent (0.4 mgd) occurring in Highlands County. Small unpermitted quantities are also withdrawn from the aquifer for lawn watering or individual household use. The quantity of water for these uses is estimated to be a combined total of 1.6 mgd in Hardee, Highlands, and Polk counties in 2014. Due to its limited extent in Polk County, approximately one-third of future demand for DSS indoor use/landscape irrigation and recreational water use can be met from the intermediate aquifer system. Future demand supplied through withdrawals from the surficial and intermediate aquifers in the planning region is expected to total 1.6 mgd, with 0.8 mgd allocated to recreational use and 0.8 mgd to DSS indoor use/outdoor irrigation (see Table 4-1).

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

County	Domestic Self-Supply Indoor Use/Outdoor Irrigation	Recreation	Total
Hardee	0.0	0.0	0.0
Highlands	0.4	0.1	0.5
Polk	0.4[1]	0.7[1]	1.1
Total	**0.8**	**0.8**	**1.6**

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

3.0 Upper Floridan Aquifer

During development of the SWUCA Recovery Strategy (2006), it was anticipated that development of new water supplies from the UFA in the region would be limited due to existing impacts to minimum flows and levels (MFL) waterbodies. Requests for new groundwater supplies are not allowed to cause further lowering of water levels in impacted MFL waterbodies. The Recovery Strategy emphasized the implementation of conservation measures and development of alternative water supplies (AWSs) as much as possible to meet future additional demands. Additionally, it was thought that changes in land-use would result in the opportunity for some new demands to be met by accessing some portion of historically used groundwater withdrawals that were retired as a result of a change in land-use activities. However, based on demand projections prepared for the Regional Water Supply Plan (RWSP) and work completed for the SWUCA Five-Year Assessment (SWFWMD, 2018), it appears the ability to meet future water demands based on changes in land use activities is more limited than previously anticipated. Chapter 3, Table 3-3, indicates a net demand increase of 13.29 mgd for industrial/commercial (I/C) and mining/dewatering (M/D). Chapter 3, Table 3-4, indicates a net demand increase of 2.59 mgd for, power generation (PG). There is a net decrease in demand of 11.95 mgd for agricultural (AG) irrigation by 2040, which is anticipated to be primarily met with groundwater. It is also anticipated that some reductions in the use of groundwater can be achieved as a result of the District's comprehensive AG water conservation initiatives and the permanent retirement of water use permits on lands purchased for conservation. These reductions could be used to help meet the SWUCA Saltwater Intrusion Minimum Aquifer Level (SWIMAL) and lake minimum levels, and/or to mitigate impacts from new groundwater withdrawals.

3.1 Upper Floridan Aquifer Permitted/Unused Quantities

A number of PS utilities in the planning region are not currently using their entire permitted allocation of groundwater. The District recognizes the potential for these utilities to eventually grow into their unused quantities to meet future demands. Based on a review of the unused quantities of water associated with PS water use permits in the planning region, approximately 53.7 mgd of additional groundwater quantities are available. It is important to consider current impacts to MFL water bodies and other environmental features. Because of impacts that have occurred, it is possible that, in the future, some portion of currently permitted demands will need to be met using AWSs.

4.0 Lower Floridan Aquifer

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

Section 2. Water Conservation

1.0 Non-Agricultural Water Conservation

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

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

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

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

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

The District's Utilities Services Group provides guidance and technical expertise to PS water utilities and helps identify and reduce water loss. The non-regulatory assistance and educational components of the program maximize water conservation throughout the PS water use sector and improve both local utility system efficiency and regional water resource benefits. Among the services provided upon request are comprehensive leak detection surveys, meter accuracy testing, and water audit guidance and evaluation. Since the program's inception, the leak detection team has conducted 154 comprehensive leak detection surveys throughout the District, locating 1,553 leaks of various sizes and totaling an estimated 5.9 mgd. In the Heartland Planning Region, the leak detection team has conducted 48 leak detection surveys, locating 488 leaks totaling an estimated 1.8 mgd.

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

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

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

Education is an important element of a successful conservation program. While the actual quantity of water saved as a result of customer education is not measurable, the effort greatly increases the success of all other facets of a conservation program by raising customer awareness and changing attitudes regarding water use. Educating the public is a necessary facet of every water conservation program, and conservation education programs accompanied with other effective conservation measures can be an effective supplement to a long-term water conservation strategy. On a Districtwide scale, water conservation efforts have contributed to declining unadjusted gross per capita use rates, from 115 gallons per day (gpd) per person in 2005 to 97 gpd per person in 2015. The per capita use rate for the District is the lowest of all five WMDs. The per capita trend for the Heartland Planning Region is also decreasing as shown in Figure 4-1.

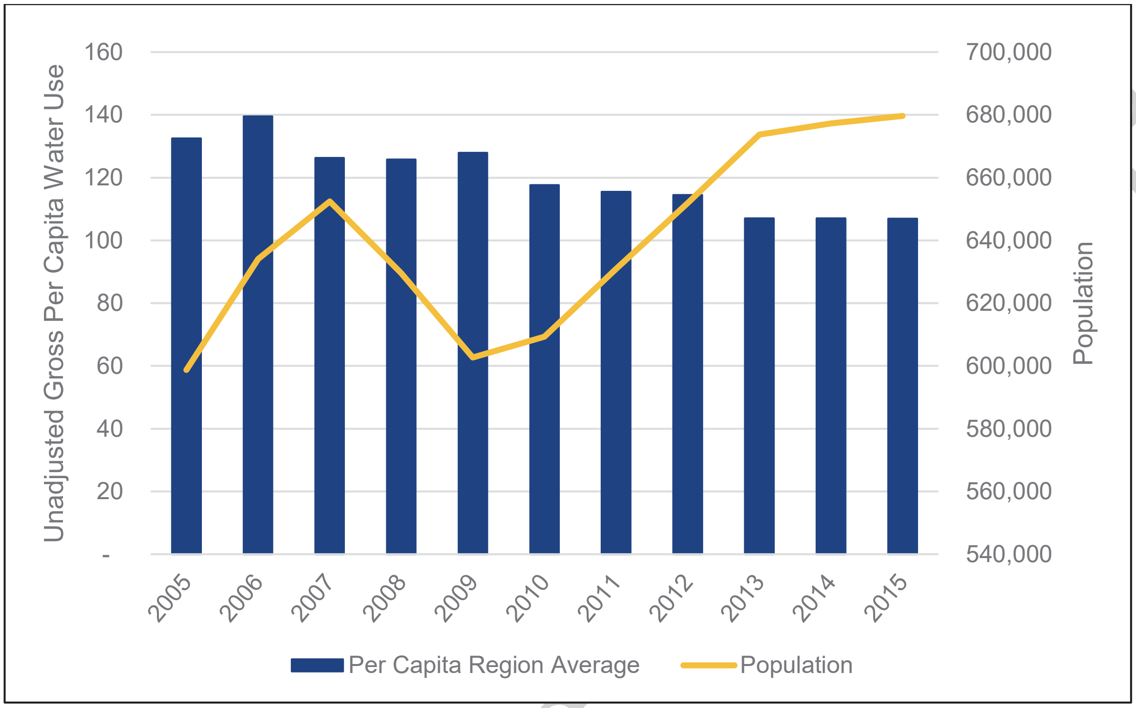

Figure 4-1. *Per capita water use rates in the Heartland Region, 2005-2015*

1.1 Public Supply

The PS sector includes all water users that receive water from public water systems and private water utilities. The PS sector may include non-residential customers such as hospitals and restaurants that are connected to a utility potable distribution system. Water conservation in the PS sector will continue to be the primary source of water savings in the District. Public supply (PS) systems lend themselves most easily to the administration of conservation programs since they measure each water customer's water use and can focus, evaluate, and adjust the program to maximize savings potential. The success of District's water conservation programs for PS systems to date is demonstrated by the 15.8 mgd in savings that has been achieved within the District since programs began in 1991. Within the region, it is estimated that savings for the PS category could be 8.69 mgd by 2040, if all water conservation programs presented below are implemented (Table 4-2).

1.1.1 Water Conservation Potential in the Heartland Planning Region

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

1.1.2 Assessment Methodology

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

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

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

Passive Conservation

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

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

Active Conservation

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

1. Residential High-efficiency Toilets
2. Industrial/Commercial High-efficiency Toilets
3. Residential Low-flow Showerheads
4. Irrigation/Landscape Evaluations
5. Rain Sensors
6. Soil Moisture Sensors
7. Residential Irrigation Controllers
8. Irrigation Enforcement
9. High-efficiency Faucets
10. Advanced Metering Analytics
11. Florida Water Star
12. Other

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

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

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

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

1.1.3 Results

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

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

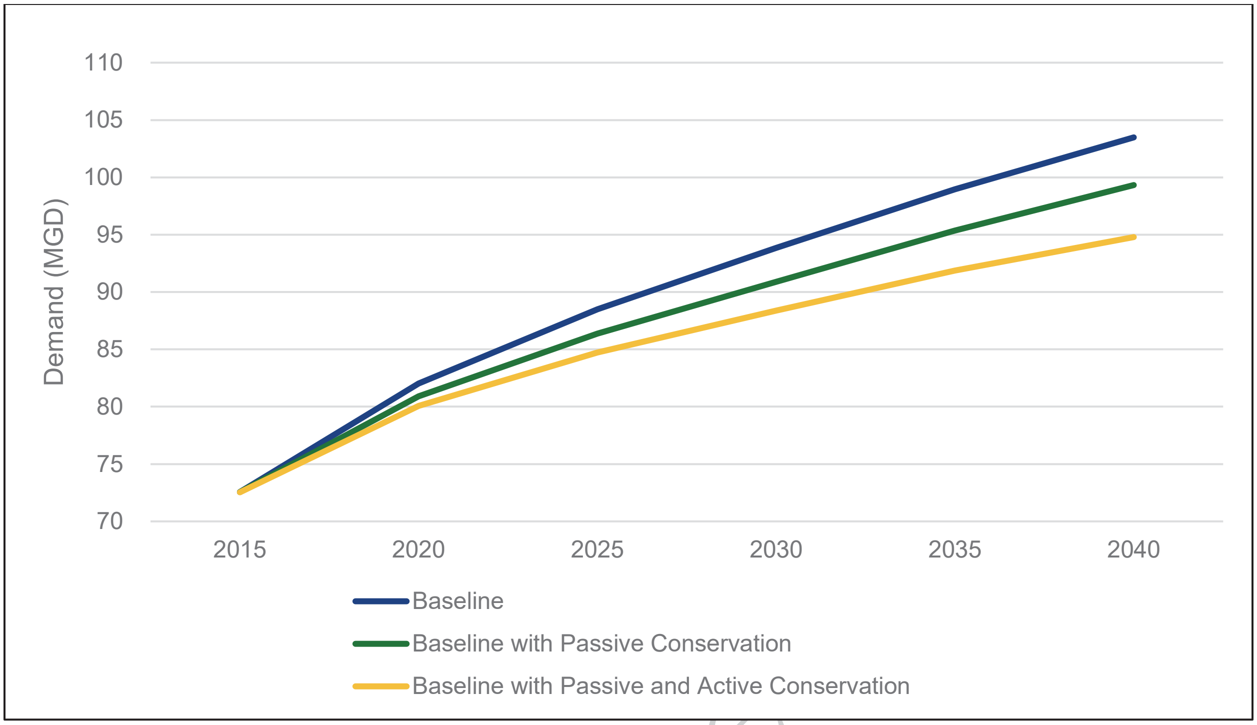

Figure 4-2. *Potential effects of conservation on projected PS demand*

1.1.4 Additional Considerations

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

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

1.2 Domestic Self-Supply

The Domestic Self-Supply (DSS) sector includes individual private homes and businesses that are not utility customers and receive their domestic water supply from a well or surface water supply for uses such as irrigation. DSS wells do not require a District water use permit, as the well diameters normally do not meet the District's requirements for a permit. Domestic Self-Supply (DSS) systems are commonly not metered and, therefore, changes in water use patterns are less measurable than those in the public supply sector. Only passive conservation was estimated for DSS systems in this RWSP. Within the region, it is estimated that passive savings for the DSS sector could be 0.25 mgd by 2040 (Table 4-3).

1.2.1 Domestic Self-Supply Assessment Methodology

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

1.3 Industrial/Commercial

The I/C water use sector includes factories and other industrial enterprises that obtain water directly from surface water and/or groundwater sources through a WUP. Businesses try to minimize water use to reduce pumping, purchasing, treatment, and disposal costs. To date, the District focused efforts on education, indoor and outdoor surveys, and commercial applications, such as spray valves and HET. The industrial processes used in this category present unique opportunities for water savings and are best identified through a site-specific assessment of water use at each (or a similar) facility. It is estimated that the savings for the I/C sector could be 0.93 mgd by 2040 (Table 4-3).

1.3.1 Industrial/Commercial Assessment Methodology

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

1.4 Landscape/Recreation

The Landscape/Recreation (L/R) water use sector includes golf courses and large landscapes (e.g. cemeteries, parks, and playgrounds) that obtain water directly from groundwater and surface water sources rather than from a public supply system. It is acknowledged that some amount of water savings has been achieved in this category through the use of efficient irrigation practices and technology. Within the region, it is estimated that the savings for the L/R water use sector could be 0.66 mgd by 2040 (Table 4-3).

1.4.1 Landscape/Recreation Assessment Methodology

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

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

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

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

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

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

2.0 Agricultural Water Conservation

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

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

Agricultural irrigation project

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

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

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

[1]Polk uses method consistent with CFWI

Polk County could have more conservation potential than the figures shown here with the consideration of the District's Mini-FARMS program. The program focuses on smaller agricultural operations (less than 100 acres) which are prevalent in the county. The small grants (up to $8,000) improve water use efficiency by helping pay for things like pump automation, weather stations, and soil moisture probes. Quantification of this program is ongoing but not available for publish in this document.

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

Section 3. Reclaimed Water

Reclaimed water is defined by the Florida Department of Environmental Protection (FDEP) as water that is beneficially reused after being treated to at least secondary wastewater treatment standards by a domestic wastewater treatment plant (WWTP). Reclaimed water can be used to accomplish a number of goals, including decreasing reliance on potable water supplies, increasing groundwater recharge and restoring natural systems. Figure 4-2 illustrates the reclaimed water infrastructure, utilization, and availability of reclaimed water within the District in 2015 as well as planned utilization that is anticipated to occur by 2025 as a result of funded projects.

Existing and funded projects are expected to result in reclaimed water increases of 14 mgd, bringing utilization within the planning region to approximately to 35 mgd by 2025. Appendix 4-1 contains anticipated 2025 reclaimed water utilization.

The benefit that can be obtained from the use of reclaimed water is governed by the concepts of utilization and water resource benefit. Utilization rate is the percent of treated wastewater from a WWTP that is beneficially used in a reclaimed water system. The utilization rate of reclaimed water systems varies by utility. Typically, only 50 to 70 percent of treated wastewater flows go to reclaimed water customers. The highest utilization rates occur in utilities in urban areas where large industries and numerous residential customers can be supplied. Utilization is also limited by seasonal supply and storage. A utility cannot expand its reuse system beyond peak flow demand, which occurs during dry periods when demand is highest, without experiencing shortages. For example, a reclaimed water system with a 1.0 mgd average annual flow normally is limited to supplying 0.5 mgd (50 percent utilization) on a yearly basis. This is because during the dry season, demand for reclaimed water for irrigation can more than double.

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

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

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

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

Environmental enhancement and recharge involves using excess reclaimed water to enhance wetland habitat, meet minimum flows and levels, or recharge the UFA to achieve water resource benefits.

Potable reuse involves purifying reclaimed water to a quality for it to be used as a raw water source for potable supplies. Supplementing reclaimed water supplies with other water sources such as stormwater and groundwater for short periods to meet peak demand also enables systems to serve a larger customer base.

Water resource benefit is the amount of potable-quality groundwater or surface water that is replaced by reclaimed water usage or the amount of reclaimed water used for environmental enhancement. Customers tend to use more reclaimed water than potable water because reclaimed water is generally less expensive and not as restricted as potable water. For example, a single-family residence with an inground irrigation system connected to potable water uses approximately 330 gpd for irrigation. However, if the same single-family residence converts to an unmetered flat-rate reclaimed water irrigation supply without day-of-week restrictions, it will use approximately two and one-half times (804 gpd) this amount. In this example, the benefit rate would be 41 percent (330 gpd benefit for 804 gpd reclaimed water utilization). Different types of reclaimed water uses have different benefit potentials. For example, a power plant or industry using 1 mgd of potable water for cooling or process water, after converting to reclaimed water, will normally use approximately the same quantity. In this example, the benefit rate would be 100 percent. Most reclaimed water utilities provide service to a wide variety of customers and, as a result, the average reclaimed water benefit rate is estimated to be 65 percent. The District is actively cooperating with utilities to help identify ways to increase reclaimed water utilization and benefit. For example, efficiency can be further enhanced with practices such as individual metering coupled with water-conserving rates, efficient irrigation design, and irrigation restrictions.

The District's goal is to achieve a 75 percent utilization rate of all WWTP flows and benefit efficiency of all reclaimed water used of 75 percent by the year 2040. This goal is intended to reduce the overuse of reclaimed water and increase potable and groundwater benefits. Opportunities may exist for utilization and benefits to be even greater in some cases by utilizing methods such as customer base selection (i.e., large industrial), project type selection (i.e., recharge), and implementation of developing technologies.

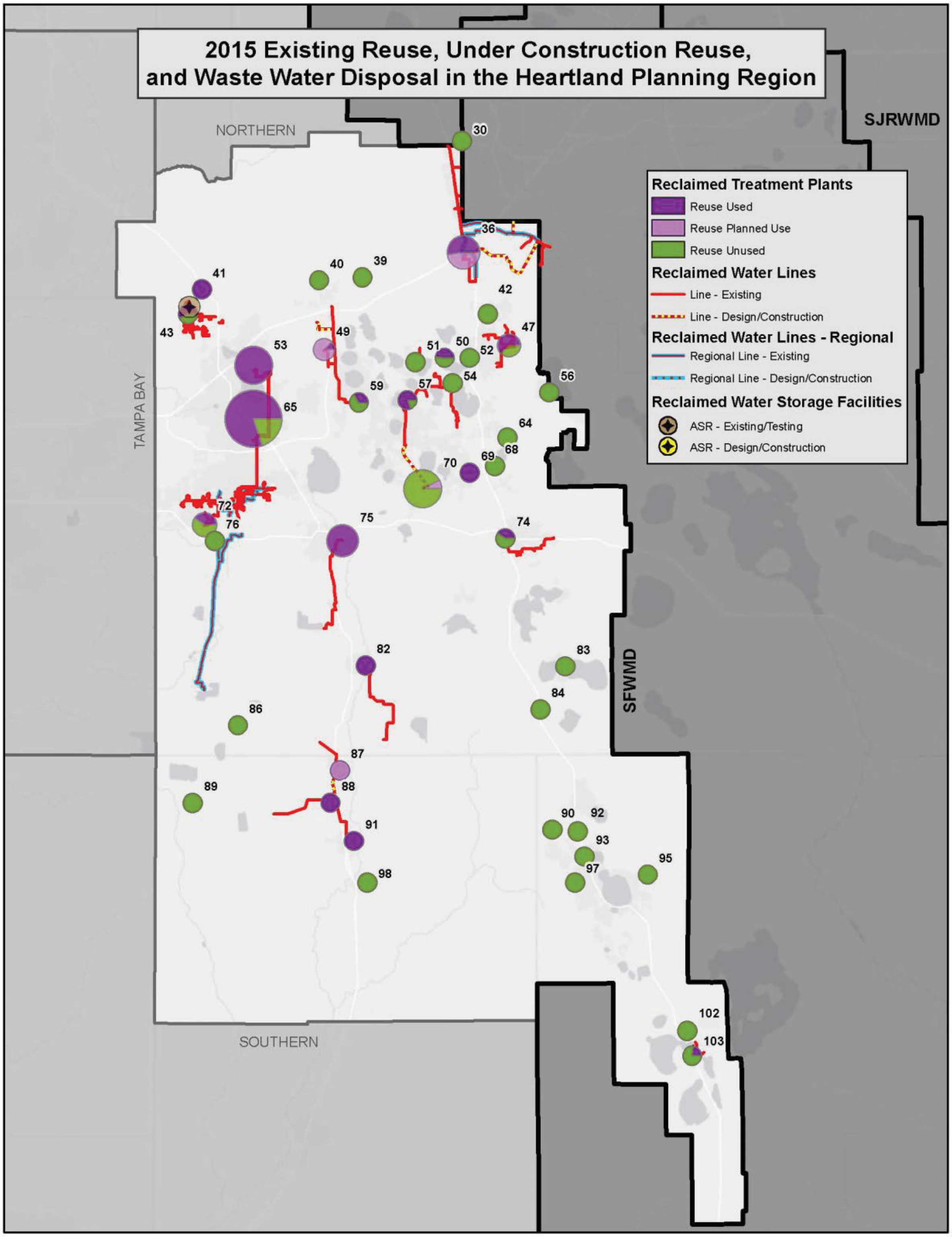

Figure 4-3. *Heartland Planning Region reclaimed water map (information on numbered facilities is available at http://www.swfwmd.state.fl.us/conservation/reclaimed/)*

1.0 Potential for Water Supply from Reclaimed Water

Table 4-5 provides information on the current and future availability of reclaimed water in the planning region and the potential to achieve potable-quality water benefits through 2040. In 2015, there were 42 WWTPs in Polk, Hardee, and Highlands counties, which collectively produced 38 mgd of treated wastewater. Of that quantity, 21 mgd was used resulting in 17 mgd of benefits to traditional water supplies. Therefore, only approximately 45 percent of the wastewater produced in the planning region was utilized for irrigation, cooling, or other beneficial purposes. By 2040, it is expected that more than 75 percent of reclaimed water available in the planning region will be utilized, and that efficiency by the end user will average more than 75 percent through a combination of measures, such as customer selection metering, volume-based rates, and education. As a result, by 2040, it is estimated that nearly 48 mgd (more than 75 percent) of the 52 mgd of wastewater treated will be beneficially used. This will result in approximately 40 mgd of benefits, of which nearly 24 mgd are additional post-2015 (75 percent efficiency).

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

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

[1] Estimated at 78 percent Region wide average.
[2] See Table 4-1 in Appendix 4.
[3] Unless otherwise noted.

Section 4. Surface Water

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

1.0 Criteria for Determining Potential Water Availability

The available yield for each river was calculated using its established minimum flow and/or hydrodynamic modeling (if available) and its current permitted allocation. If neither the adopted minimum flow nor the hydrodynamic model was available, planning-level minimum flow criteria were utilized. The five-step process used to estimate potential surface water availability includes

(1) estimation of unimpacted flow, (2) selection of the period used to quantify available yield, (3) application of minimum flow or planning level criteria, (4) consideration of existing legal users, and (5) application of engineering limitations. The amount of water that can be developed in the future will depend on adopted minimum flows and the permitting process. A complete explanation of this methodology is included in the Chapter 4 Appendix.

2.0 Overview of River/Creek Systems

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

2.1 Peace River

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

The major withdrawal from the Peace River is for public supply by the Peace River Manasota Regional Water Supply Authority (PRMRWSA). The PRMRWSA operates a regional water supply facility in southwest DeSoto County. Consistent with minimum flow methodology, annual flow was calculated by summing flow at the Peace River at Arcadia, Horse Creek near Arcadia, and Joshua Creek at Nocatee for the reference period 1975 through 2018. Adjusted annual flow was 762.7 mgd (1,180.6 cfs). The PRMRWSA is permitted to supply an annual average of 101.6 mgd from the river.

Projects have been developed to divert and store water from the upper Peace River during high-flow periods for release to meet minimum flows during low-flow periods. Reservations of water for projects such as the Lake Hancock Lake Level Modification Project will affect future surface water availability. Flow assumptions used for the minimum flow reservations may be adjusted in the future as projects are finalized and could affect the calculations in Table 4-6.

All available surface water in the Peace River is allocated to the Southern Planning Region in Table 4-6 because more water is physically present and available downstream; however, future withdrawals from the river in the Heartland Planning Region are being explored by the Polk Regional Water Cooperative. To maximize development of additional water supplies from the river, future withdrawals will need to be closely coordinated with the PRMRWSA and other users, as well as consider minimum flow requirements. Based on the minimum flow criteria, an additional 2.3 mgd of water supply is potentially available from the lower river.

2.2 Josephine Creek

Josephine Creek, with a watershed of 109 square miles, conveys water from more than 30 lakes on the Lake Wales Ridge to Lake Istokpoga (McDiffett, 1981). Wolf, Josephine, Red Beach, Ruth, and Charlotte lakes drain into Josephine Creek from the north and Annie, Placid, June-in-Winter, and Francis lakes drain north through Jack Creek, a tributary of Josephine Creek. Approximately 11 percent of the inflow into Lake Istokpoga is contributed by Josephine Creek (SFWMD, 2005). Land uses in the watershed are approximately one-third urban or built up, one-third water or wetlands, and one-third agriculture. The adjusted annual average discharge at Josephine Creek near the DeSoto City gage is 43.1 mgd (67 cfs). Annual average withdrawals of 0.46 mgd are permitted from the creek. Average annual diversions from 1996 to 2018 were 0.46 mgd. Based on the planning level minimum flow criteria, an additional 4.2 mgd of water supply is potentially available from the creek. Future use of Josephine Creek will be dependent on the MFL for Lake Istokpoga adopted November 2005; moreover, SFWMD has completed more recent rulemaking that limits further withdrawals from the lake beyond current levels. Development of this source requires coordination with the SFWMD on issues that include the effect on Lake Istokpoga minimum levels and existing legal users.

3.0 Potential for Water Supply from Surface Water

Table 4-6 summarizes potential availability of water from rivers in the planning region. The estimated additional surface water that could potentially be obtained from rivers in the planning region is approximately 4.2 mgd. It is important to note that although water available from the Peace and Alafia rivers is assigned to the Southern and Tampa Bay planning regions, respectively, there is potential for water supplies to be developed from these rivers in the Heartland Planning Region. Additional factors that could affect the quantities of water that are ultimately developed for water supply include the future establishment of minimum flows, the ability to develop sufficient storage capacity, variation in discharges to the river from outside sources, and the ultimate success of adopted recovery plans.

Table 4-6. *Summary of current withdrawals and potential availability of water from rivers/creeks in the Heartland Planning Region (mgd) based on planning-level minimum flow criteria (p85/10 percent) or the proposed or established minimum flow*

Water Body	Instream Impoundment	Adjusted Annual Average Flow[1]	Potentially Available Flow Prior to Withdrawal[2]	Permitted Average Withdrawal Limits[3]	Current Withdrawal[4]	Unpermitted Potentially Available Withdrawals[5]	Days/Year New Water Available[6]		
							Avg	Min	Max
Peace River @ Treatment Plant[7]	See Southern Planning Region								
Josephine Creek @ WMD Boundary[8]	No	43.1	4.3	0.46	0.46	4.2	310	148	366
TOTAL		**43.1**	**4.3**	**0.46**	**0.46**	**4.2**			

[1] Mean flow based on recorded U.S. Geologic Survey flow plus reported WUP withdrawals added back in when applicable. Maximum period of record used for rivers in the region is 1980–2018.
[2] Based on 10 percent of mean flow for all water bodies with the following exceptions: minimum flows have been established and were applied to calculate potentially available quantities for the Peace River.
[3] Based on individual WUP permit conditions, which may or may not follow the current 10 percent diversion limitation guidelines.
[4] Based on average reported withdrawals during the period 2007–2018.
[5] Equal to remainder of 10 percent of total flow after permitted uses allocated, with minimum flow cutoff for new withdrawals of P85 and maximum system diversion capacity of twice median flow (P50).
[6] Based on estimated number of days that any additional withdrawal is available considering current permitted quantities and withdrawal restrictions. The minimum and maximum are the estimated range of days that additional withdrawals would have been available in any particular year.
[7] All available surface water is allocated to the Southern Planning Region because the calculation was based on flows in the Southern Planning Region; however, future withdrawals from the River in the Heartland Planning Region are possible.
[8] Availability will be dependent on coordination with SFWMD regarding the adopted minimum level for Lake Istokpoga and existing legal users.

Section 5. Brackish Groundwater

Brackish groundwater suitable for water supply is available from two general sources within the District; in the UFA and intermediate aquifer system along coastal areas, and inland at greater depths within the LFA below Middle Confining Unit 2 (MCU II). The coastal brackish groundwater is found as a depth-variable transition between fresh and saline waters. Figure 4-3 depicts the generalized location of the freshwater/saltwater interface (as defined by the 1,000 milligrams per liter (mg/L) isochlor) in the Avon Park high production zone of the UFA in the southern and central portions of the District. Generally, water quality declines to the south and west of the District.

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

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

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

Both RO and EDR treatment systems generate a concentrate byproduct that must be disposed of through methods that may include surface water discharge, deep-well injection, or dilution at a WWTP. Surface water discharges require a National Pollutant Discharge Elimination System (NPDES) permit and may be restrained by TMDL limitations. In some cases, brackish water treatment facilities have been required to run below their potential efficiencies to reduce the strength of the concentrate. Because of these environmental considerations, deep-well injection is becoming more prevalent. Deep-well injection may not be permittable in some areas with unsuitable geologic conditions. An additional but costly disposal option is zero liquid discharge (ZLD). Zero liquid discharge (ZLD) is the treatment of concentrate for a second round of high-recovery desalination, then crystallization or dehydration of the remaining brine. The resulting solids might have economic value for various industrial processes.

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

The District revised its Cooperative Funding Initiative policy in December 2007, recognizing brackish groundwater as an AWS and allowing for assistance with construction projects. Since then, the District has assisted constructing five brackish groundwater treatment projects in the cities of North Port, Oldsmar, Tarpon Springs, Clearwater, and Punta Gorda. Each City has a regionally interconnected water supply system. The District is also co-funding two additional brackish groundwater projects for the Polk Regional Water Cooperative that are under design. The funding is intended to incentivize the development of integrated, robust, multijurisdictional systems that are reliable, sustainable, and utilize diverse water sources. While the District's regional water supply development processes have traditionally been based on meeting increasing demand projections, several brackish groundwater projects have been pursued for other needs: to blend permeate with treated surface water in order to meet finished water quality standards, to maintain viability of existing wellfields with deteriorating water quality, and to provide seasonal source substitution to meet an MFL. Future projects might also incorporate indirect potable reuse. The District recognizes the importance of maintaining the viability of existing supplies, but also encourages the consideration of alternate options based on economics and long-term regional benefit. A phased approach to brackish groundwater development is recommended that includes hydrogeologic evaluations to determine project viability, design phases that help refine the economic and permitting feasibility, and construction procured through a competitive bidding process.

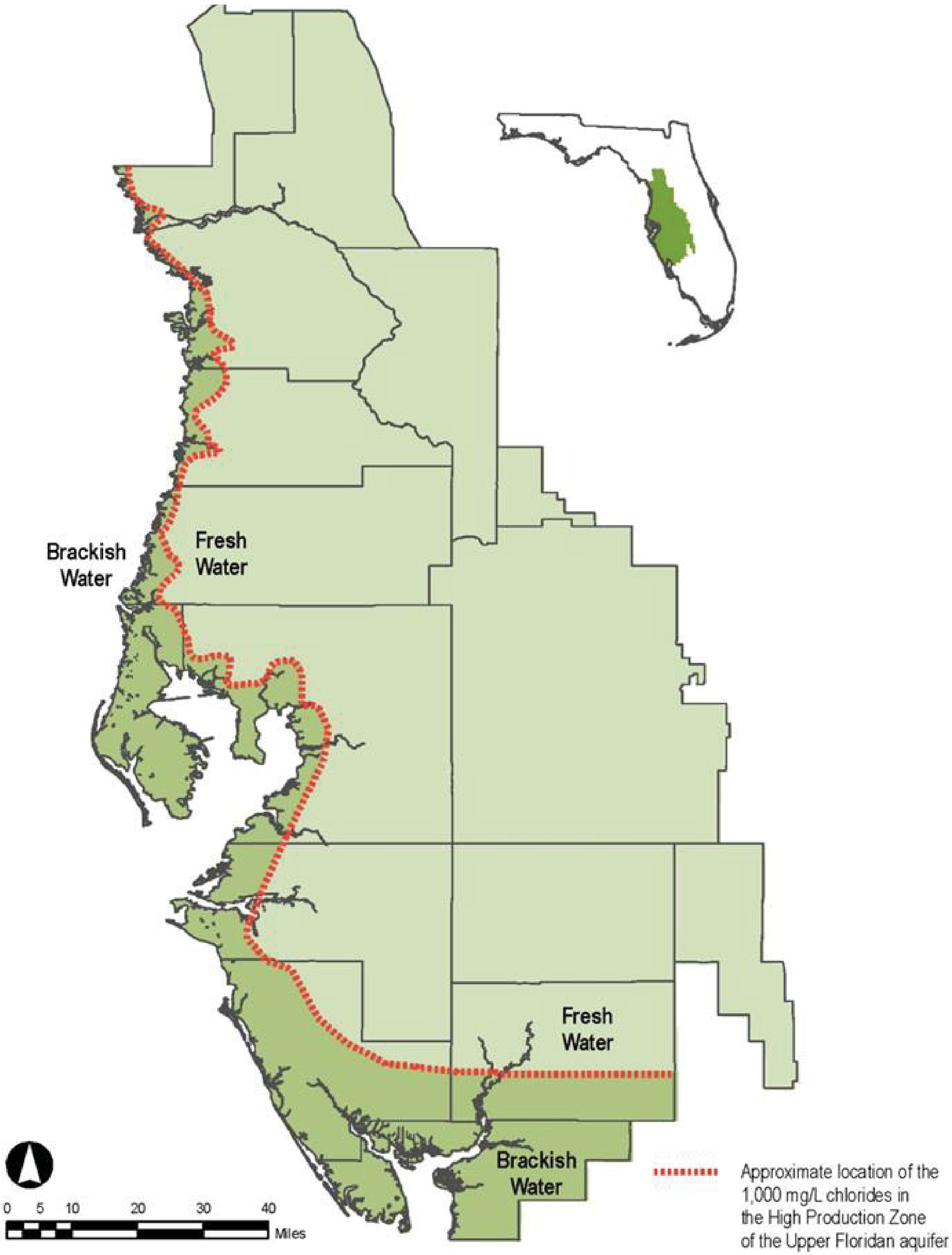

Figure 4-4. *Generalized location of the freshwater/saltwater interface in the District*

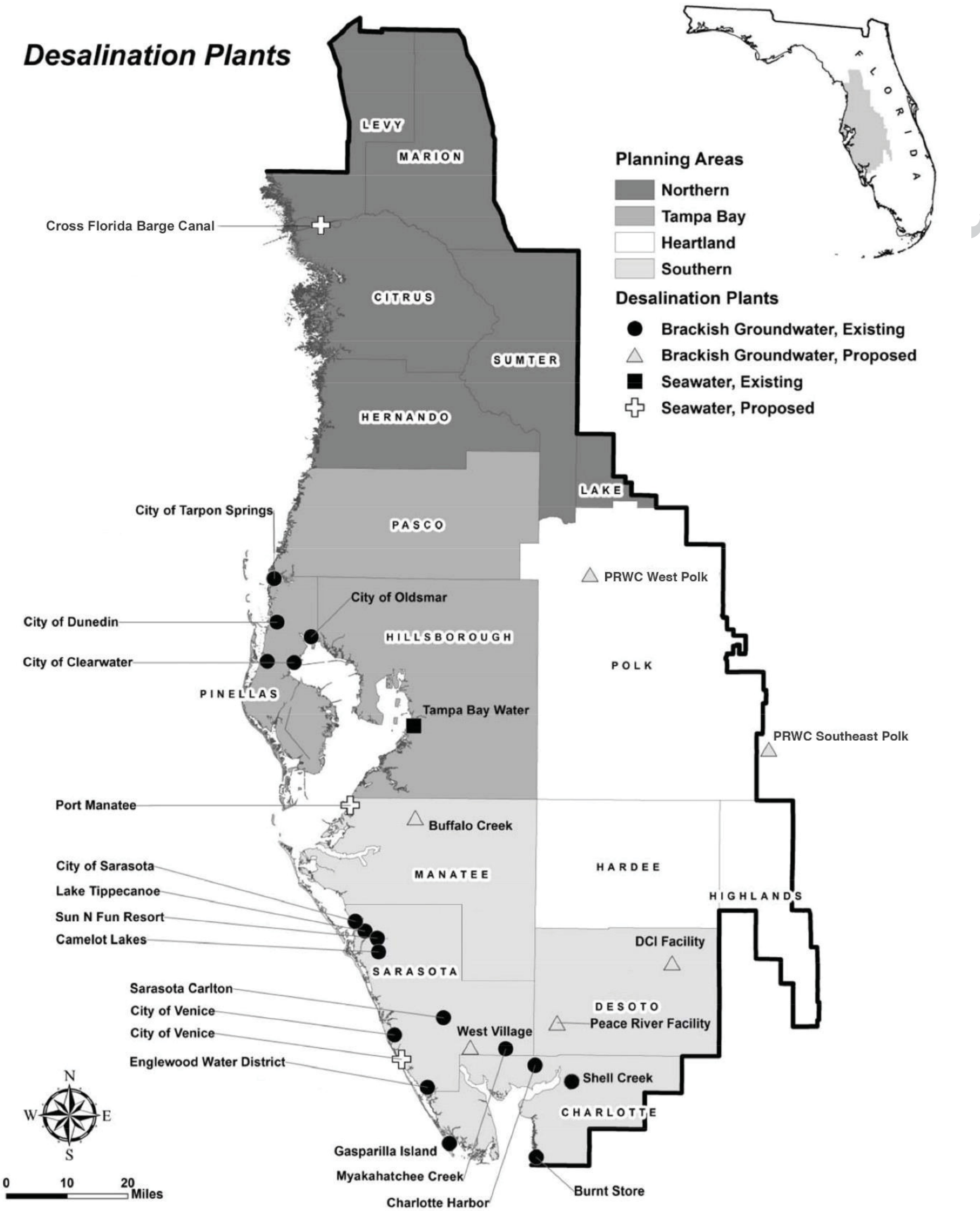

Figure 4-5. *Location of existing and potential seawater and brackish groundwater desalination facilities in the District*

1.0 Potential for Water Supply from Brackish Groundwater

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

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

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

From a treatment perspective, small quantities of brackish water from the LFA may be diluted with other fresh groundwater from the UFA to augment public supply, so long as the finished water meets drinking standards. Larger supply projects using membrane treatment will require the installation of an injection well to dispose of the concentrate generated during desalination. Injection wells have been successfully constructed in the planning region, but they are completed to sub-Floridan depths from 4,000 to 8,000 feet below surface and are costly to develop. The high costs can negatively impact the financial viability of brackish groundwater treatment options: thus, a regionalized implementation is preferred to benefit from economies of scale. Additional exploration is underway to explore the injection of concentrate in the lower portions of the LFA.

The quantity of brackish groundwater supply available for future needs in the Heartland Planning Region has yet to be fully defined, but investigations of the water resources of the LFA is ongoing and preliminary information is available in selected areas of the Heartland region. The availability of this groundwater supply must be determined on a case-by-case basis through the permitting process.

Section 6. Aquifer Storage and Recovery

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

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

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

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

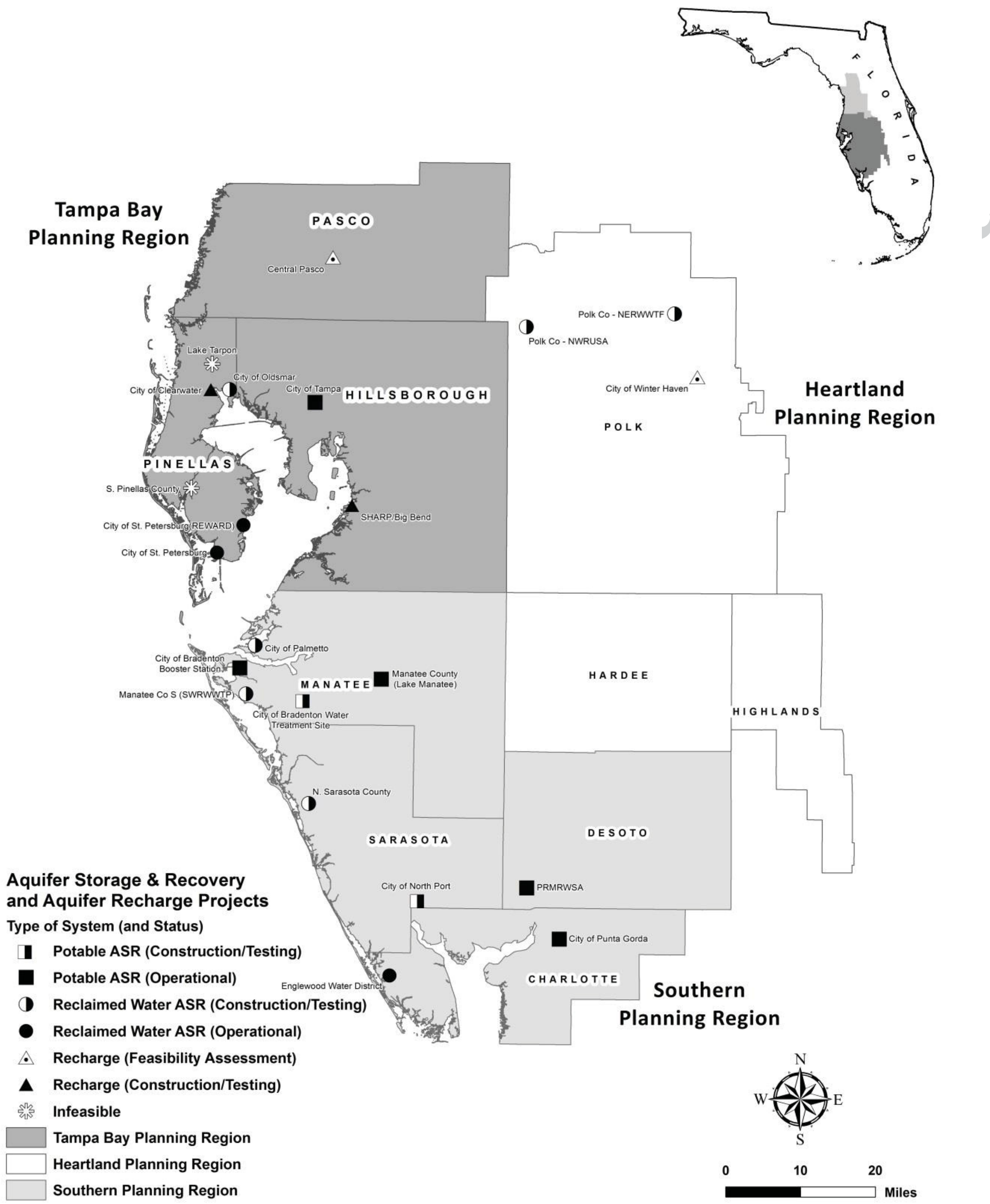

Figure 4-6. *Location of aquifer storage and recovery and aquifer recharge projects in the District that are operational or under development*

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

1.0 Aquifer Storage and Recovery Hydrologic and Geochemical Considerations

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

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

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

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

2.0 Aquifer Storage and Recovery Permitting

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

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

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

3.0 Aquifer Storage and Recovery and Arsenic

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

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

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

Most ASR projects in the District are located in coastal areas where water in the UFA is brackish. In much of this area, the aquifer is not utilized for potable supply and the recovered water from

ASR systems is treated to remove arsenic prior to distribution. Therefore, there has been no known exposure to arsenic above the current drinking water standard from water injected into the aquifer as a result of ASR operations.

Section 7. Aquifer Recharge

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

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

Sources of water for use in AR projects are often available seasonally and may include high quality reclaimed water, surface water, and storm water. A total volume of 738 mgd of reclaimed water was used Statewide in 2015 (DEP, 2015), for water uses including residential, industrial, recreational (golf courses), water treatment plants, rapid infiltration basins, and spray field applications.

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

1.0 Direct Aquifer Recharge

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

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

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

2.0 Indirect Aquifer Recharge

Indirect AR is when water is applied to land surface where it can infiltrate and recharge the aquifer. Indirect AR can be accomplished by using a variety of techniques, including spray fields, recharge wetlands, large-scale drain fields, and RIBs. This recharge approach is used in areas where there is a good connection between the surface and source aquifer for water supply. Water applied to the surface must meet minimum water quality standards approved by the FDEP. Infiltration capacity and permeability of the soil, presence of drainage features, depth to the water table, local hydrogeology, locations of nearby drinking water wells, as well as locations of nearby wetlands and lakes are all important to identify, test, and characterize to determine the feasibility of indirect AR. In favorable regions, indirect AR can provide additional natural water quality treatment to the water as it percolates through sediments during infiltration, in addition to subsequently increasing aquifers levels. It is estimated by the District that 20 mgd of available reclaimed water (Districtwide) was being applied through RIBs for indirect AR as of 2015 (DEP, 2015).

Section 8. Seawater

Seawater is defined as water in any sea, gulf, bay, or ocean having a TDS concentration of 35,000 mg/L or more (SWFWMD, 2001). Seawater can provide a stable, drought proof water supply that may be increasingly attractive as the availability of traditional supplies diminish and advances in technology and efficiency continue to reduce costs. There are five principal elements to a seawater desalination system that require extensive design considerations: (1) an intake structure to acquire the source water, (2) pretreatment to remove organic matter and suspended solids, (3) RO desalination to remove dissolved minerals and microscopic constituents, (4) post-treatment to stabilize and buffer product water and prepare it for transmission, and (5) concentrate disposal management (National Research Council, 2008). Each of these elements is briefly discussed below.

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

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

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

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

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

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

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

1.0 Potential for Water Supply from Seawater

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

Section 9. Stormwater

In the coming years, additional effort may be focused 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 SHP. There are scenarios where water is available, and the solutions may be cost effective; however, the alternatives might not be the highest and best use of available resources. A SHP must therefore balance stormwater availability against a defined need, so it must identify areas in the District where traditional water supply sources are limited. For this reason, a need-based approach may target areas such as the MIA, as well as Water Use Caution Areas (WUCAs). Having defined many of the SHP impediments and considerations, the following is a list of areas of opportunity for stormwater harvesting now and in the future:

- Dispersed Water Management & Dispersed Water Storage
- AG Conservation and Reuse Systems
- Commercial Irrigation
- Residential Irrigation
- Retrofit Urban Runoff Areas
- Augmentation of Reclaimed Water Systems
- Waterbody (Natural Systems) Base Flow Augmentation and/or Restoration
- Regionalization of Stormwater Ponds
- Surficial AR

Section 10. Summary of Potentially Available Water Supply

Table 4-7 is a summary of the additional quantity of water that will potentially be available from all sources of water in each county in the planning region from 2015 through 2040. The table shows that the total quantity available could be as high as 77.22 mgd.

Part B. Determination of Water Supply Deficits/Surpluses

Future water supply deficits/surpluses were calculated as the difference between projected demands for 2040 and demands for the 2015 base year (Table 3-7). The projected additional water demand for the planning period is approximately 48.88 mgd. As shown in Table 4-7, up to 77.22 mgd is potentially available from sources in the planning region to meet this demand. Based on a comparison of projected demands and identified supplies, it is concluded that sufficient sources of water are generally available in the planning region to meet demands through 2040. It should be noted, however, that resource constraints within the planning region may limit the availability of permitted unused groundwater quantities.

Peace River in Hardee County

Table 4-7. *Potential additional water availability in the Heartland Planning Region through 2040 (mgd)*

County	Surface Water[1]		Reclaimed Water	Desalination		Fresh Groundwater		Water Conservation		Total
	Permitted Unused	Available Unpermitted	Benefits	Seawater	Brackish Groundwater	Surficial and Intermediate	Upper Floridan[2] Permitted Unused	PS	AG	
Polk	-	-	21.95	-	-	1.1	27.76	7.97	0.49	59.27
Hardee	-	-	0.17	-	-	0.0	0.46	0.65	3.64	4.92
Highlands	0.46	4.20	1.65	-	-	0.5	2.21	0.08	3.93	13.03
Total	**0.46**	**4.20**	**23.77**	**NA**	**TBD**	**1.6**	**30.43**	**8.70**	**8.06**	**77.22**

[1] All available surface water from the Peace River is shown in DeSoto County, because the calculation was based on flows in DeSoto County; however, future withdrawals from the Peace River in Hardee and Polk counties are possible.
[2] Groundwater that is permitted but unused for public supply. Based on 2018 Estimated Water Use (SWFWMD, 2019).

Chapter 5. Overview of Water Supply Development Options

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

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

Part A. Water Supply Development Options

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

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

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

Section 1. Fresh Groundwater Options

Fresh groundwater options were evaluated as part of the Heartland Water Alliance water supply planning efforts in 2003, the 2009 Polk County Comprehensive Water Supply Plan, and the 2015 CFWI RWSP and the draft 2020 CFWI RWSP. Additional groundwater options utilizing the Lower Floridan aquifer (LFA) are discussed in Section 5 of this chapter. Future requests for groundwater from the Upper Floridan aquifer (UFA) in the planning region will be evaluated based on projected effects on existing legal users and water resources, including those with established minimum flows and levels (MFLs). In particular, projected effects of groundwater withdrawals cannot impact groundwater levels in the MIA of the SWUCA and cannot cause lake levels to fall below their established minimum levels or hinder their recovery.

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

Section 2. Water Conservation Options

1.0 Non-Agricultural Water Conservation

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

Some readily applicable conservation activities are not addressed due to the wide variance in implementation costs and the site-specific nature of their implementation. One such measure is water-conserving rate structures, which have savings potential but are not addressed as part of this RWSP. The District strongly encourages these measures and, when properly designed, they can be effective at conserving water. In addition, permittees are required to address these measures in their water conservation plan, which is part of the package provided by permittees during the water use permit (WUP) application or renewal period. Below is a description of each non-agricultural water conservation option. Savings and costs for each conservation activity evaluated in the 2020 RWSP are also summarized in Table 5-1 below.

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

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

Conservation Activity	2040 PS Savings (mgd)	Average Cost Effectiveness ($/kgal)	Total Cost
Region-wide Activities[2]			
High-efficiency Toilets (Residential)	0.22	$2.27	$1,828,249
High-efficiency Toilets (I/C)	0.03	$1.74	$195,575
High-efficiency Showerheads	0.93	$0.66	$4,155,059
Smart Irrigation Controllers	0.03	$0.89	$156,176
Rain Sensors	0.01	$1.26	$111,884
Soil Moisture Sensors	0.03	$0.89	$156,176
Landscape and Irrigation Evaluations/Audits	0.29	$0.71	$1,500,076
Polk County-exclusive Activities			
Irrigation Restriction Enforcement	1.04	-	-
High-efficiency Faucet Aerators	0.39	-	-
Advanced Metering Infrastructure	0.43	-	-
Florida Water Star	0.35	-	-
Other[3]	0.78	-	-
Total Public Supply	**4.54**	**$0.90[1]**	**$8,103,195**

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

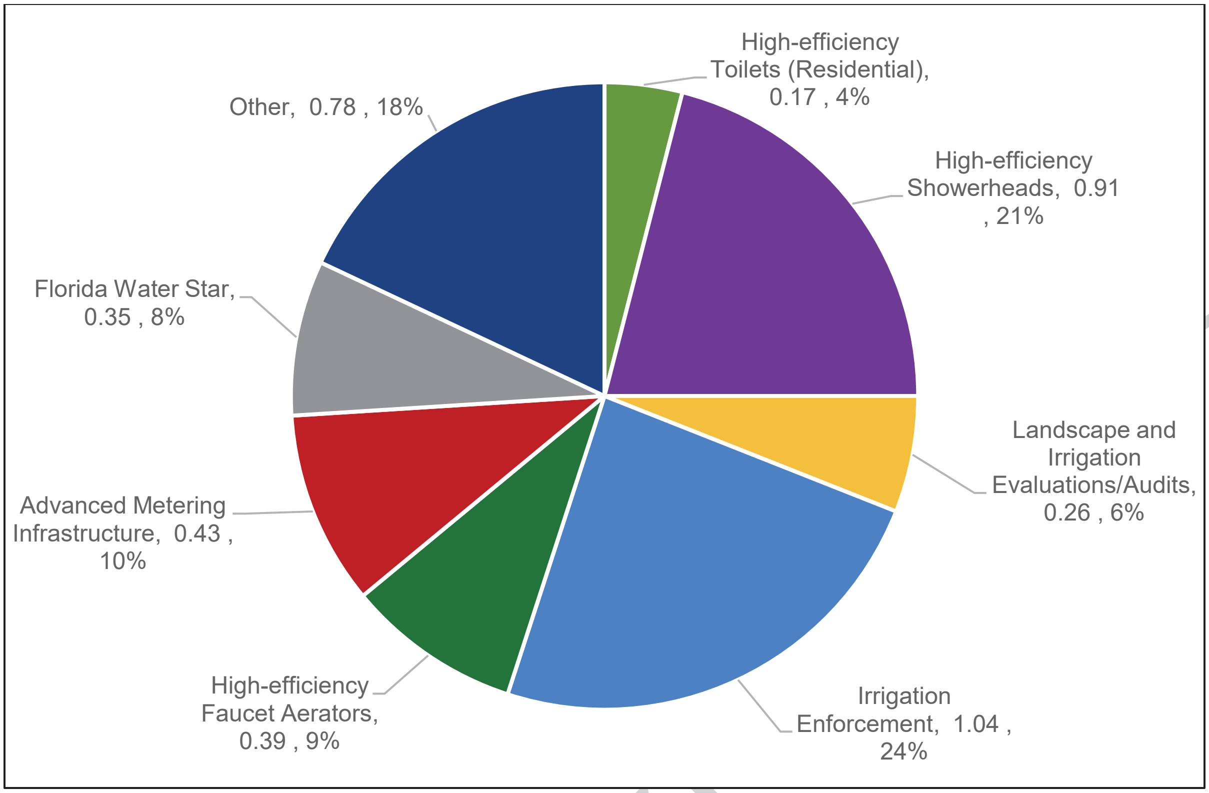

Figure 5-1. *Total 2040 active water savings (mgd) in Polk County, by conservation activity*

1.1 Description of Non-Agricultural Water Conservation Options

1.1.1 High-Efficiency Showerheads

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

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

1.1.2 High-Efficiency Toilets Rebates (Residential)

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

1.1.3 Landscape and Irrigation Evaluations/Audits

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

1.1.4 Rain Sensors

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

1.1.5 Smart Irrigation Controllers

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

1.1.6 Soil Moisture Sensors

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

1.1.7 Irrigation Restriction Enforcement

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

1.1.8 High-Efficiency Faucet Aerators

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

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

1.1.9 Advanced Metering Analytics

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

1.1.10 High-Efficiency Toilets (Industrial/Commercial)

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

1.1.11 Florida Water Star℠

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

1.1.12 Other

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

2.0 Agricultural Water Conservation Options

Citrus is the predominant agricultural commodity in the Planning Region

Approximately 47.46 percent of irrigated agricultural acreage in the District is located in the planning region. In 2015, 181.06 mgd will be used to irrigate 171,103 acres of agricultural commodities. From 2010 to 2035, irrigated acreage is expected to increase by 1.55 percent, or 2,635 acres. Most of the increase in acreage will be in citrus. Citrus will remain the predominant commodity, accounting for 89.73 percent of the total irrigated acreage in the planning region. The majority of citrus acreage, 74,156 acres, is located in Polk County, followed by Hardee County with 47,754 acres. Agriculture will continue to be a large user of water in the planning region in 2040. The District has a comprehensive strategy to significantly increase the water use efficiency of agricultural users over the next 20 years. A key component of this strategy is the cooperative programs the District has established with other agencies to provide the agricultural community with a wide array of technical and financial assistance to facilitate increases in water use efficiency. For nearly 30 years, the District has administered programs that have provided millions of dollars to fund more than 200 projects that have helped farmers increase the efficiency of their water use and improve water quality. Water conservation options for which the District will provide assistance are described below.

2.1 Facilitation of Agricultural Resource Management Systems

The District, in cooperation with the Florida Department of Agriculture and Consumer Services (FDACS), initiated the Facilitation of Agricultural Resource Management Systems (FARMS) Program in 2003. The FARMS Program provides cost-share reimbursement for the implementation of agricultural best management practices (BMPs) that involve both water-quantity and water-quality aspects. It is intended to expedite the implementation of production-scale agricultural BMPs that will help farmers become more efficient in their water use, improve water quality, and restore and augment natural systems. The FARMS Program is a public/private partnership among the District, FDACS, and private agriculturalists. Reimbursement cost-share rates for agriculturalists are based on the degree to which they implement both water-quantity and water-quality BMPs. The goal for the FARMS Program is to offset 40 mgd of groundwater use for agriculture within the SWUCA.

2.2 Facilitation of Agricultural Resource Management Systems Conservation Potential

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

1.7 mgd through precision irrigation or other groundwater conservation BMPs. Within the Heartland Planning region, the District projects that FARMS alternative water supplies could save nearly 9.6 mgd and conservation BMPs could save nearly 0.5 mgd over the same planning horizon of FY 2015 through FY 2040.

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

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

Typical FARMS Project #1. Tailwater Recovery

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

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

Typical FARMS Project #2. Precision Irrigation Systems

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

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

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

2.3 Mobile Irrigation Laboratory

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

2.4 Best Management Practices

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

Section 3. Reclaimed Water Options

The planning region's diverse mix of urban land uses along the I-4 corridor, extensive mining and industrial areas, and large tracts of agricultural lands provides opportunities to use large quantities of reclaimed water in numerous, beneficial ways. Since the wastewater treatment plants (WWTPs) for many towns are small, inter-system connections are not among the example options for maximizing reclaimed water. Instead, the focus is on selectively discontinuing the disposal of treated wastewater in rapid infiltration basins and spray fields and using it beneficially within the towns and surrounding agricultural lands. The following are the different types of reclaimed water options that are compatible with the geology, hydrology, geography, and available reclaimed water supplies in the planning region:

- **Augmentation with Other Sources:** introduction of another source (stormwater, surface water, or groundwater) into the reclaimed water system to expand available supply
- **ASR:** injection of reclaimed water into an aquifer during times of excess supply and the recovery of that same water for use during high demand
- **Distribution:** expansion of a reclaimed water system to serve more customers

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

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

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

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

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

Reclaimed water pipes

The District developed five reclaimed water project options (Table 5-3) for the planning region through coordination with utilities and other interested parties in concert with the CFWI and the Heartland Region. The District determined the quantity of reclaimed water available for each option based on an analysis of wastewater flows anticipated to be available in 2040 at a utilization rate of 75 percent or greater (see Chapter 4 Appendix, Table 4-1). The District recognizes that the viability of some options depends on whether certain other options are developed, and not all options can be developed because some would utilize the same reclaimed water source. These options are listed in Table 5-3.

Flow and capital cost data for the 39 funded reclaimed water construction projects identified as being under development (FY2015-2020) within the District were used to develop a representative cost per 1,000 gallons and capital cost for each of the following options. The data shows that for projects anticipated to come online between 2015 and 2025, the average capital cost is approximately $10.27 million for each 1 mgd supplied. This figure was used in cost calculations for individual reclaimed water options unless specific cost data were available.

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

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

The use of italics denotes SWFWMD estimations.
Offset = (if estimated) Annualized Supply: 1. x 75% for Ag, & R/A/C, 2. x 100% for I/C, NSR, & PG. 3. x 75% for Variety and 4. for RES is number of customers X 300 gpd.

Section 4. Surface Water/Stormwater Options

Capturing and storing water from river/creek systems in the planning region during times of high flow can supply significant quantities of water. The rivers/creeks that could potentially be utilized for water supply include the Peace River in Polk and Hardee counties, Josephine Creek in Highlands County, and the Alafia River and Peace Creek in Polk County. The most prominent river system in the planning region is the Peace River. Although the availability of water is greater in downstream portions of the river, developing water supply options in the upper watershed has advantages, such as locating water supply options on mined lands. Mined lands are well suited to water supply projects because of the large expanses of mine cuts and clay settling areas that remain following mining activities that could be used, with modifications, as surface water reservoirs. An additional advantage of utilizing the river in the upper watershed is the reduction in distribution costs that results from locating the supply closer to demand centers. A complicating factor in developing water supply options in the upper watershed is the possibility that the availability of water may not be sufficient and must take into consideration the MFL. Two water supply development projects on the Peace River and Peace Creek are in the feasibility stage and are discussed as ongoing projects in Chapter 6. Additional river supply options listed above are discussed in this section.

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

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

Option, Water Body, and Entity Responsible for Implementation	User Group	Avg Annual Yield (mgd)	Capital Cost ($1,000/ mgd)	Unit Cost ($/1,000 gal)	Annual O&M ($1,000)	Storage Method / Level of Treatment	Distribution Method
Highlands County (District)							
Josephine Creek Highlands County and/or others [1]	Ag, PS, I/C	3.2	6,077	2.27	960	AR	Aquifer conveyance to AG, PS, and I/C
Polk County (PRWC)							
Alafia River (confluence of North and South Prongs)	PS	10.0	26,340	5.30	TBD	ASR/reservoir	Transmission lines

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

Section 5. Brackish Groundwater Options

As discussed in Chapter 4, the Upper Floridan aquifer (UFA) and Lower Floridan aquifer (LFA) are divided within the planning region by two partially overlapping confining units, middle confining unit I (MCU I) and middle confining unit II (MCU II). The water quality in the LFA may vary in part by its proximity to a particular confining unit. Below MCU I, it is often fresh or near potable quality, and is used extensively in central Florida for water supply. Below MCU II, it has been less utilized and explored due to poorer water quality, but in some areas the aquifer may be significantly confined enough to avoid impacts to surface water bodies and be considered an alternative water supply. Studies are ongoing to enhance the District's geologic understanding of the LFA below MCU II and its viability as a water supply.

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

Section 6. Seawater Options

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

Chapter 6. Water Supply Projects Under Development

This chapter is an overview of water supply projects that are under development in the Heartland Planning Region. Projects under development are those the District is co-funding and are either (1) actively in the planning, design, or construction phase, or (2) not yet in the planning phase but have been at least partially funded through FY2019, or (3) have been completed since the year 2015 and are included to report on the status of implementation since the previous Regional Water Supply Plan (RWSP).

The demand projections presented in Chapter 3 show that approximately 48.9 mgd of new water supply will need to be developed during the 2020–2040 planning period to meet demand for all use sectors in the planning region. As of 2019, it is estimated that at approximately 136 percent of that demand (66.6 mgd) will be met by projects that meet the above definition of being "under development." These projects may assist in offsetting the need for additional water supplies proposed for development by various entities in the planning region outside of the District's funding programs.

Section 1. Fresh Groundwater

1.0 Polk Regional Water Cooperative– Virtual Pipelines Concept

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

Section 2. Water Conservation

1.0 Non-Agricultural Conservation

1.1 Indoor Water Conservation Projects

Since 2010, the District has cooperatively funded the distribution of approximately 1,330 ultra low-flow or high-efficiency fixtures. These programs have cost the District and cooperating local governments a combined $398,550 and have yielded a potable water savings of approximately 179,370 gallons per day (gpd). Table 6-1 provides information on indoor water conservation projects that are under development.

1.2 Outdoor/Other Water Conservation Projects

Since 2015, the District has cooperatively funded 573 rain sensor rebates and landscape and irrigation evaluations. These programs have cost the District and cooperating local governments a combined $$2,098,240 and have yielded a potable water savings of approximately 420,548 gpd. Table 6-1 provides information on outdoor water conservation projects that are under development.

Table 6-1. *Water conservation projects under development in the Heartland Planning Region*

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

Polk Regional Water Cooperative	Q023	Water Demand Management Plan	NA[5]	NA	$340,000	$170,000	NA
Outdoor/Other Total			420,548		$2,098,240	$1,087,942	
Totals			**599,918**		**$2,496,790**	**$1,287,217**	

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

2.0 Agricultural Water Conservation Projects

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

3.0 Institute of Food and Agricultural Sciences Research and Education Projects

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

The District provides funding for Institute of Food and Agricultural Sciences (IFAS) to investigate a variety of agriculture/urban issues that involve water conservation. These include, but are not limited to, development of tailwater recovery technology, determination of crop water use requirements, evaluation of alternative irrigation methods, field irrigation scheduling, frost/freeze protection, residential irrigation, and urban water use. Institute of Food and Agricultural Sciences (IFAS) conducts the research and then promotes the results to the agricultural community. The District has funded research on strawberries, citrus, tomatoes, potatoes, peaches, biofuel grasses, turf grass, peppers, blueberries, and various landscape and nursery ornamental plants and trees. Of the 58 research projects, 48 have been completed. Completed projects include 10 projects dealing with urban landscape issues and 38 involving various agricultural commodities. While the research projects are not specific to each planning region, they are specific to a commodity group that has a strong presence in each region. The research will help develop best management practices that will conserve water Districtwide. Specific benefits to the planning region are dependent on the commodities dominant in that planning region. The 10 ongoing projects are described in Table 6-2.

Table 6-2. *Water conservation research projects*

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

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

Section 3. Reclaimed Water

1.0 Reclaimed Water Projects – Research, Monitoring, and Education Projects

Continued support of reclaimed water research and monitoring is central to maximizing reclaimed water use and increasing benefits. The District assists utilities in exploring opportunities for increased utilization of reclaimed water and supports applied research projects, which not only include innovative treatment and novel uses of reclaimed water, but also nutrient and constituent monitoring. Table 6-3is a list of the benefits and costs that have been or will be realized by the 10 reclaimed water projects currently under development and another 6 are estimated to experience additional future supply growth. It is anticipated that these projects will be online by 2025. Table 6-4 includes general descriptions and a summary of 10 research projects for which the District has provided more than $1,026,000 in funding. The District has also committed to developing a comprehensive reclaimed water education strategy. All reclaimed water construction projects funded by the District require education programs that stress the value and benefits of efficient and effective use regardless of the water source. To provide reclaimed water information to a broader audience, the District has developed a web page which is one of the top internet sources of reuse information, including Geographic Information System (GIS) and other data. The District also produces reclaimed water publications that are offered to residents, utilities, engineering firms, environmental agencies and other parties interested in developing and expanding reclaimed water systems.

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

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

Cooperator	General Project Description	Reuse (mgd)			Customer (#)		Costs	
		Produced	Benefit	Stored	Type	Total	Total	District[1]
Wauchula	Wauchula Growth Increase to Mine	0.01	0.01	NA	Ind	1	Prior	Prior
Wauchula Hills	Wauchula Hills Growth Increase to Mine	0.01	0.01	NA	Ind	1	Prior	Prior
Bowling Green	Trans Q022	0.14	0.14	NA	Ind	1	$1,111,000	$833,250
Polk County	Trans N772	0.35	0.28	NA	Res	915	$2,505,000	$1,252,500
Polk County	Trans N862	0.38	0.32	NA	Res	1060	$869,500	$434,750
Polk County	Trans N868	0.41	0.33	NA	Res	1,100	$2,113,000	$1,056,500
Polk County	Trans N918	0.14	0.12	NA	Res	400	$1,696,000	$848,000
Polk County	Trans Q066	0.18	0.17	NA	Res	1025	$525,500	$262,750
Polk County	Trans Q067	0.52	0.52	NA	Res	1365	$4,373,500	$2,186,750
City of Winter Haven	Trans, Pump, Store N339	0.30	0.15	5.00	Res, Com, GC	TBD	$9,466,000	$2,750,000
City of Auburndale	Trans N536	1.50	1/13	NA	Com	1	$3,000,000	$1,500,000
Tampa Electric Company	Trans/ Pump H076	10.00	10.00	0.50	Ind	1	$97,960,725	$49,203,020
Streamsong	Streamsong Growth to Golf Course	0.01	0.01	NA	GC	1	Prior	NA
Cypress Lakes	Cypress Lakes Growth to Golf Course	0.01	0.01	NA	GC	1	Prior	NA
Ft Meade	Ft. Meade Growth to Mine	0.14	0.14	NA	Ind	1	Prior	Prior
Bartow	Bartow Growth to Power Plant	0.62	0.62	NA	Ind	1	Prior	Prior
Total	**16 Projects**	**20.45**	**15.69**	**5.50**		**5,874**	**$122,620,225**	**$60,327,520**

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

Table 6-4. *Reclaimed water research, monitoring, and education projects co-funded in the District*

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

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

Section 4. Surface Water/Stormwater

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

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

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

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

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

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

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

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

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

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

Section 5. Brackish Groundwater

Brackish Groundwater Project #1. PRWC Southeast Wellfield

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

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

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

Brackish Groundwater Project #2. PRWC West Polk Wellfield

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

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

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

Section 6. Aquifer Storage and Recovery

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

Section 7. Aquifer Recharge Projects

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

Chapter 7. Water Resource Development Component

This chapter addresses the legislatively required water resource development (WRD) activities and projects that are conducted primarily by the District. The intent of WRD projects is to enhance the amount of water available for regional-beneficial uses and for natural systems. Section 373.019, Florida Statutes (F.S.), defines WRD as: *"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 government-owned and privately owned water utilities"* (Subsection 373.019 [24], F.S.). The District is primarily responsible for implementing water resource development; however, additional funding and technical support may come from state, federal, and local entities.

Part A. Overview of Water Resource Development Efforts

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

Section 1. Data Collection and Analysis Activities

The District budgets significant funds annually to implement the WRD data collection and analysis activities, which support the health of natural systems and water supply development. Table 7-1 displays the Fiscal Year (FY)2020 budget and anticipated five-year funding levels for Districtwide data collection and analysis activities. Approximately $40.8 million will be allocated toward these activities annually for a five-year total of approximately $204 million. Because budgets for the years beyond FY2020 have not yet been developed, but are projected to be fairly constant, future funding estimates for activities are set equal to FY2020 funding. Funding for these activities is primarily from the Governing Board's allocation of ad valorem revenue collected within the District. In some cases, additional funding is provided by water supply authorities, local governments, and the U.S. Geological Survey (USGS). The activities listed in Table 7-1 are described in subsections 1.0 through 5.0, below.

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

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

1.0 Hydrologic Data Collection

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

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

1.1 Surface Water Flows and Levels

This includes data collection at the District's 808 surface water level gauging sites, and cooperative funding with the USGS for discharge and water-level data collection at 129 river, stream and canal sites. The data is available to the public through the District's Water Management Information System (WMIS), and through the USGS Florida Water Science Center Web Portal.

1.2 Geohydrologic Data Well Network

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

1.3 Meteorologic Data

The meteorologic data monitoring program consists of measuring rainfall totals at 171 rain gauges, most of which provide near real-time data. Annual funding is for costs associated with measurement of rainfall, including sensors, maintenance, repair, and replacement of equipment. Funding allows for the operation of one District evapotranspiration (ET) station for reference near Lake Hancock, and for District participation in a cooperative effort between the USGS and all five Florida water management districts to map statewide potential and reference ET using data measured from the Geostationary Operational Environmental Satellites (GOES). The program also includes a collaborative effort between the five the water management districts (WMDs) to provide high-resolution radar rainfall data for modeling purposes.

1.4 Water Quality Data

The District's Water Quality Monitoring Program (WQMP) collects data from water quality monitoring networks for springs, streams, lakes, and coastal and inland rivers. Many monitoring sites are sampled on a routine basis, with data analysis and reporting conducted on an annual basis. The WQMP develops and maintains the Coastal Groundwater Quality Monitoring Network, which involves sample collection and analysis from approximately 380 wells across the District to monitor saltwater intrusion and/or the upwelling of mineralized waters into potable aquifers.

1.5 Groundwater Levels

The District maintains 1,618 monitor wells in the data collection network, including 856 wells that are instrumented with data loggers that record water levels once per hour, and 762 that are measured manually by field technicians once or twice per month.

1.6 Biologic Data

The District monitors ecological conditions as they relate to both potential water use impacts and changes in hydrologic conditions. Funding for biologic data collection includes support for routine monitoring of approximately 150 wetlands and a five-year assessment of over 400 wetlands to document changes in wetland health and assess level of recovery in impacted wetlands. Funding also supports an effort to map the estuarine hard bottom of Tampa Bay, as well as SWIM program efforts for mapping of seagrasses in priority water bodies including Tampa Bay, Sarasota Bay, Charlotte Harbor, and the Springs Coast area.

1.7 Data Support

This item provides administrative and management support for the WQMP, hydrologic and geohydrologic staff support, the District's chemistry laboratory, and the District's LoggerNet data acquisition system.

2.0 Minimum Flows and Levels (MFLs) Program

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

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

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

As of August 2019, the District has preliminarily planned to monitor and assess the status of 210 adopted MFLs, including MFLs for 23 river segments, 10 springs or spring groups, 127 lakes, 41 wetlands, 7 wells in the NTBWUCA, and the Upper Floridan aquifer (UFA) in the MIA of the SWUCA, and in the DPCWUCA. The District is scheduling the establishment or reevaluation of 96 additional MFLs and one reservation through FY2029. The District's annual MFL Priority List and Schedule and Reservations List and Schedule is approved by the Governing Board in October, submitted to FDEP for review in November, and subsequently published in the Consolidated Annual Report. The approved and proposed priority lists and schedules are also posted on the District's Minimum Flows and Levels Documents and Reports webpage at: https://www.swfwmd.state.fl.us/projects/mfl/documents-and-reports

3.0 Watershed Management Planning

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

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

4.0 Quality of Water Improvement Program

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

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

5.0 Stormwater Improvements: Implementation of Storage and Conveyance Best Management Practices (BMPs)

The District's WMPs and SWIM programs implement stormwater and conveyance BMPs for preventative flood protection to improve surface water quality, particularly in urban areas, and to enhance surface and groundwater resources. The BMPs involve construction of improvements identified and prioritized in the development of WMPs. Most of the activities are developed through cooperative funding with a local government entity, Florida Department of Transportation (FDOT), or state funding. As stormwater is a primary contributor of water quality degradation in older urban areas, the District seeks opportunities to retrofit or improve these systems to reduce impacts to receiving waters. FY2020 funding includes new storage and conveyance projects in the Tampa Bay area, particularly in Hillsborough and Pasco County, as well as several continuing Tampa Bay projects.

Section 2. Water Resource Development Projects

As of FY2020, the District has 20 ongoing projects that meet the definition of water resource development "projects." The projects are listed in Table 7-2, below, along with their funding to date, total costs, participating cooperators, the estimated water quantity to be become available, and the planning region benefitted by the project. The total cost of these projects is approximately $150 million and a minimum of 78 mgd of additional water supply will be produced or conserved.

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

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

Water Resource Development Projects		Prior District Funding through FY2019	Total Project Cost (District + Cooperator)	Funding Source	Water to Become Available	Planning Region of Benefit
1) Alternative Water Supply Feasibility Research and Pilot Projects						
1.1	South Hillsborough Aquifer Recharge Program (SHARP) (N287)	$1,382,500	$2,765,000	SWFWMD, Hillsborough County	2 mgd	TBPR
1.2	Bradenton Aquifer Protection Recharge Well (N842)	$1,500,000	$5,050,000	District, City of Bradenton	5 mgd	TBPR
1.3	PRMRWSA Partially Treated Water ASR (N854)	$495,500	$7,755,000	District, PRMRWSA	3 mgd	SPR
1.4	Southern Hillsborough Aquifer Recharge Expansion (SHARE) Phase 1 (N855)	$4,500,000	$9,700,000	District, Hillsborough County	4 mgd	TBPR
1.5	Braden River Utilities ASR Feasibility (N912)	$2,736,250	$5,995,000	District, Braden River Utilities	TBD	SPR
1.6	Hydrogeologic Investigation of Lower Floridan Aquifer in Polk County (P280)	$11,375,000	$12,000,000	SWFWMD	TBD	HPR
1.7	Optical Borehole Imaging Data Collection from LFA Wells (P925)	$100,200	$167,000	District, USGS	NA	HPR
1.8	Sources/Ages of Groundwater in LFA Wells (P926)	$368,300	$555,800	District, USGS	NA	HPR
1.9	City of Venice Reclaimed Water Aquifer Storage Recovery (Q050)	$0	$5,065,000	District, City of Venice	0.17 mgd	SPR
1.10	Direct Aquifer Recharge-North Hillsborough Aquifer Recharge Program Phase 2 (Q064)	$0	$1,500,000	District, Hillsborough County	TBD	TBPR

1.11	Direct Aquifer Recharge-South Hillsborough Aquifer Recharge Program Phase 3 (Q088)	$0	$13,000,000	District, Hillsborough County	6 mgd	TBPR
2) Facilitating Agricultural Resource Management Systems (FARMS)						
2.1	FARMS Projects	$40,780,456	$71,791,225	SWFWMD, FDACS, State of FL, private farms	29 mgd	All
2.2	Mini-FARMS Program	$616,237	$150,000 (annual)	SWFWMD	2 mgd	All
3) Environmental Restoration and Minimum Flows and Levels (MFL) Recovery						
3.1	Lower Hillsborough River (LHR) Recovery Strategy (H400)	$5,464,712	$10,857,462	SWFWMD, City of Tampa	3.1 mgd	TBPR
3.2	Lower Hillsborough River (LHR) Pumping Facilities	$394,512	$4,850,044	SWFWMD, City of Tampa	TBD	TBPR
3.3	Pump Stations on Tampa Bypass Canal (H404)	$3,668,040	$700,000	SWFWMD	3.9 mgd	TBPR
3.4	Haines City Reclaimed Water MFL Recharge & Advanced Treatment Feasibility Study (N888)	$225,000	$357,710	SWFWMD, Haines City	0.7 mgd	HPR
3.5	Lake Hancock Lake Level Modification (H008)	$9,989,166	$10,428,490	SWFWMD, State of FL, Federal	TBD	HPR, SPR
3.6	Lake Jackson Watershed Hydrology Investigation (N554)	$260,000	$400,000	SWFWMD, City or Sebring, Highlands County	NA	HPR
3.7	Upper Myakka /Flatford Swamp Hydrologic Restoration and Implementation (H089)	$5,044,012	$31,000,000	SWFWMD	6.0 mgd	SPR, HPR

Note: Tampa Bay Planning Region (TBPR); Southern Planning Region (SPR); Heartland Planning Region (HPR)

1.0 Alternative Water Supply Research, Restoration, and Pilot Projects

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

1.1 South Hillsborough Aquifer Recharge Program (SHARP) (N287)

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

1.2 Bradenton Aquifer Protection Recharge Well (N842)

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

1.3 PRMRWSA Partially Treated Water ASR (N854)

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

1.4 Southern Hillsborough Aquifer Recharge Expansion (SHARE) Phase 1 (N855)

This project is for a third-party review of the County's 30 percent design, completion of design and permitting, and the initiation of construction for Phase 1 of the SHARE project. Pending third-party review and approval, the project will construct 9,500 feet of transmission mains, two reclaimed water recharge wells (2 mgd each), eight monitoring wells, and associated appurtenances. The SHARE project expands upon the county's current recharge project (N287).

1.5 Braden River Utilities ASR Feasibility (N912)

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

1.6 Hydrogeologic Investigation of LFA in Polk County (P280)

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

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

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

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

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

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

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

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

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

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

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

2.0 Facilitating Agricultural Resource Management Systems Projects

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

The FARMS Program has five specific goals: (1) offset 40 mgd of groundwater within the SWUCA, (2) improve surface water quality impacted by mineralized groundwater within the Shell, Prairie, and Joshua Creek (SPJC) watersheds, (3) improve natural systems impacted by excess irrigation and surface water runoff within the Flatford Swamp region of the upper Myakka River watershed, (4) reduce UFA groundwater use and nutrient loading impacts in the Springs Coast, and (5) reduce frost-freeze pumpage by 20 percent within the DPCWUCA. These goals are critical in the District's overall strategy to manage water resources.

2.1 FARMS Cost-Share Projects

Facilitating Agricultural Resource Management Systems (FARMS) projects employ many of the agricultural water conservation strategies described in the RWSP to reduce groundwater withdrawals by increasing the water use efficiency of agricultural operations. The projects have the added benefit of reducing agricultural impacts to surface water features. The projects are public/private partnerships where the District provides financial incentives to farmers to increase the water use efficiency of their operations. Each project's performance is tracked to determine its effectiveness toward program goals. Since actual use of permitted quantities is dependent on hydrologic conditions, one of the objectives of FARMS projects is to reduce groundwater use regardless of hydrologic conditions. Facilitating Agricultural Resource Management Systems (FARMS) projects not only offset groundwater use with surface water but increase the overall efficiency of irrigation water use. The District has routinely budgeted approximately $6 million annually for these projects. A listing of cost-share projects within the planning region that have been board approved since FY 2020 is provided in Table 7-3.

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

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

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

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

2.2 Mini-FARMS Program

Mini-FARMS is a scaled down version of the District's FARMS cost-share reimbursement program to implement agricultural BMPs on agricultural operations of 100 irrigated acres or less to conserve water and protect water quality within the District. Mini-FARMS is intended to assist in the implementation of the SWUCA Recovery Strategy, DPCWUCA Recovery Strategy, the Shell and Prairie Creek WMP, and the District's Strategic Plan. Much like the FARMS projects, the Mini-FARMS Program implements BMPs on agricultural operations to reduce UFA groundwater use and/or improve water quality conditions throughout the District. The maximum cost-share amount available from Mini-FARMS projects is $8,000 per agricultural operation per year, and the maximum cost-share rate is 75 percent of project costs.

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

2.3 FARMS Irrigation Well Back-Plugging Program

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

A total of 85 wells have been back plugged in the SWUCA through FY2014, with 63 of these wells located in the SPJC priority watersheds. Analytical results for all back-plugged wells indicated conductivity, total dissolved solids (TDS), and chloride were decreased by averages of 42 percent, 42 percent, and 58 percent, respectively, with well volume yields retained at an average of 77 percent. Routine water quality monitoring of select back-plugged wells assures that these improvements are sustained long-term.

2.4 University of Florida's Institute of Food and Agricultural Services (IFAS) BMP Implementation Project

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

3.0 Environmental Restoration and Minimum Flows and Levels Recovery Projects

As of FY2020, the District has five ongoing environmental restoration and MFL recovery projects that benefit water resources. The Lower Hillsborough River (LHR) Recovery Strategy and LHR Pumping Facilities projects are in the Tampa Bay Region. The Lake Hancock Lake Level Modification, the Lake Jackson Watershed Hydrology Investigation, and the Haines City Reclaimed Water MFL Recharge & Advanced Treatment Feasibility Study Projects are in the Heartland region. The Upper Myakka/Flatford Swamp Hydrologic Restoration and Implementation project is in the Southern Planning Region.

3.1 MFL Recovery Lake Hancock Design, Permit, Mitigation to Raise Lake (H008)

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

3.2 MIA Recharge SWIMAL Recovery at Flatford Swamp (H089)

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

3.3 Lower Hillsborough River Recovery Strategy (H400)

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

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

3.4 Lake Jackson Watershed Hydrology Investigations (N554)

Lake Jackson is a 3,412-acre lake located in the City of Sebring and is one of nine lakes in Highlands County with an established MFL. Residents and local officials have voiced concerns over persistent low water levels potentially related to storm water canal structures, potential flow through the shallow aquifer to the canals, and possible leakage in the lake's hardpan bottom. This project is a hydrologic investigation, including data collection, to identify the causes of low water level in Lake Jackson and Little Lake Jackson over the last decade and develop cost-effective recovery strategies.

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

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

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

Table 8-1 shows the projected increase in demand for each planning region for the planning period, as described in Chapter 3 of each volume of the Regional Water Supply Plan (RWSP). The table shows that approximately 209.8 mgd of new water supply is needed to meet user demands and to restore natural systems.

Table 8-1. *Summary of total projected increases in demand (5-in-10) (mgd) by each planning region from base year 2015 to 2040*

Planning Region	Projected Demand Increase
Heartland	38.9
Northern	50.4
Southern	44.4
Tampa Bay	76.1
Total	**209.8**

Note: Summation differences occur due to decimal rounding.

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

To prepare an estimate of the capital cost for projects needed to meet the portion of demand not yet under development, the District has compiled a list of large-scale water supply development (WSD) projects (Table 8-2). The District anticipates that a large portion of the remaining demand will be met through projects that users will select from the water supply options listed in Chapter 5 of this RWSP.

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

Part A. Statutory Responsibility for Funding

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

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

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

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

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

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

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

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

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

1. *The project supports establishment of a dependable, sustainable supply of water which is not otherwise financially feasible;*
2. *The project provides substantial environmental benefits by preventing or limiting adverse water resource impacts, but requires funding assistance to be economically competitive with other options; or*
3. *The project significantly implements reuse, storage, recharge, or conservation of water in a manner that contributes to the sustainability of regional water sources.*

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

Part B. Funding Mechanisms

Section 1. Water Utilities

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

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

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

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

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

Conservation incentivized by block rate structures, in combination with collecting project revenues in advance of construction, can distribute price increases more evenly over time and buffer price fluctuations inherent in common water-pricing practices. This allows customers to adjust water

use practices and technology over time. Indexing of prices is another means of distributing price increases over time. If changes to water rates are revenue-neutral, additional conservation can still occur, as the difference between average and marginal price blocks for larger water users increases. There are a number of additional means available to mitigate the impact of higher cost sources to customers. Many of these are addressed in the American Water Works Association's publications Avoiding Rate Shock: Making the Case for Water Rates (AWWA, 2004) and Thinking Outside the Bill: A Utility Manager's Guide to Assisting Low-Income Water Customers (AWWA, 2005).

Section 2. Water Management District

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

1.0 Cooperative Funding Initiative

The primary funding mechanism is the District's CFI, which includes funding for major regional water supply and WRD projects and localized projects throughout the District's 16-county jurisdiction. The Governing Board, through its Regional Sub-Committees, jointly participates with local governments and other entities to ensure proper development, use, and protection of the regional water resources of the District. The CFI is a matching grant program and projects of mutual benefit are generally funded 50 percent by the District and 50 percent by the public or private cooperators. Any state and federal funds received for the projects are applied directly against the project costs, with both parties benefitting equally. The CFI has been highly successful. Since 1988, this highly successful program has resulted in a combined investment (District and cooperators) of approximately $3.3 billion for a variety of water projects addressing the District's four areas of responsibility: (1) water supply, (2) natural systems, (3) flood protection, and (4) water quality. From Fiscal Year (FY)2016 through FY2020, the District's adopted budget included an average of $56.8 million in ad valorem tax dollars for the CFI program, of which $30 million (53 percent) was for WRD and water supply assistance.

2.0 District Initiatives

Projects funded through the District Initiatives program are of great importance or a regional priority. The District can increase its percentage match and, in some cases, provide total funding for the project. Examples of these initiatives include: (1) the Quality of Water Improvement Program (QWIP) to plug deteriorated, free-flowing wells that wastewater and cause inter-aquifer contamination, (2) the Utilities Services Group to conserve water by assisting utilities in controlling their water loss, (3) data collection and analysis to support major District initiatives such as the MFL program, (4) the FARMS program, and other various agricultural research projects designed to increase the water-use efficiency of agricultural operations, (5) water resource development investigations and MFL Recovery projects which may not have local cooperators, and (6) the WISE (Water Incentives Supporting Efficiency) program launched in 2019 offers cost-share funding for a wide variety of water conservation projects (max of $20,000 per project) to a wide variety of non-agricultural entities. From FY2016 through FY2020, the District's adopted budget included an average of $24.5 million in ad valorem tax dollars for District Initiatives, of which $9 million (37 percent) was for WRD and WSD assistance.

The average total commitment from FY2016 through FY2020 for CFI and District Initiatives was approximately $81.3 million. The continued level of investment for these programs depends on various economic conditions, resource demands, and the District's financial resources. However, the District believes its resources are sufficient to ensure the long-term sustainability of the region's water resources moving forward.

Section 3. State Funding

1.0 The Springs Initiative

The FDEP Springs Initiative is a special legislative appropriation that has provided revenue for protection and restoration of major springs systems. The District has allocated Springs Initiative funding to implement projects to restore aquatic habitats, to reduce groundwater withdrawals and nutrient loading within first-magnitude springsheds, and to improve the water quality and quantity of spring discharges. Projects include the reestablishment of aquatic and shoreline vegetation near spring vents, construction of infrastructure necessary to convey wastewater currently treated in septic systems or package plants to a centralized wastewater treatment facility and may increase reclaimed water production and implementation of other best management practices (BMPs) within springshed basins.

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

2.0 Water Protection and Sustainability Program

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

Program funds are applied toward a maximum of 20 percent of eligible project construction costs. In addition, the Legislature established a goal for each WMD to annually contribute funding equal to 100 percent of the state funding for alternative WSD assistance, which the District has exceeded annually. The legislation also requires that a minimum of 80 percent of the WPSPTF funding must be related to projects identified in a district water supply plan. The District's RWSP is utilized in the identification of the majority of WPSPTF-eligible projects.

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

3.0 The Florida Forever Program

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

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

4.0 State Funding for the Facilitating Agricultural Resource Management Systems Program

Operating under Chapter 40D-26, Florida Administrative Code (F.A.C.), the FARMS Program, through the District, utilizes additional state funding when available. Since the inception of the program, the District has received $6.4 million in state appropriations and $1.3 million from the Florida Department of Agriculture and Consumer Services (FDACS). No funding was provided by the state from FY2016 through FY2020.

5.0 West-Central Florida Water Restoration Action Plan

The WRAP is an implementation plan for components of the SWUCA recovery strategy adopted by the District. The document outlines the District's strategy for ensuring that adequate water supplies are available to meet growing demands, while at the same time protecting and restoring the water and related natural resources of the SWUCA. The WRAP prescribes measures to implement the recovery strategy and quantifies the funds necessary, making it easier for the District to seek funding for the initiative from state and federal sources. In 2009, the Legislature officially recognized the WRAP through Senate Bill 2080, creating Section 373.0363, F.S., as the

District's regional environmental restoration and water resource sustainability program for the SWUCA. In FY2009, the District received $15 million in funding for the WRAP, however, no new funding has been provided via state appropriation since that time.

Section 4. Federal Funding

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

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

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

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

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

The District's FARMS Program works cooperatively with the NRCS EQIP, AWEP, and RC&D programs on both financial and technical levels, and dual cost-share projects have been coordinated whenever possible. By an agreement between the District, FDACS, and the NRCS, the maximum funding for using both FARMS and EQIP is 75 percent of total project cost. As of FY2018, 41 FARMS projects Districtwide have involved some level of dual cost-share with EQIP, AWEP, and/or the RC&D, with several additional cooperative projects expected in the near future. On a technical level, agency interaction includes using the NRCS mobile irrigation lab to investigate using FARMS cost-share for improvements to overall irrigation system efficiency, using NRCS engineering designs for regulatory agricultural exemptions whenever possible, and coordinating cost-share on specific project related infrastructure. For example, FARMS may assist with an alternative source of irrigation water and EQIP assists with an upgrade to an irrigation delivery system. The relationship is mutually beneficial, extends cost-share dollars, and provides more technical assistance to participants in both programs.

Section 5. Public-Private Partnerships and Private Investment

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

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

1.0 Public-Private Utility Partnerships

Two advantages of public-private partnerships are 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, TBW undertook a public-private partnership with Veolia Water, formerly USFilter, to design, build, and operate its surface water treatment plant that has been in operation since 2002. Veolia assumed all risks for cost, schedule, plant design and construction, equipment supply, startup services, and facility performance through operation and maintenance. The cost savings over the life cycle of the contract is expected to be significant.

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

2.0 Cooperatives

Cooperatives are arrangements where multiple self-supplied water users pool their resources to construct water facilities that they could not technically or economically undertake on their own. They also share the risks. Such private or public/private cooperative institutions are more common where lengthy transmission systems are required, such as in the western U.S. where surface water is distributed to water districts and for irrigation. Water is usually obtained from a supplier at a cost and then distributed among members by the water district. Members cooperatively fund the construction of transmission and distribution facilities. As groundwater resources become increasingly limited and reclaimed water systems expand, the same type of economic forces that created irrigation and water districts in the west could develop in portions of Florida. Cooperatives may also shift financial risk by entering into design, build, and operate arrangements with contractors. One example of this structure is the Polk Regional Water Cooperative, formed in 2016 to address the development and provision of alternative water sources to its member local governments. Other forms of cooperative institutions in Florida, such as drainage districts and grower cooperatives, have effectively reduced competition and litigation over resources (OPPAGA, 1999).

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

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

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

Section 1. Projection of Potentially Available Funding

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

1.0 Cooperative Funding Initiative

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

2.0 District Initiatives

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

3.0 Springs Initiative

The amount of future state funding for the Springs Initiative cannot be determined at this time. Any funding allocated to this District will be used for projects for the protection and restoration of major springs systems, including projects to reduce groundwater withdrawals and improve stormwater systems.

4.0 Water Protection and Sustainability Trust Fund

The amount of future state funding for this program cannot be determined at this time. As economic conditions improve and the state resumes funding, any funding allocated for this District will be used as matching funds for the development of alternative water supply projects.

5.0 Florida Forever Trust Fund

The amount of future state funding for the Florida Forever Trust Fund cannot be determined at this time. Any funding allocated for this District will be used for land acquisition, including land in support of WRD.

If funding allocations remain consistent with the previous five years, approximately $1.62 billion could potentially be generated or made available to fund the CFI and District Initiatives projects necessary to meet the water supply demand through 2040 and to restore MFLs for impacted natural systems. This figure may be conservative, since it is not possible to determine the amount of funding that may be available in the future from the federal government and state legislative appropriations.

Section 2. Evaluation of Project Costs to Meet Projected Demand

Of the 209.8 mgd of Districtwide projected demand increases during the 2015–2040 planning period to meet the demand for all users and to restore MFLs for impacted natural systems, it is estimated that 46 mgd, or 22 percent of the demand, has either been met or will be met by reclaimed water and conservation projects that are under development. The total District share of cost for the projects currently under development including regional transmission, ASR, and brackish groundwater treatment systems is $490 million.

To develop an estimate of the capital cost of projects necessary to meet demand, the District compiled a list of large-scale WSD projects proposed for development within the 2040 planning horizon. Projects proposed by the PRMRWSA, TBW, and Polk Regional Water Cooperative could produce up to 105 mgd of water supply. Estimated costs and the quantity of water these projects will produce are listed in Table 8-2. Many of these are alternative water supply projects that would be eligible for co-funding by the District. The table shows the estimated total cost of the 100 to 105 mgd of water supply that will be produced by these projects is up to $1.57 billion.

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

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

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

Project	Entity to Implement	Quantities (mgd)	Capital Costs
Peace River Facility Surface Water System Expansion and Regional Reservoir	PRMRWSA	15	$208
Regional Loop System and ASR Projects	PRMRWSA	10	$189
Flatford Swamp Hydrologic Restoration	TBD	10	$44-96
Southeast Wellfield and West Polk County Lower Aquifer Deep Wells	PRWC	45	$650
Big Bend Desalination	Tampa Bay Water	10-12.5	$244
Enhanced Surface Water Expansion from Alafia River	Tampa Bay Water	10-12.5	$88
New Regional Feed Line to Balm Area	Tampa Bay Water	N/A	$76-97
Subtotal Southern Planning Region		**35**	**$441-493**
Subtotal Heartland Planning Region		**45**	**$650**
Subtotal Tampa Bay Planning Region		**20-25**	**$408-429**
Total – Districtwide		**100-105**	**$1,499-1,572**

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

The conservative estimate of $2.66 billion in cooperator and District financial resources that will be generated through 2040 for funding is sufficient to meet the projected $1.50 to $1.57 billion total cost of the large-scale projects listed in Table 8-2. State and federal funding sources may also assist with any remaining and/or high-end costs for future alternative water supply projects and water conservation measures where fresh groundwater resources are limited. These financial projections are subject to economic conditions that may affect the level of District ad valorem tax revenue and the availability of federal and state funding. However, such conditions may similarly affect future water demand increases.

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2020 Regional Water Supply Plan

Northern Planning Region

April 2020

Southwest Florida
Water Management District

The Southwest Florida Water Management District (District) does not discriminate on the basis of disability. This nondiscrimination policy involves every aspect of the District's functions, including access to and participation in the District's programs, services and activities. Anyone requiring reasonable accommodation, or would like information as to the existence and location of accessible services, activities, and facilities, as provided for in the Americans with Disabilities Act, should contact Donna Kaspari, Sr. Performance Management Professional, at 2379 Broad St., Brooksville, FL 34604-6899; telephone (352) 796-7211 or 1-800-423-1476 (FL only), ext. 4706; or email ADACoordinator@WaterMatters.org. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1-800-955-8771 (TDD) or 1-800-955-8770 (Voice). If requested, appropriate auxiliary aids and services will be provided at any public meeting, forum, or event of the District. In the event of a complaint, please follow the grievance procedure located at WaterMatters.org/ADA.

2020 Regional Water Supply Plan
Northern Planning Region

Public Review Draft

April 2020

For further information regarding this plan, please contact the Water Supply Section at:

2379 Broad Street
Brooksville, FL 34604-6899
(352) 796-7211 or
(800) 423-1476 (Florida Only)

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Southwest Florida Water Management District

2020 Regional Water Supply Plan

This report is produced by the Southwest Florida Water Management District

April 2020 – Public Review Draft

District Project Manager: Joseph Quinn, AICP

District Contributors

Anthony Andrade
Ron Basso, P.G.
Mike Bray
April Breton
Miurel Brewer
Joel Brown
Mike Cacioppo
Cortney Cameron
Donna Campbell
Jake Cuarta
Corey Denninger, GISP
Don Ellison, P.G.
Randy Emberg
Carole Estes, P.G.
John Ferguson, P.G.
Mark Fulkerson, Ph.D., P.E.
Frank Gargano
Yonas Ghile
Jim Golden, AICP
Mohamed Hersi
Mary Margaret Hull, APR
Doug Leeper
Tamera McBride, P.G.
Lisann Morris, P.E., PMP
Cassidy Hampton
Mike Hancock, P.E.
Jerry Harding
Darrin Herbst, P.G.
Jay Hoecker, PMP
Ashlee Hollifield
Thomas Kiger, P.E.
Luke LeMond, P.G.
Josh Madden
Lydia Manos
Cara Martin, APR
Jeremy McKay
Jason Patterson
Ryan Pearson
Robert Peterson, P.G.
Amy Poxson
Dennis Ragosta
Patricia Robertshaw
Cindy Rodriguez
Danielle Rogers
Carmen Sanders
George Schlutermann, P.G.
Andrea Shamblin
Virginia Singer
Claire Stapley
Susanna Martinez Tarokh
Chris Tumminia
Don Weaver
Jeff Whealton, P.W.S.
Brent White
Kevin Wills
Marra Wood
Lei Yang
Allen Yarbrough
Chris Zajac

Other Contributors

Wade Trim, Inc.
Sarah Mastison
Brad Cornelius, AICP, CPM
Amanda Warner, AICP

This report is available online at: WaterMatters.org/RWSP
You may send a request for a printed copy to info@watermatters.org

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List of Abbreviations

AG	Agriculture
AR	Aquifer Recharge
ASR	Aquifer Storage and Recovery
AWEP	Agriculture Water Enhancement Program
AWE	Alliance for Water Efficiency
AWS	Alternative Water Supply
BEBR	Bureau of Economic and Business Research
BMP	Best Management Practice
CAR	Consolidated Annual Report
CDD	Community Development District
CFI	Cooperative Funding Initiative
CFS	Cubic Feet per Second
CFWI	Central Florida Water Initiative
CII	Commercial, Industrial, and Institutional
DPCWUCA	Dover/Plant City Water Use Caution Area
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
FDEP	Florida Department of Environmental Protection
FFL	Florida-Friendly Landscaping
F.S.	Florida Statutes
FTMR	Focus Telescopic Mesh Refinement
FWS	Florida Water Star℠
FY	Fiscal Year
GAL	Gallons
GIS	Geographic Information System
GPD	Gallons per Day
GPF	Gallons per Flush
GPM	Gallons per Minute
GRP	Gross Regional Product
HET	High-Efficiency Toilets
HRWUCA	Highlands Ridge Water Use Caution Area
I/C	Industrial/Commercial
ICU	Intermediate Confining Unit
IFAS	Institute of Food and Agricultural Sciences
IPCC	Intergovernmental Panel on Climate Change
IWF	Integrated Water Factor
L/R	Landscape/Recreation
LFA	Lower Floridan aquifer

LHR	Lower Hillsborough River
MCU	Middle Confining Unit
MCU I	Middle Confining Unit I (1)
MCU II	Middle Confining Unit II (2)
M/D	Mining/Dewatering
MFL	Minimum Flows and Levels
MGD	Million Gallons per Day
MG/L	Milligrams per Liter
MIA	Most Impacted Area
NHARP	North Hillsborough Aquifer Recharge Program
NPDES	National Pollutant Discharge Elimination System
NPR	Northern Planning Region
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
OEP	Oxygen-Reduction Potential
PG	Power Generation
PPT	Parts per Thousand
PRMRWSA	Peace River Manasota Regional Water Supply Authority
PRWC	Polk Regional Water Cooperative
PS	Public Supply
PSI	Pounds per Square Inch
QWIP	Quality of Water Improvement Program
RC&D	Florida West Coast Resource Conservation and Development Council
RIB	Rapid Infiltration Basin
RO	Reverse Osmosis
ROMP	Regional Observation and Monitor-well Program
RWSP	Regional Water Supply Plan
SHARE	South Hillsborough Aquifer Recharge Expansion
SHARP	South Hillsborough Aquifer Recharge Project
SJRWMD	St. Johns River Water Management District
SMS	Soil Moisture Sensor
SPJC	Shell, Prairie and Joshua Creek watersheds
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
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
WMP	Watershed Management Plan
WPSPTF	Water Protection and Sustainability Program Trust Fund
WQMP	Water Quality Monitoring Program
WRAP	Water Resource Assessment Project or West-Central Florida Water Restoration Action Plan
WRD	Water Resource Development
WRPC	Withlacoochee Regional Planning Council
WRWSA	Withlacoochee Regional Water Supply Authority
WSD	Water Supply Development
WUCA	Water Use Caution Area
WUP	Water Use Permit
WUWPD	Water Use Well Package Database
WWTP	Wastewater Treatment Plant
ZLD	Zero Liquid Discharge

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Chapter 1. Introduction

The Regional Water Supply Plan (RWSP) for the Southwest Florida Water Management District (SWFWMD) (District) is an assessment of projected water demands and potential sources of water to meet these demands for the period from 2020 through 2040. The RWSP has been prepared in accordance with the Florida Department of Environmental Protection's (FDEP) 2019 Format and Guidelines for Regional Water Supply Planning. The RWSP consists of four (4) geographically based volumes that correspond to the District's four designated water supply planning regions: Northern, Tampa Bay, Southern and Heartland (Figure 1-1). This volume is the 2020 RWSP update for the Northern Planning Region, which includes Hernando, Citrus and Sumter counties and the portions of Lake, Levy and Marion counties within the District. In 2010, the RWSP update included the District's Northern Planning Region for the first time.

The purpose of the RWSP is to provide the framework for future water management decisions in the District. The RWSP for the Northern Planning Region shows that demand for water through 2040 can be met with fresh groundwater supplemented by the use of all available reclaimed water options and through implementation of comprehensive water conservation measures.

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

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

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

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

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

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

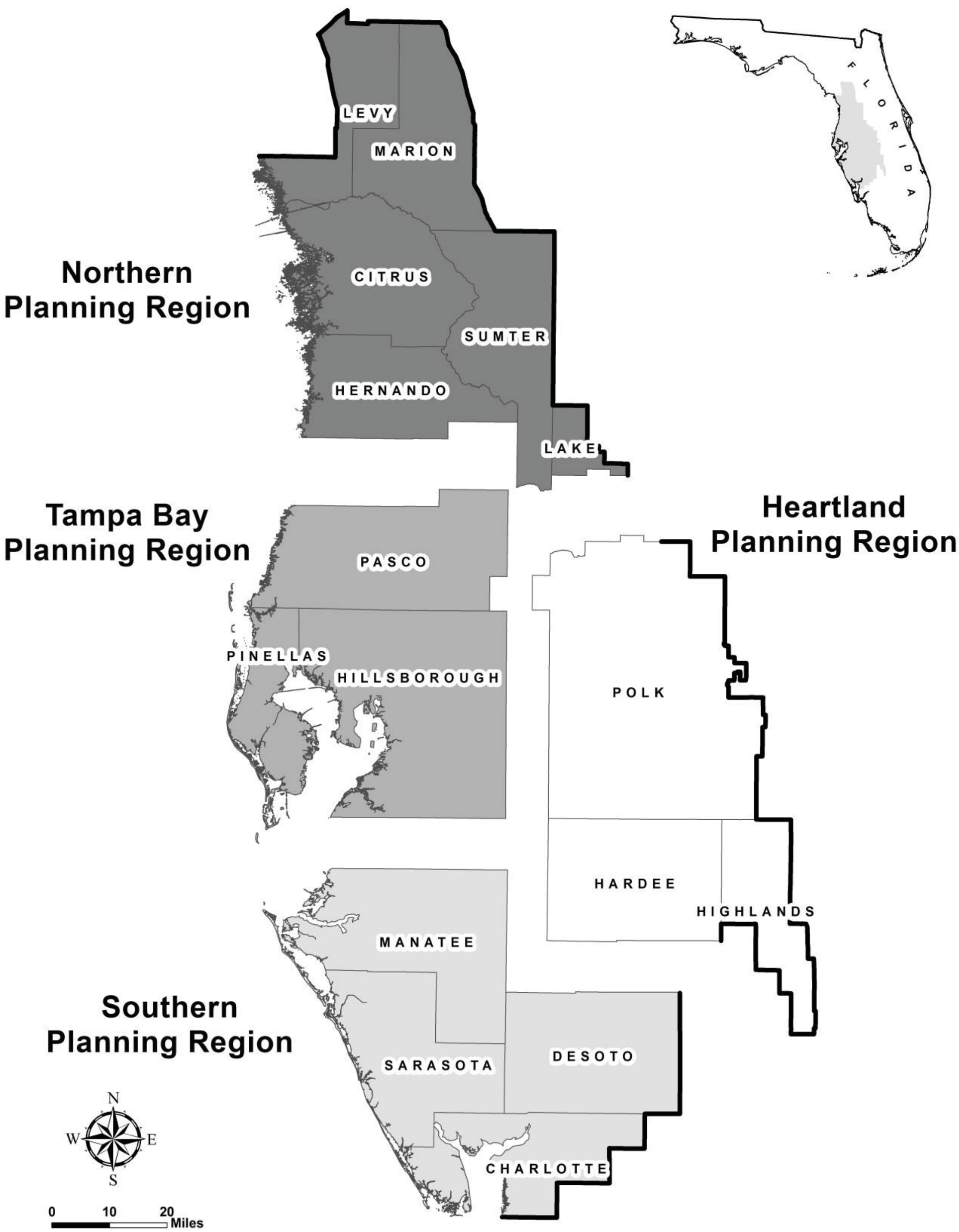


Figure 1-1. *Location of the four water supply planning regions within the District*

Part A. Introduction to the Northern Planning Region RWSP

The following describes the content of the RWSP for the Northern Planning Region:

- Chapter 1, Introduction, contains an overview of water supply planning accomplishments in the planning region prior to the development of this RWSP; a description of the land use, population, physical characteristics, hydrology, geology/hydrogeology of the region; and a description of the technical investigations that provide the basis for the District's water resource management strategies.
- Chapter 2, Resource Protection Criteria, addresses the resource protection strategies that the District has implemented or is considering implementing, including water use caution areas (WUCAs) and the District's minimum flows and levels (MFLs) program.
- Chapter 3, Demand Estimates and Projections is a quantification of existing and reasonably projected water supply demand through the year 2040 for public supply (PS), agricultural, industrial/commercial, mining/dewatering, power generation and landscape/recreation users and environmental restoration.
- Chapter 4, Evaluation of Water Sources, is an evaluation of the future water supply potential of traditional and alternative sources.
- Chapter 5, Water Supply Development Component, presents a list of WSD options for local governments and utilities, including surface and stormwater, reclaimed water and water conservation. For each option, the estimated amount of water available for use and the estimated cost of developing the option are provided.
- Chapter 6 is an overview of WSD projects that are currently under development and receiving District funding assistance.
- Chapter 7, Water Resource Development Component, is an inventory of the District's ongoing data collection and analysis activities and water resource projects that are classified as water resource development.
- Chapter 8, Overview of Funding Mechanisms, provides an estimate of the capital cost of water supply and water resource development projects proposed by the District and its cooperators to meet the water supply demand projected through 2040 and to restore MFLs to impacted natural systems. An overview of mechanisms available to generate the necessary funds to implement these projects is also provided.

Part B. Accomplishments since Completion of the 2015 RWSP

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

Section 1. Conservation and Reclaimed Water Development

1.0 Water Conservation

The District continues to promote and cooperatively fund water conservation efforts to more efficiently use existing water supplies. In the PS sector, for fiscal years 2015-2019, this includes cooperatively funded projects for toilet rebates, rain sensors, water-efficient landscape and irrigation evaluations, evapotranspiration (ET)-based smart irrigation controllers, and Florida Water Star℠ rebates. The District has funded conservation projects undertaken by Citrus and

Marion counties, the Withlacoochee River Water Supply Authority (WRWSA), the Bay Laurel Community Development District, and the North Sumter Utility Development District.

In the agricultural water use sector, the District's primary initiative for water conservation is the Facilitating Agricultural Resource Management Systems (FARMS) Program. Established in 2003 in partnership with the Florida Department of Agriculture and Consumer Services (FDACS), FARMS is a cost-share reimbursement program for production-scale best management practices to reduce groundwater use and improve water quality. These projects predominantly include tailwater recovery systems as an AWS, and precision irrigation systems. To date, more than 194 operational projects Districtwide are providing a groundwater offset of more than 27 million gallons per day (mgd). An additional nine projects in the planning, design or construction phase are expected to yield another 1 (mgd) of offset. Within the Northern Planning Region, FARMS has funded nine operational projects providing 0.24 mgd of offset.

2.0 Reclaimed Water

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

In 2015, utilities within the Northern Planning Region were utilizing approximately 64 percent, or 12 mgd of the 19 mgd, of available wastewater treatment plant flows resulting in an estimated 10 mgd of water resource benefits (81 percent efficiency). There are three reclaimed water projects under development and another six estimated to experience additional future supply growth. The projects will supply more than 6 mgd of additional reclaimed water that is estimated to result in 5 mgd of additional post-2015 potable quality water benefits at a total cost of approximately $16 million.

Section 2. Support for Water Supply Planning

In November 2019, the Withlacoochee Regional Water Supply Authority, with District funding assistance, completed the most recent update to its 2014 RWSP. This plan is a 20-year assessment of water demands and potential water sources for meeting these demands. The objective of the update is to assist water supply utilities within the WRWSA's four-county region by developing implementable water supply options and strategies to meet future demands. Information from the update has been incorporated in this RWSP update for the Northern Planning Region.

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

Section 3. Minimum Flows and Levels Establishment

1.0 Established Minimum Flows and Levels

Minimum flows and water levels (MFLs) established in the planning region during or since 2015 and as of July 18, 2019, include those for Crystal River(Kings Bay Spring Group), Gum Slough (Gum Springs Group), and Rainbow River (Rainbow Spring Group). The District continues to re-evaluate and establish new MFLs per the Priority List and Schedule for the Establishment of Minimum Flows, Minimum Water Levels and Reservations (see Chapter 2, Part B, and Appendix 2).

2.0 Minimum Flows and Levels Recovery Initiatives

All MFLs established in the planning region are currently being met and, therefore, none require recovery strategies. Reduction in groundwater withdrawals from Tampa Bay Water (TBW) wellfields in Pasco County associated with the recovery strategy for the Northern Tampa Bay Water Use Caution Area (NTBWUCA), and reduced water demand for PS in western Hernando County, have had a beneficial effect on groundwater levels, spring flows, and lakes in Hernando County. In addition, groundwater use in the remainder of the Northern Planning Region has generally remained flat or slightly declined over the last five years.

Section 4. Regulatory and Other Initiatives

Since 2011, the District has been working with public water supply utilities, the St. Johns River and South Florida WMDs, FDEP, FDACS, and multiple stakeholders on the Central Florida Water Initiative (CFWI), which includes portions of Polk and Lake counties and all or parts of four other counties in central Florida outside of the District (see Figure 2-3). This is an area where the WMDs have previously determined, through water supply planning efforts and real-time monitoring, that groundwater availability is limited. The CFWI mission is to help protect, develop, conserve and restore central Florida's water resources by collaborating to address central Florida's current and long-term water supply needs. The CFWI is led by a Steering Committee that includes a public water supply utility representative, a Governing Board member from each of the three WMDs, and representatives from FDEP and FDACS. The Steering Committee oversees the CFWI process and provides guidance to the technical teams and technical oversight/management committees that are developing and refining information on central Florida's water resources. The Steering Committee has guided the technical and planning teams in the development of the CFWI RWSP, which ensures the protection of water resources and related natural systems and identifies sustainable water supplies for all water users in the CFWI region through 2040. Those efforts, which are reflected in this 2020 RWSP update for the Northern Planning Region, will lead to adoption of new rules and management strategies. More detailed information concerning the CFWI is available on the CFWI website at http://cfwiwater.com/planning.html.

The District partnered with the WRWSA, The Villages, a large master planned active retirement community located in portions of Sumter, Lake, and Marion counties, and the City of Wildwood to expand groundwater monitoring and data collection in northern Sumter County. This project, called the North Sumter Data Collection Plan, was completed in 2012. In addition, the District continued its deep exploratory drilling and testing program that included several sites close to the boundary between the District and the SJRWMD in Marion and Sumter counties. This is a high-growth area that is hydrogeologically complex. Information gained from this work was incorporated into the Northern District groundwater flow model that was completed in late 2013 (HydroGeoLogic, 2013) and updated in 2016 through a cooperative agreement with the SJRWMD. The model was used in development of the 2020 RWSP to assess current and future groundwater withdrawal impacts on lake levels, spring flows and the Withlacoochee River. The SJRWMD and the District use this tool for MFL evaluations and regional water supply planning.

Part C. Description of the Northern Planning Region

Section 1. Land Use and Population

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

The population of the planning region is projected to grow from approximately 599,932 in 2015 to 873,535 in 2040. This is an increase of approximately 273,603 new residents, a 46 percent increase over the planning period. Marion, Lake and Sumter counties include sections of The Villages retirement communities, the largest residential development in central Florida. The Suncoast Parkway extension, currently under development, may result in an increase in commercial and industrial land uses and bring new residents to Citrus and Levy counties. Residential and commercial development has also been concentrated along U.S. 19 in Hernando and Citrus counties and along SR 200 southwest of Ocala in Marion County.

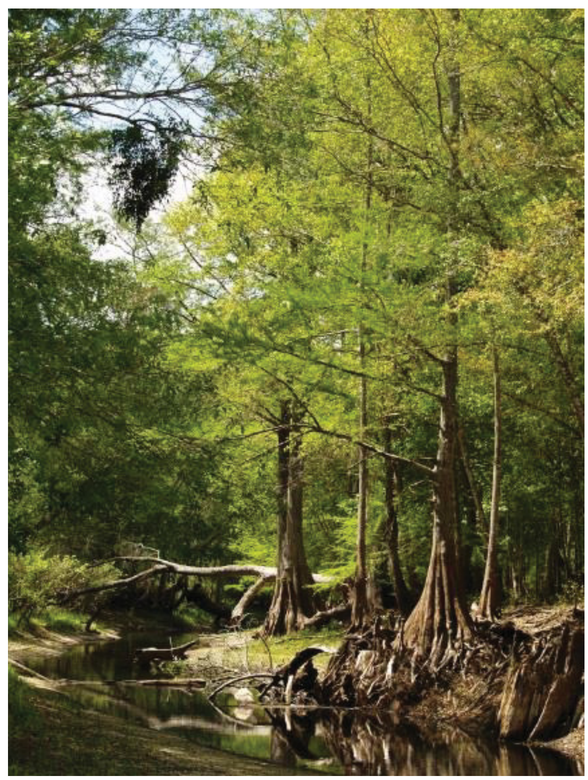
Table 1-1*. Land use/land cover in the Northern Planning Region (2017)*

Land Use/Land Cover Types (2017)	Acres	Percent
Urban and Built-up	416,963.56	24.42
Agriculture	374,476.92	21.93
Rangeland	24,381.30	1.43
Upland Forest	477,045.40	27.94
Water	22,313.08	1.31
Wetlands	338,915.84	19.85
Barren Land	5,263.79	0.31
Transportation, Communication and Utilities	22,423.00	1.31
Industrial and Mining	25,834.37	1.51
Total	**1,707,617.26**	**100**

Source: SWFWMD 2017 LULC GIS layer (SWFWMD, 2019).

Section 2. Physical Characteristics

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



Withlacoochee River watershed

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

Section 3. Hydrology

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

1.0 Rivers

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

2.0 Lakes

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

3.0 Springs

Five first-magnitude springs (discharge exceeds 100 cubic feet per second [cfs]) are located in the planning region. These include the Rainbow Spring Group in Marion County, the Kings Bay Spring Group, Chassahowitzka and Homosassa Spring groups in Citrus County, and the Weeki Wachee Spring Group in Hernando County. The Rainbow Spring Group consists of multiple springs, which are the source of the Rainbow River. The river flows for approximately 5.7 miles before merging with the Withlacoochee River upstream of Lake Rousseau and, based on United States Geological Survey (USGS) data, the river has a median discharge of 676 cfs (437 mgd) from 1931 through 2018.

The Gum Slough springs in Sumter County feed the Withlacoochee River

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

Lake Panasoffkee, Sumter County

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

4.0 Wetlands

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

Extensive hardwood swamps and wet prairies occur throughout the Withlacoochee River watershed. The Green Swamp covers the entire southern end of Sumter County with isolated wetlands typically vegetated by herbaceous plants. Nearly half of Levy County is designated as freshwater wetlands that extend from the forested systems of the Goethe State Forest into

Alachua County. The hardwood-cypress swamps in the Hálpata-Tastanaki tract are a major freshwater system in southwest Marion County.

5.0 Karst Hydrology

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

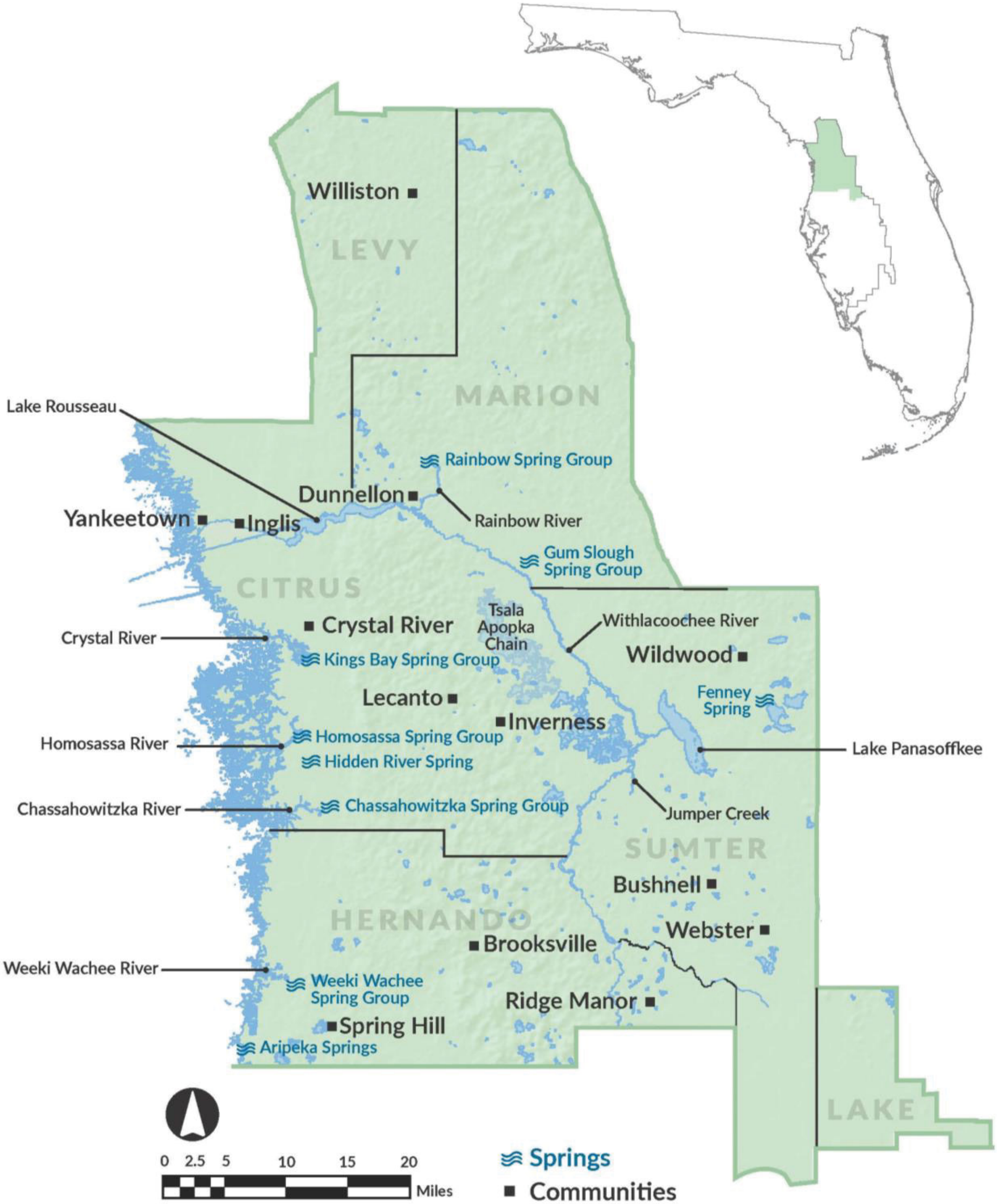


Figure 1-2. *Major hydrologic features in the Northern Planning Region*

Section 4. Geology/Hydrogeology

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

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

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

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

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

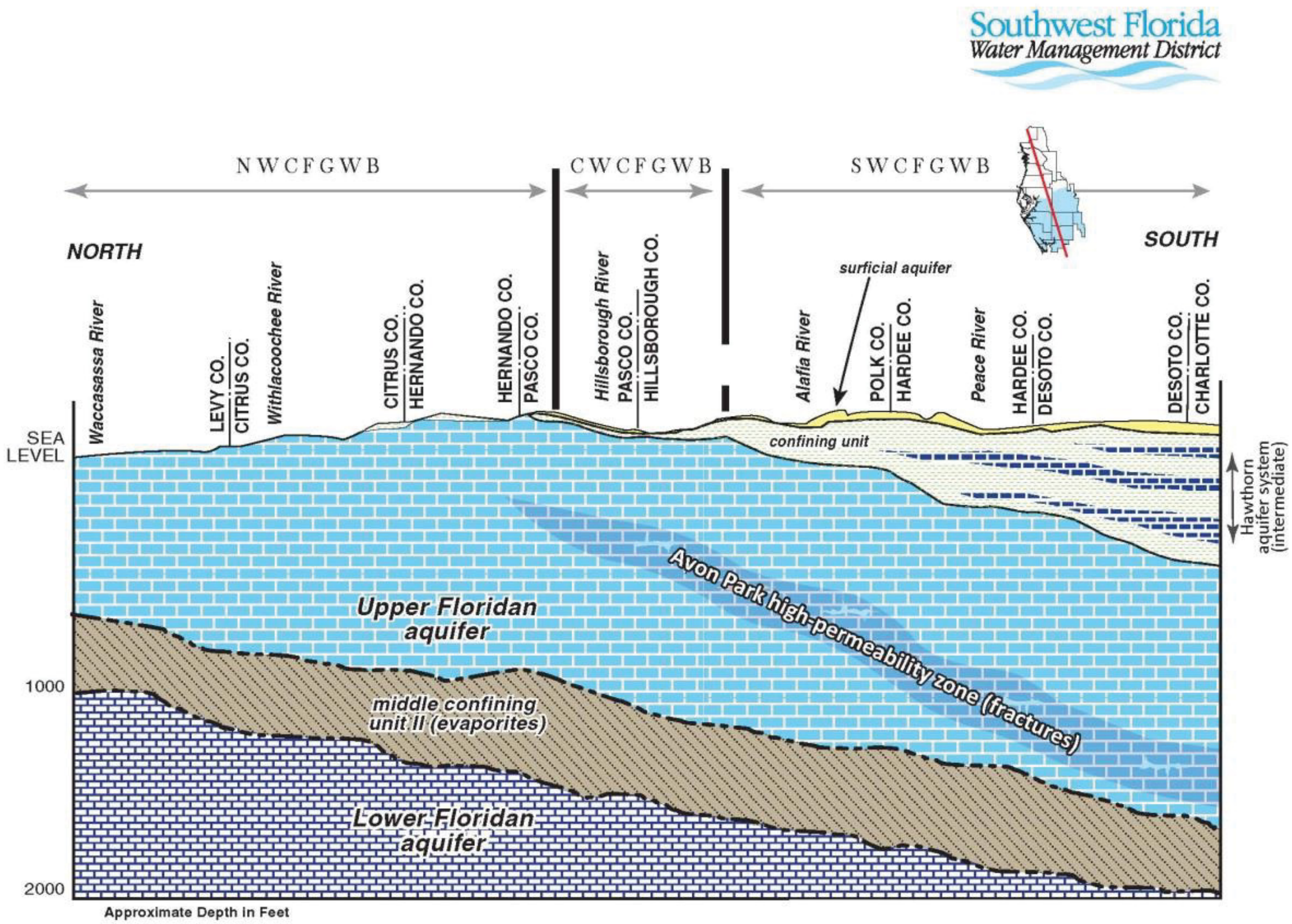


Figure 1-3. *Generalized north-south geologic cross section through the District*

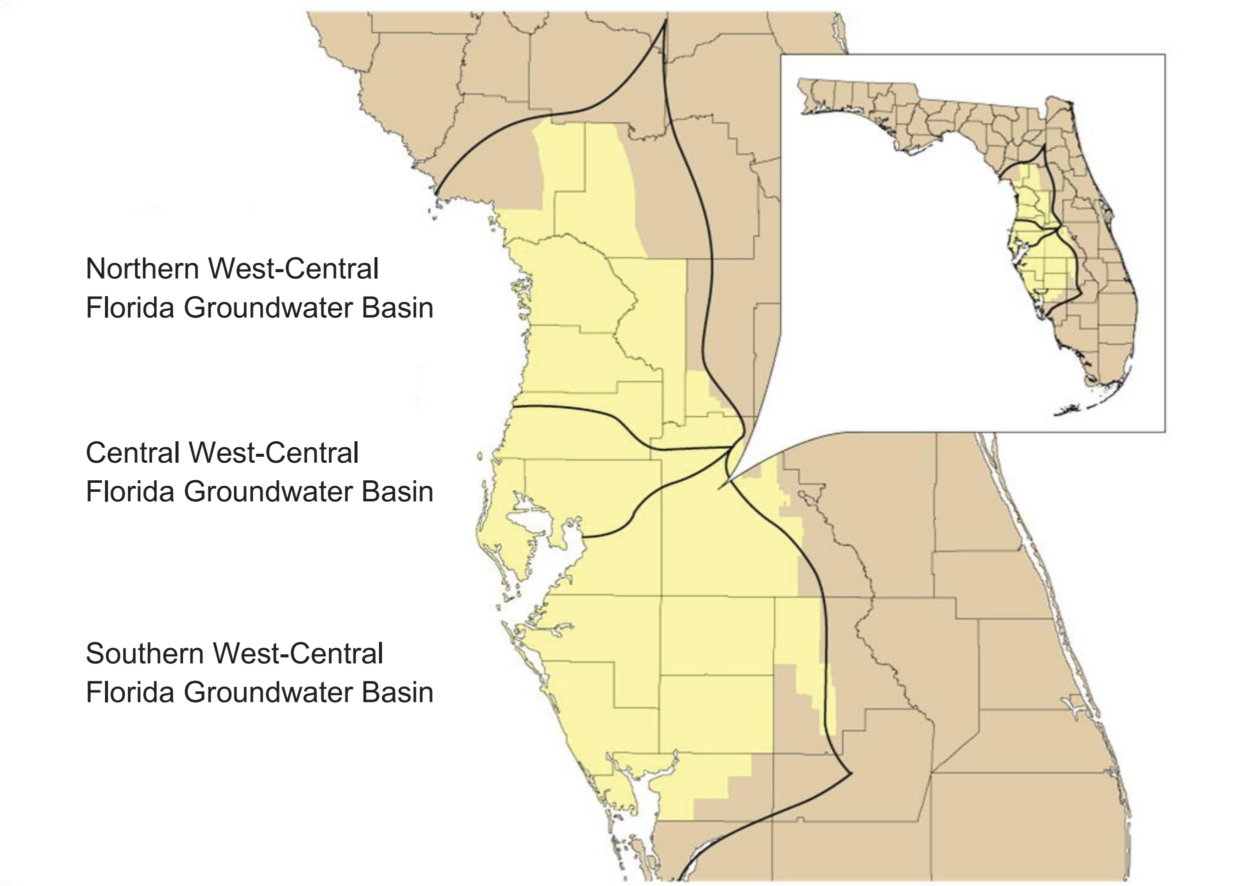


Figure 1-4. *The District and the West-Central Florida Groundwater Basins*

Part D. Previous Technical Investigations

The 2020 RWSP builds on a series of cornerstone technical investigations that were undertaken by the District and the USGS beginning in the 1970s. These investigations have provided the District with an understanding of the complex relationships between human activities (i.e., surface water and groundwater usage and large-scale land-use alterations), climate cycles, aquifer/surface water interactions, aquifer and surface hydrology, and water quality. Investigations conducted in the planning region and in areas adjacent to it are listed by categories and briefly outlined below.

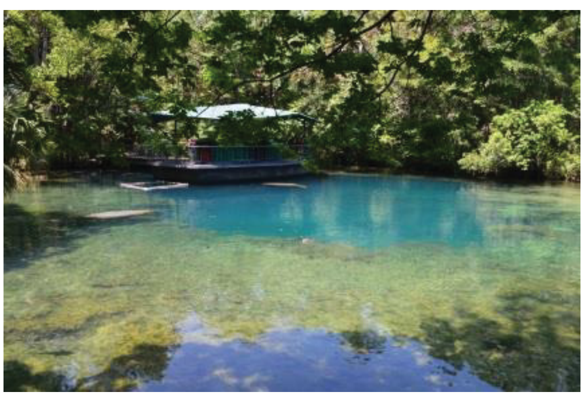
Section 1. Water Resource Investigations

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

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

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

A WRAP is currently being conducted for the Northern Planning Region (NPR) to gain a better understanding of the water resource issues from Pasco County north to Levy County. Exploratory drilling and testing data are being collected to enhance understanding of the groundwater system, characterize the saline water interface, identify areas of poor groundwater quality, determine the nature of flow to major springs, and provide information for regional flow models. This effort will also assist in the evaluation of future water supply planning assessments and MFL establishment. The CFWI is a collaborative approach to study whether the Floridan aquifer system is reaching its sustainable limits of use and exploring the need to develop additional water supplies. The area includes southern Lake, Orange, Osceola, Seminole, and Polk Counties. It is a multi-district effort that includes the St. Johns River, South Florida, and Southwest Florida WMDs. Additionally, stakeholders, such as the FDEP and FDACS, regional public water supply utilities, and others are participating in this collaborative effort that builds on work started for a prior effort called the Central Florida Coordination Area. A CFWI RWSP that included a solutions component was developed in 2015. Current CFWI work is focused on enhancing the regional data collection network and development of the 2020 CFWI RWSP.



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

The District developed a Springs Management Plan (SWFWMD, 2013) that includes Rainbow Springs, Kings Bay, Homosassa Springs, Chassahowitzka Springs, and Weeki Wachee Springs. The plan addresses four priority issues that affect the ecological integrity of the spring systems. The priority issues are flow, water clarity, aquatic vegetation, and fish and wildlife. The plan is a roadmap describing the overall approach the District is taking to conserve and restore the ecology of all springs within its borders. Quantifiable objectives of the plan are aquatic habitat conservation and restoration; MFLs development; water quality standard compliance; and communications plan development. An adaptive management strategy to achieve the objectives is outlined in the plan and it includes planning, monitoring, and restoration components and a list of specific projects.

Section 2. U.S. Geologic Survey Hydrologic Investigations

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

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

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

Section 3. Water Supply Investigations

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

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

Control structure at Tsala-Apopka Outfall

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

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

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

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

The District's 2010 and 2015 RWSP updates (SWFWMD, 2010 and SWFWMD, 2015) extended the planning horizons to 2030 and 2035, respectively, and included four regional volumes covering all counties of the District, based on four planning regions originally defined in previous assessments. For both the 2010 and 2015 RWSPs, it was concluded that the Northern Planning Region demand for water through the respective planning horizons 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.

Section 4. Minimum Flows and Levels Investigations

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

Section 5. Modeling Investigations

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

1.0 Groundwater Flow Models

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

The Northern Planning Region groundwater flow model (also known as the Northern District Model [NDM]) covers the northern half of the District, and portions of the St. Johns and Suwannee River WMDs (HydroGeoLogic, Inc., 2008, 2010, 2011, 2013, Dynamic Solutions Inc. and HydroGeoLogic, Inc., 2016). This model, first completed in 2008, was updated in 2010, 2011, 2013, and most recently in 2016 with version 5. When first developed, the model was unique for west-central Florida in that it was the first regional groundwater flow model that represented 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 LFA. The model was expanded eastward in 2013 to the St. Johns River to encompass all of Marion County through a cooperatively funded agreement between the District, SJRWMD, WRWSA, and Marion County. The model was expanded at the request of Marion County so that one model could be used by both districts for Marion County water resource investigations. The Northern Planning Region model serves as an important tool to examine potential impacts to wetlands, lakes, springs and the Withlacoochee River from regional groundwater withdrawals. The results of these predictions have been used by the District to support water supply planning assessments and establishment of MFLs.

The Districtwide Regulatory Model (DWRM) was developed to produce a regulatory modeling platform that is technically sound, efficient, reliable and has the capability to address cumulative impacts. The DWRM was initially developed in 2003 (Environmental Simulations, Inc., 2004). It is mainly used to evaluate whether requested groundwater withdrawal quantities in water use permit (WUP) applications have the potential to cause unacceptable impacts to existing legal users, off-site land uses and environmental systems on an individual and cumulative basis. The DWRM Versions 1, 2, 2.1, and 3 (Environmental Simulations, Inc., 2004, 2007, 2011, 2014) incorporate Focused Telescopic Mesh Refinement (FTMR), which was developed to enable DWRM to be used as a base model for efficient development of smaller scale sub-models (FTMR models). The FTMR uses a fine grid around a well or group of wells and increasing grid spacing out to the edge of the model. It was specifically designed to enhance WUP analysis. The DWRM Version 3 simulates groundwater flow of the entire District using a quasi-3D conceptualization of the Modular finite Difference Groundwater Flow Model code (MODFLOW2005). The DWRM3 simulates groundwater flow in the surficial, intermediate, Upper Floridan, and Lower Floridan aquifers and supports current regulatory functions as a core business process addressed in the District's Strategic Plan.

2.0 Saltwater Intrusion Models

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

3.0 Integrated Groundwater/Surface Water Models

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

Chapter 2. Resource Protection Criteria

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

Part A. Water Use Caution Areas

Section 1. Definitions and History

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

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

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

Rural agricultural and pasture lands in the Northern Planning Region

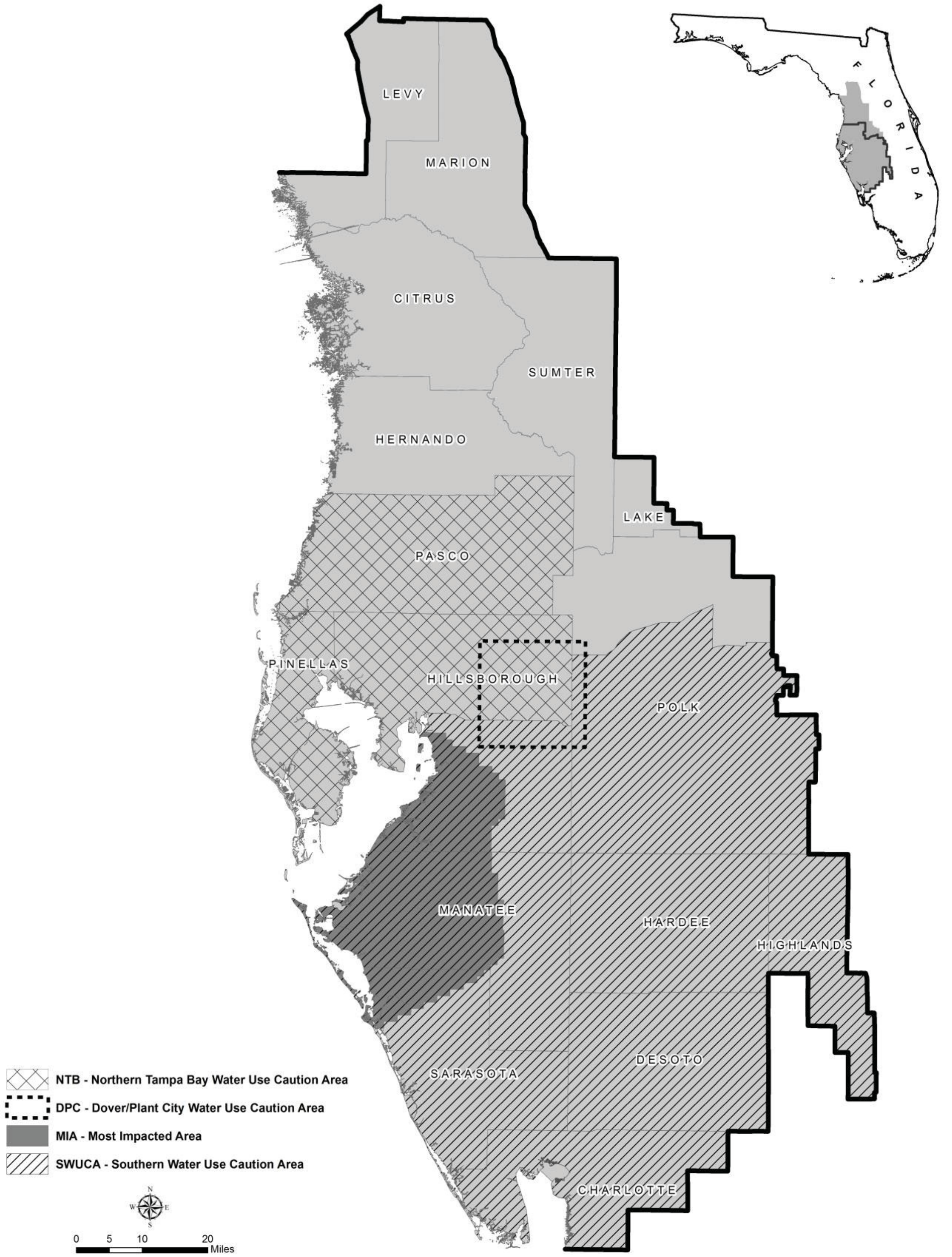


Figure 2-1. *Location of the District's water use caution areas and the MIA of the SWUCA*

Part B. Minimum Flows and Levels

Section 1. Definitions and History

Section 373.042 of the Florida Water Resources Act of 1972 (Chapter 373, F.S.), directs the Florida Department of Environmental Protection (FDEP) or the water management districts (WMDs) to establish minimum flows or minimum water levels, i.e., MFLs, for priority water bodies using the best available information. The minimum flow for a given watercourse is defined by statute as the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. The minimum water level of an aquifer or surface waterbody is similarly defined by statute as the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

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

Section 2. Priority Setting Process

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

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

The updated priority list and schedule is submitted to FDEP for approval by November 15th each year and, as required by statute, is published in the District's Consolidated Annual Report. The District's current priority list and schedule is also posted in the District website and is included in the Chapter 2 Appendix to this RWSP.

Section 3. Technical Approach to the Establishment of Minimum Flows and Levels

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

The District's technical approach for MFLs development assumes that alternative hydrologic regimes may exist that differ from historic conditions but are sufficient to protect water resource features from significant harm. For example, consider a historic condition for an unaltered river or lake system with no 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 includes water levels of flows that are lower or less than those of the historic regime, but which protects the water resources and ecology of the system from significant harm. This threshold regime could conceptually allow for water withdrawals, while protecting the water resources and ecology of the area. MFLs established based on such a hydrologic regime may therefore represent minimum acceptable, rather than historic or potentially optimal, hydrologic conditions.

1.0 Scientific Peer Review

Section 373.042(4), F.S., permits affected parties to request independent scientific peer review of the scientific and technical data and methodologies used to establish MFLs. In addition, the District or FDEP may decide to voluntarily subject MFLs to independent scientific peer review, based on guidelines provided in Rule 62-40.473, F.A.C.

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

Section 4. Established and Proposed Minimum Flows and Levels

Figure 2-2 depicts priority MFLs water resources that are in or partially within the Northern 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 within or extending into the planning region include the:

- Chassahowitzka River / Chassahowitzka Spring Group / Blind Spring;
- Crystal River / Kings Bay Spring Group;
- Gum Slough Spring Run;
- Homosassa River, Homosassa Spring Group;
- Rainbow River / Rainbow Spring Group;
- Weeki Wachee River / Weeki Wachee Springs Group;

- 4 Citrus County lakes (Fort Cooper, Tsala Apopka Florida City Pool, Tsala Apopka Inverness Pool, and Tsala Apopka Hernando Pool):
- 8 Hernando County lakes (Hunters, Lindsey, Mountain, Neff, Spring, Tooke, Weekiwachee Prairie, and Whitehurst);
- 1 Levy County lake (Marion);
- 3 Marion County lakes (Bonable, Little Bonable, and Tiger); and
- 6 Sumter County lakes (Big Gant, Black, Deaton, Miona, Okahumpka, and Panasofkee).

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

- Withlacoochee River (lower segment);
- Withlacoochee River (three upper segments; located partially in the Tampa Bay Planning Region and Heartland Planning Region)

Jenkins Creek

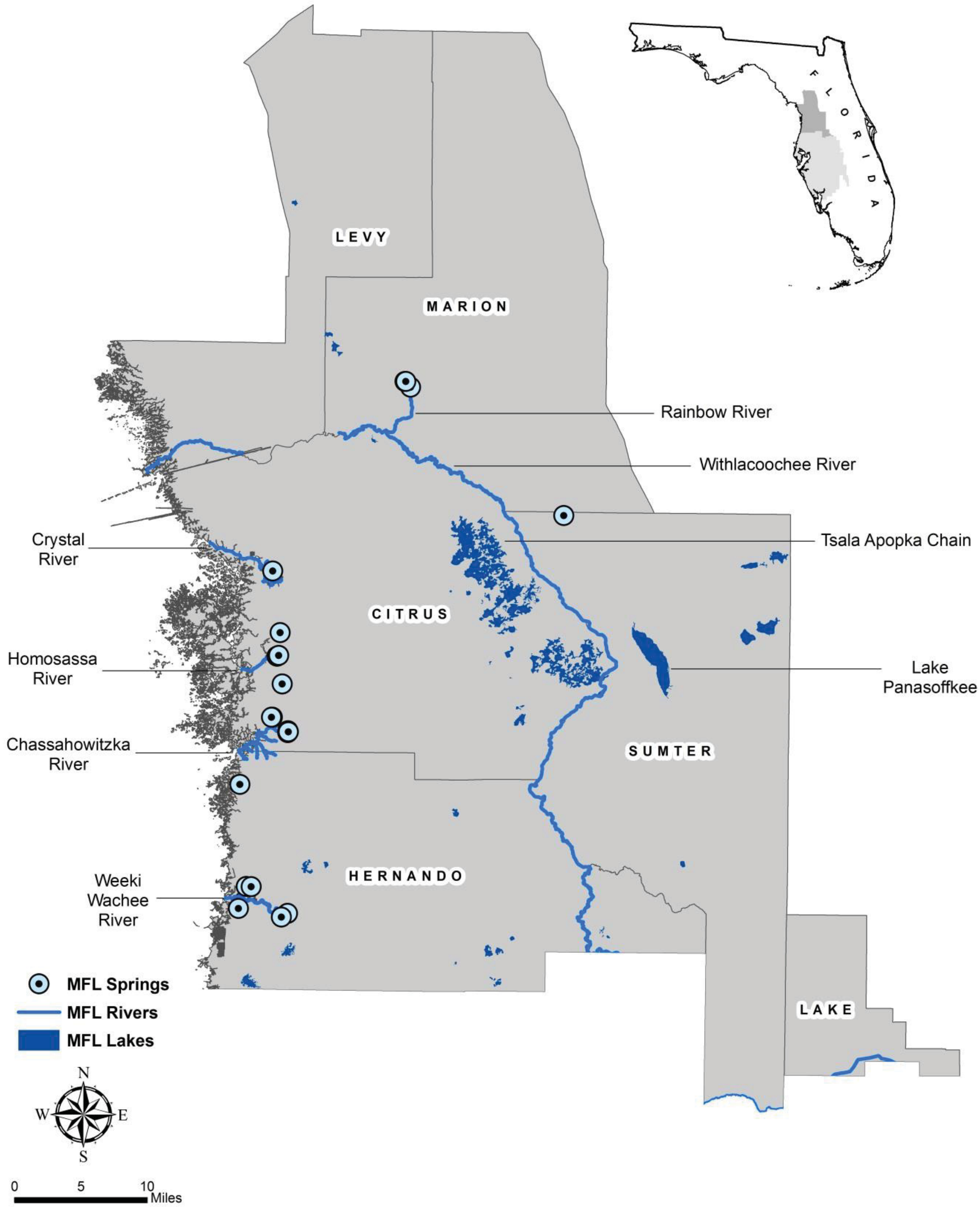


Figure 2-2. *MFL priority water resources in the Northern Planning Region*

Part C. Prevention and Recovery Strategies

Section 1. Prevention Activities

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

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

1.0 Northern Planning Region Strategy

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

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

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

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

2.0 Withlacoochee Regional Water Supply Authority Master Regional Water Supply Planning and Implementation Program

The District cooperated with the WRWSA to update the WRWSA RWSP for 2019. The plan reviews potential water supply project options based on 2040 population projections and possible member partnerships. The update addresses how conservation and water reuse can prolong the availability of current water resources. An assessment of PS water conservation in the WRWSA four-county region was conducted for the planning period using the Water Conservation Tracking Tool that was developed by the Alliance for Water Efficiency. The update includes recently studied Lower Floridan aquifer resources in its list of water supply project options, along with options for traditional groundwater, desalination, surface water, conservation, and reclaimed water availability based on updated population and MFLs criteria. The update incorporated numerous changes to regulatory and economic factors affecting demands and source availability. Cost estimates and supply quantities for project options were recalculated by the WRWSA and are incorporated within the District's 2020 RWSP.

The WRWSA first developed their Master Regional Water Supply Plan in 1995, and a 2005 Regional Water Supply Master Plan Update was completed in March 2007. A 2010 Feasibility Analysis was developed following Marion County’s inclusion into the WRWSA in 2008 and provided a revised list of proposed water supply, reclaimed water optimization, and water conservation options. Each update included population projections for Authority members, the associated water demands, and water supply options that could be developed to meet those demands. The 2014 and 2019 updates continue the WRWSA’s efforts to provide a regional approach to planning and developing cost-effective, sustainable water supplies for its member governments.

Northern Planning Region modeling and technical support for local communities is being conducted simultaneously with the WRWSA water supply planning efforts. The District entered into a cooperative agreement with the SJRWMD, Marion County, and the WRWSA to expand and recalibrate the Northern District groundwater model eastward to the St. Johns River in 2013. This project was completed in November 2013, and the final report and model files were submitted to all parties. The Northern District version 4.0 model has been run from non-pumping to 2035 pumping conditions to note regional changes in aquifer levels, springflow, and Withlacoochee River flow. This information was used by the WRWSA to update groundwater availability in their 2014 RWSP. As part of the District’s 2020 RWSP update, the Northern District version 5.0 model, completed in 2016, was run from non-pumping to 2040 pumping conditions to note regional changes in aquifer levels, springflow, and Withlacoochee River flow. The District again worked cooperatively with the WRWSA for their 2019 RWSP update. In addition to joint groundwater modeling efforts, the WRWSA provides qualified expertise and technical support to local member communities to help them prepare and interpret technical modeling data.

3.0 Springs Management

There are more than 150 documented springs within the District. Most of these springs have experienced significant ecological changes over the past half century as a result of natural variability and human activities. The District developed a Springs Management Plan in 2013 (SWFWMD, 2013) that included a general restoration strategy, an overview of the goals and issues, and a list of proposed projects for the five-year period from 2013-2017. The plan recognizes the need to manage all springs within the District; however, it places a priority on the five first-magnitude spring groups: Rainbow, Kings Bay, Homosassa, Chassahowitzka, and Weeki Wachee. The vision for this effort is to conserve and restore the ecological balance of spring systems, thereby supporting regional economies and quality of life.

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

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

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

Section 2. Recovery Strategies

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

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

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

Part D. Reservations

Subsection 373.223(4), F.S., authorizes reservations of water by providing as follows: “The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety…” Reservations of water are established by rule.

The District will consider establishing a reservation of water when a District water resource development project will produce water needed to achieve adopted MFLs. The rule-making process associated with reservation adoption allows for public input to the Governing Board in its deliberations about establishing a reservation including, among other matters, the amount of water to be reserved and the time of year the reservation would be effective. When a reservation is established and incorporated into Rule 40D-2.302, F.A.C., only those water use withdrawals that do not reduce the reserved quantity can be evaluated for permitting. There are currently no plans to establish a reservation in the Northern Planning Region.

Part E. Climate Change

Section 1. Overview

Climate change has been a growing global concern for several decades. According to the Intergovernmental Panel on Climate Change (IPCC), the global mean average land and ocean temperatures have likely increased approximately 1.4 to 2.2°F from pre-industrial levels (IPCC, 2018). Such increases are driving a slow but persistent increase in sea levels and are altering precipitation regimes. These conditions will likely have local impacts including changes to natural habitats, encroachment of seawater into surface and groundwater resources, risk to public infrastructure, warmer temperatures that increase evaporation and impact agriculture, and changes to seasonal and annual rainfall patterns. Climate change is a global issue that requires international coordination and planning, although strategies for assessing vulnerabilities and developing adaptation plans are necessary on the local, regional, and statewide level.

In recent years, numerous agencies and organizations in Florida have developed initiatives to address climate change. Many of the state’s Regional Planning Councils (RPCs) have pooled resources and are developing vulnerability assessments, climate adaptation plans, and post-disaster redevelopment plans for member communities. The Florida Department of Environmental Protection’s Community Resilience Initiative provides planning tools and promotes collaboration among RPCs and coastal communities. The WMDs and other agencies participate in focus groups organized by RPCs, Florida Sea Grant, and other entities to consolidate climate information, develop consistent approaches to planning, and provide technical expertise when appropriate. Other participants in these initiatives include the National Weather Service; regional water supply authorities; state universities; and Florida Fish and Wildlife Conservation Commission, Department of Transportation, Department of Health, Department of Environmental Protection, and the Division of Emergency Management.

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

Section 2. Possible Effects

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

1.0 Sea Level Rise

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

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

Sea level rise is projected to occur relatively slowly, although persistently, which allows time to thoroughly evaluate the impacts to natural resources and public infrastructure, plan and implement adaptation strategies, and continue to use most existing coastal infrastructure for several decades. The cost of initiating sea level rise planning or incorporating it into other existing efforts is relatively low compared to disaster recovery efforts.

2.0 Air Temperature Rise

The IPCC estimates that current green-house emission levels will cause mean global air temperatures to reach or stabilize at approximately 2.7°F above pre-industrial levels (1850-1900) by the end of this century, with greatest warming at inland and polar regions (IPCC, 2018). The impacts to southwest Florida will likely be more hot days and few cold days seasonally. Evaporation is likely to increase with a warmer climate, which could result in lower surface water levels and increased irrigation demand. Increased evaporation is likely to impact stormwater runoff, soil moisture, groundwater recharge, and reservoir storage losses (Bates et al., 2008). Additionally, higher air temperatures may exacerbate algal blooms and declines in reservoir water quality that could raise treatment costs for potable water supply.

3.0 Precipitation Regimes and Storm Frequency

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

Warming temperatures in the Atlantic and Gulf of Mexico can increase the likelihood of intense tropical storms and hurricanes that can generate storm surge, strong winds, and heavily concentrated rainfall. Hurricane activity near Southwest Florida is statistically more common during AMO warm periods. Higher summer temperatures and humidity may also increase the frequency of local convective weather events, resulting in thunderstorms, higher peak surface water flows, and increased flooding in some areas (Groisman et al., 2005).

Section 3. Current Management Strategies

The District has taken several steps to address the management of water resources that will also benefit efforts to plan and prepare for climate change impacts. First, the District's data collection and monitoring activities are likely to provide information critical to monitoring and responding to local climate change. Long-established networks of rainfall and streamflow gauge stations, many with real-time electronic reporting, provide continuous streams of data that will enable the District to monitor changes in local hydrology. In addition to monitoring rivers, lakes, springs, and wetlands to ensure adequate water for natural systems and human use, the District has an extensive network of coastal and inland surface and groundwater monitoring sites to collect and analyze water quality data, including information about saltwater intrusion. In those places where water quantity and quality issues become evident due to groundwater withdrawal impacts, 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 due to regional saltwater intrusion occuring in southwest Hillsborough, Manatee, and northwest Sarasota Counties. 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 (AR), and seawater desalination.

Section 4. Future Adaptive Management Strategies

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

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

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

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

Part F. Central Florida Water Initiative

Section 1. Formation

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

- Review and update the 2015 CFWI RWSP as well as the sustainable quantities of traditional groundwater sources available in the CFWI area that can be used without causing unacceptable harm to the water resources and associated natural systems.
- Monitor progress of regional strategies and solutions identified in the 2015 CFWI Plan; review and update strategies to meet water demands that are in excess of the sustainable yield of existing traditional groundwater sources.
- Establish consistent rules and regulations for the three WMDs that meet the Collaborative Process Goals and implement the results of this CFWI.
- Encourage funding for regional strategies necessary to achieve the objectives of the CFWI.

Section 2. Central Florida Water Initiative Regional Water Supply Plan

The first ever RWSP for the CFWI Planning Area was prepared and approved in 2015. The 2015 CFWI RWSP addressed water demand estimates and projections, assessment of water resources and, in conjunction with a Solutions Plan component, development of feasible water supply and water resource development options that would meet future water supply needs in a manner that sustains the water resources and related natural systems. Modeling results and groundwater availability assessments concluded that fresh groundwater resources alone cannot meet future water demands in the CFWI Planning Area without resulting in unacceptable impacts to water resources and related natural systems. Assessments identified areas susceptible to the effects of groundwater withdrawals, including the Wekiva Springs/River System, western Seminole and Orange counties, southern Lake County, the Lake Wales Ridge, and the portion of the SWUCA in Polk County. The evaluations also indicated that expansion of withdrawals associated with projected demands through 2035 could increase the existing areas of water resource stress within the CFWI Planning Area. The 2015 CFWI RWSP identified 142 potential

WSD project options that could potentially provide up to 411 million gallons per day of additional water supply, including maximized use of reclaimed water, increased water storage capacity, limited use of fresh and brackish groundwater, use of surface water, and use of desalinated seawater.

The CFWI Solutions Planning Team, consisting of representatives from the WMDs, FDEP, FDACS, PS utilities, the agricultural industry, environmental groups, business representatives, and regional leaders used the 2015 CFWI RWSP to further develop specific water supply projects through partnerships with water users. The final work product of the Solutions Planning Team was the CFWI 2035 Water Resources Protection and Water Supply Strategies document, which was incorporated into the CFWI RWSP. The document also includes the necessary financing, cost estimates, potential sources, feasibility and permitting analysis, identification of governance structure options, and any potential recovery needs. The 2020 CFWI RWSP is currently under development, with ongoing coordination occurring to ensure consistency is maintained between the CFWI RWSP and the District's RWSP.

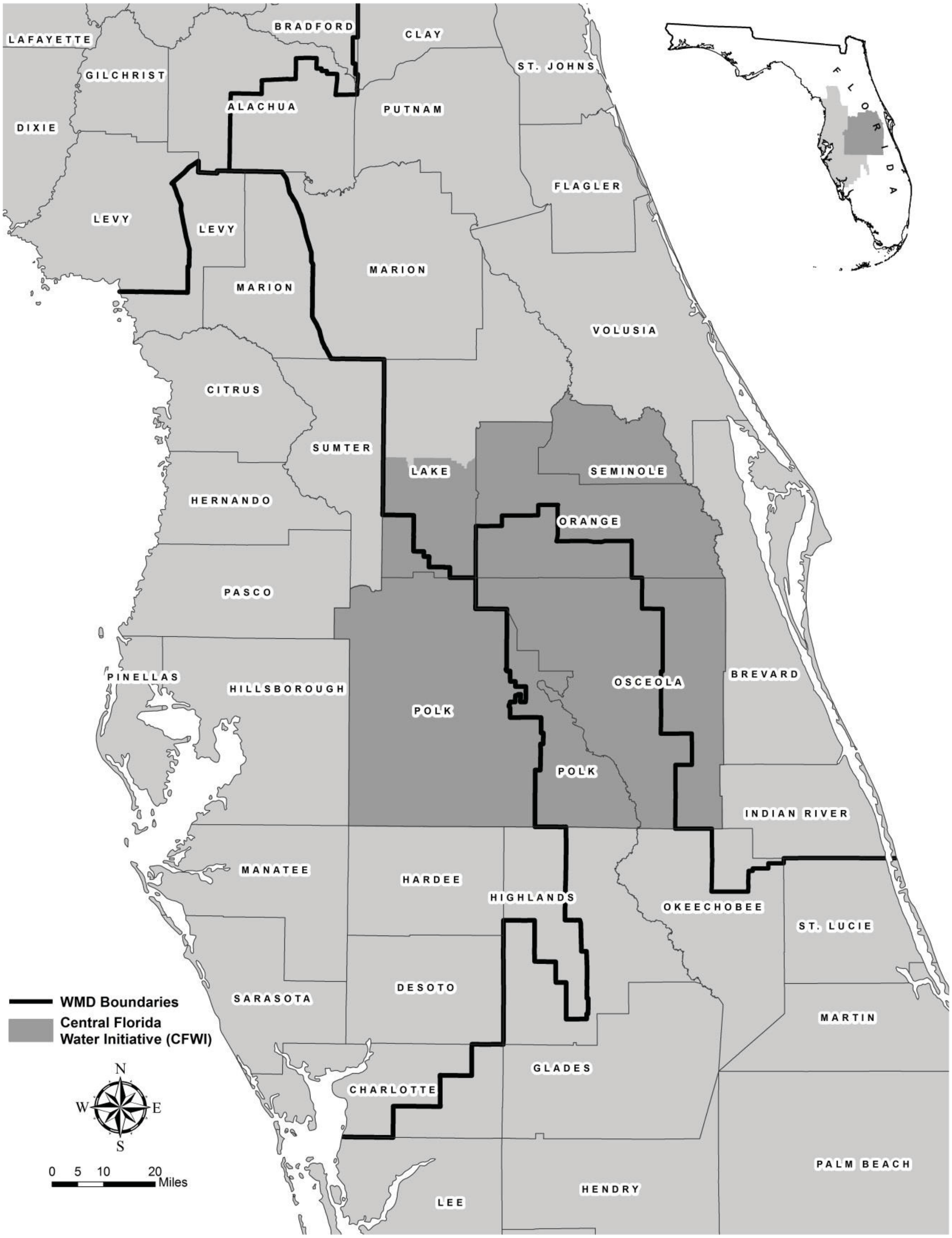


Figure 2-3. *Location of the Central Florida Water Initiative Area*

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Chapter 3. Demand Estimates and Projections

This chapter is a comprehensive analysis of the demand for water for all use categories in the Northern Planning Region for the 2015 to 2040 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 (PS), agricultural (AG), industrial/commercial (I/C), mining/dewatering (M/D), power generation (PG) and landscape/recreation (L/R) sector for each county in the planning region. An additional water use sector, environmental restoration (ER), comprises quantities of water that need to be developed and/or retired to meet established minimum flows and levels (MFLs). The ER demand could increase during the planning period based on the recovery requirements of MFLs established in future years. The methodologies used to project demand for each category are briefly summarized in this chapter and presented in greater detail in the Chapter 3 Appendix.

The demand projections represent those reasonable and beneficial uses of water that are anticipated to occur through the year 2040. The District determined 5-in-10 (average condition) and 1-in-10 (drought condition) demands for each five-year increment from 2015 to 2040 for each sector. The demand projections for counties located partially in other water management districts (WMDs) (Lake, Levy and Marion) reflect only the anticipated demands in those portions located within the District's boundaries.

General reporting conventions for the Regional Water Supply Plan (RWSP) were guided by the document developed by the Water Planning Coordination Group: Final Report: Development and Reporting of Water Demand Projections in Florida's Water Supply Planning Process (WPCG, 2005). This document was produced by the Water Demand Projection Subcommittee of the Water Planning Coordination Group, a subcommittee consisting of representatives from the WMDs and the Florida Department of Environmental Protection (FDEP), 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 2015 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 2015; whereas, data for the years 2020 through 2040 are projected demands.
- Water use reporting thresholds: Minimum thresholds of water use within each water use category were agreed upon as the basis for projection.
- 5-in-10 versus 1-in-10: For reporting demand in average versus drought conditions, specific parameters were prescribed for at least a portion of the demand related to all water supply categories except I/C, M/D, and PG. In general, demand is reported for a 5-in-10 average annual effective rainfall condition and a 1-in-10 drought year condition (an increase in water demand having a 10 percent probability of occurring during any given year).

The projected demand represents the total amount of water required to meet reasonable and beneficial water needs through 2040. Total demand does not account for reductions that could be achieved by additional demand management measures. Water conservation and other sources are accounted for separately in Chapter 4, as a means by which demand can be met.

Part A. Water Demand Projections

Demand projections were developed for five sectors: (1) PS, (2) AG, (3) I/C, M/D and PG, (4) L/R and (5) 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 PS sector consists of four subcategories: (1) large utilities (permitted for 0.1 million gallons per day [mgd] or greater), (2) small utilities (permitted for less than 0.1 mgd), (3) domestic self-supply (DSS) (individual private homes or businesses that are not utility customers that receive their water from small wells that do not require a water use permit [WUP]) and (4) additional irrigation demand (water from domestic wells that do not require a WUP and used for irrigation by residences that rely on a utility for indoor and other non-irrigation water needs).

2.0 Population Projections

2.1 Base Year Population

All WMDs agreed that 2015 would be the base year from which projections would be determined. The District calculated the 2015 population by extrapolating back from GIS Associates, Inc.'s 2016 population estimate. Utilities with permitted quantities less than 100,000 gallons per day (gpd) are not required to report population or submit service area information. Consequently, population was obtained from the previously issued permit.

2.2 Methodology for Projecting Population

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

3.0 2015 Base Year Water Use and Per Capita Rate

3.1 Base Year Water Use

The 2015 PS base year water use for each large utility is derived by multiplying the average 2011-2015 unadjusted gross per capita rate by the 2015 estimated population for each individual utility. For small utilities, per capita information is found in the last issued permit. If no per capita information is available, the per capita is assumed to equal the average county per capita. Base year water use for small utilities is obtained by multiplying the per capita from the current permit by the 2015 estimated population from the last issued permit. Domestic self-supply (DSS) base year is calculated by multiplying the 2015 DSS population for each county by the average 2011-2015 residential countywide per capita water use.

4.0 Water Demand Projection Methodology

4.1 Public Supply

Water demand is projected in five-year increments from 2020 to 2040. To develop the projections, the District used the 2011-2015 average per capita rate multiplied by the projected population for that increment. An additional component of public water supply demand is water derived from domestic wells for irrigation. These wells have a diameter of less than 6 inches, do not require a WUP and are used for irrigation at residences that receive potable water for indoor use from a utility. 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

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

5.0 Water Demand Projections

Table 3-1 presents the projected PS demand for the planning period. The table shows that demand will increase by 41.2 percent or 36.77 mgd for the 5-in-10 condition. These projections are lower than those in the District's 2015 RWSP. The differences can be attributed to slower than anticipated regional population growth 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 PS demand, DSS, and private irrigation wells in the Northern Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Citrus	19.95	21.14	20.87	22.13	21.74	23.04	22.46	23.81	23.06	24.44	23.53	24.95	3.59	3.80	27.2%	27.2%
Hernando	24.32	25.78	26.20	27.77	27.94	29.62	29.42	31.19	30.75	32.60	31.88	33.80	7.57	8.02	31.1%	31.1%
Lake	0.14	0.15	0.17	0.18	0.20	0.21	0.24	0.25	0.27	0.29	0.31	0.33	0.17	0.18	121.4%	121.4%
Levy	1.62	1.72	1.68	1.78	1.73	1.83	1.77	1.87	1.80	1.91	1.82	1.93	0.20	0.21	12.4%	12.4%
Marion	15.21	16.13	16.69	17.69	18.01	19.09	19.16	20.30	20.25	21.47	21.29	22.56	6.07	6.44	39.9%	39.9%
Sumter	27.96	29.64	33.05	35.03	37.15	39.38	40.63	43.07	44.10	46.75	47.14	49.97	19.18	20.33	68.6%	68.6%
Total	**89.20**	**94.56**	**98.66**	**104.58**	**106.77**	**113.17**	**113.68**	**120.49**	**120.23**	**127.46**	**125.97**	**133.54**	**36.77**	**38.98**	**41.22%**	**41.22%**

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 PS. Included in this category are irrigated crops and other miscellaneous water uses associated with agricultural commodity production within the District. Irrigation demand was determined and reported in the RWSP for each of the following major categories of irrigated crops: (1) citrus, (2) field crops, (3), fruits (non-citrus), (4) greenhouse/nursery, (5) hay, (6) potatoes, (7) sod, and (8) fresh market vegetables. Most of these crop categories are self-explanatory, but some include several crops which are grouped together for reporting purposes by Florida Department of Agriculture and Consumer Services (FDACS). The fruits category includes several prominent crops in the District, such as strawberries, blueberries, and peaches, and the fresh market vegetables category includes tomato production along with cucumbers, peppers and other vegetables. Water demands associated with non-irrigated agriculture such as aquaculture and livestock 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. Acreage projections were developed by the FDACS as part of the Florida Statewide Agricultural Irrigation Demand (FSAID5) projections through 2040. These projections were based on trends in historic National Agricultural Statistics Service irrigated acreage data. Irrigation requirements were adjusted from the FSAID5 demands and were based on permit-level metered water use data. Where possible, permit by permit water use rates were maintained, and in non-metered operations, average application rates were developed for each crop category by county. Per acre water use for each crop category was held constant, and changes in projected water demands are based on increases of decreases in irrigated acreages for each crop type. The methodologies are described and data provided in more detail in Appendix 3-1.

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

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

3.0 Water Demand Projections

Agriculture in the Northern Planning Region has historically been practiced at a considerably smaller scale than in the District's planning regions to the south, however, FDACS projects that irrigated acreage in the planning region is expected to increase significantly over the 2016 to 2040 timeframe. Irrigated acreage is expected to increase by nearly sixty percent, from 22,700 acres in 2016 to over 36,000 acres in 2040. This projection indicates that the Northern Planning Region would be the fastest growing agricultural region in the District. Total agricultural water use in this region has been relatively steady in this region since the 1990s and has hovered between 20 and 30 mgd from 2001 to 2014 depending on rainfall patterns. There was a slight decrease in water use in the 2014-2016 range, when average water use was about 19 mgd.

Current average year demands are estimated at 18.4 mgd for 2016 acreage levels. In 2040, the District projects that the projected increase in acreage will result in a 45 percent increase in water demands to about 26.7 mgd for a typical year. Most of the increase in acreage will be in fresh market vegetables and field crops, with smaller increases in hay and fruits (likely blueberries). Field crops are expected to continue to make up the majority of irrigated acres. FDACS forecasts that the SWFWMD portions of Levy and Marion counties will gain nearly 14,000 acres of irrigated land, while Sumter county is expected to have a 50 percent decrease in irrigated acreage of about 1,900 acres. The Northern Planning Region lies north of the freeze line and has historically had significantly different agricultural patterns than counties further to the south, with significantly more field crop production and minimal citrus acreage. Additionally, the Northern Planning Region is located farther from the Tampa-Orlando I-4 corridor and experiences less development pressure than more urban areas, with the exception of The Villages development and surrounding areas. These trends are expected to continue into the future as irrigated agriculture expands in the region. Table 3-2 displays projected combined agricultural irrigation and non-irrigation demands for the 5-in-10 (average) and 1-in-10 (drought) conditions for the planning period.

4.0 Stakeholder Review

District staff began presenting draft agricultural demand projections to our Agricultural and Green Industry Advisory Committee, permit evaluation staff, and FDACS staff in September 2018. The District additionally requested input from the Agricultural and Green Industry Advisory Committee on the FSAID5 water use projections and methodology as well as the adjusted FSAID 5 method developed by the District. The Committee wished to take time to consider the proposed methods and adjourned to solicit feedback from industry groups and other stakeholders. In October 2018, the Committee reconvened, and District staff provided an additional presentation on the potential agricultural projections methods and draft results. Stakeholders present included representatives from the Florida Turfgrass Association, Florida Citrus Mutual, the Florida Strawberry Growers Association, the Florida Nursery Growers and Landscape Association, and the University of Florida IFAS, among others. After discussion, the Agricultural and Green Industry Advisory

Committee voted to support the District's updated Agricultural Water Demands Projections Methodology based on the FSAID V projected acreages and adjustments to incorporated District metered water use data. The vote was passed unanimously. Additionally, the District consulted with staff from the FDACS Office of Agricultural Water Policy on the proposed method, and FDACS accented to the Districts' method based on FSAID5 acreage projections, and District metered water use data.

Non-irrigation agricultural demand includes livestock watering

Table 3-2. *Projected agricultural demand in the Northern Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Citrus	1.62	2.12	1.74	2.28	1.77	2.31	1.80	2.35	1.83	2.39	1.88	2.46	0.26	0.34	16.0%	16.0%
Hernando	1.87	2.36	2.07	2.62	2.25	2.87	2.53	3.21	2.78	3.52	3.04	3.85	1.17	1.49	62.6%	63.1%
Lake[1]	0.66	0.96	0.59	0.86	0.51	0.74	0.31	0.43	0.31	0.43	0.28	0.39	-0.38	-0.57	-57.6%	-59.4%
Levy	7.27	9.07	7.82	9.78	8.27	10.36	8.92	11.2	9.87	12.43	10.62	13.39	3.35	4.32	46.1%	47.6%
Marion	1.7	2.11	2.99	3.74	4.13	5.22	5.31	6.77	6.27	8.04	7.4	9.51	5.70	7.40	335.3%	350.7%
Sumter	5.32	6.06	4.96	5.64	4.72	5.35	4.31	4.85	3.89	4.35	3.49	3.87	-1.83	-2.19	-34.4%	-36.1%
Total	**18.44**	**22.68**	**20.17**	**24.92**	**21.65**	**26.85**	**23.18**	**28.81**	**24.95**	**31.16**	**26.71**	**33.47**	**8.27**	**10.79**	**44.8**	**47.6%**

[1] Lake County projections derived from the 2020 CFWI RWSP (March 2020).

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

Section 3. Industrial/Commercial and Mining/Dewatering

1.0 Description of the Industrial/Commercial and Mining/Dewatering Water Use Sectors

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

2.0 Demand Projection Methodology

Demand projections for the 2020 RWSP were developed by multiplying the 2015 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 2015 and the county calculated growth factor from 2015 to 2020 was three percent, the 2020 projection for that facility would be 1.03 x 0.30 = 0.31 mgd. If the 2015 to 2020 growth factor was four percent, the 2020 projection would be 0.32 mgd. Water use for 2015 is derived from the District's 2015 Water Use Well Package Database (WUWPD). Based on the well package, in 2015 there were 53 I/C and 15 M/D water use permittees in the planning region.

3.0 Water Demand Projections

Table 3-3 shows the projected I/C and M/D regional water demand for the planning period. The table shows an increase in demand from 6.36 mgd in 2015 to 7.19 mgd in 2040, an increase of 0.83 mgd, or 13.0 percent. The projections for the District's portion of Lake County is zero for this water demand category based on the projections from the Central Florida Water Initiative (CFWI) RWSP. The projection is quite reasonable given that the portion of Lake County that is within the District is very small and rural.

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

In accordance with the 2019 Format and Guidelines, the 5-in-10 and 1-in-10 demands are the same. The uses "are assumed to be reasonably the same in a 1-in-10-year drought event as in an average year (i.e., no significant demand variation)" (FDEP et al., 2019).

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

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Citrus	0.22	0.23	0.23	0.24	0.24	0.25	0.03	13.00%
Hernando	5.42	5.55	5.69	5.83	5.96	6.08	0.67	12.00%
Lake	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Levy[1]	0.01	0.01	0.01	0.01	0.01	0.01	0.00	11.00%
Marion	0.01	0.01	0.01	0.01	0.01	0.01	0.00	10.00%
Sumter	0.70	0.74	0.76	0.79	0.82	0.84	0.14	20.00%
Total	**6.36**	**6.54**	**6.70**	**6.88**	**7.04**	**7.19**	**0.83**	**13.00%**

[1] Lake County projections derived from the Draft 2020 CFWI RWSP (March 2020).

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

4.0 Stakeholder Review

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

Section 4. Power Generation

1.0 Description of the Power Generation Water Use Sector

The PG uses within the District include water for thermo-electric PG used for cooling, boiler make-up, or other purposes associated with the generation of electricity. The PG quantities have previously been grouped with IC and MD quantities but are provided separately in this section per the 2019 Format and Guidelines (FDEP et al., 2019).

2.0 Demand Projection Methodology

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

3.0 Water Demand Projections

Table 3-4 shows the projected PG water demand for the planning period. The table shows an change in demand from 2.94 mgd in 2015 to 2.21 mgd in 2040, a decrease of 0.73 mgd, or 25.0

percent. The demand projections do not include reclaimed, seawater or non-consumptive use of freshwater. In accordance with the 2019 Format and Guidelines, the 5-in-10 and 1-in-10 demands are the same. Power generation (PG) 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)" (FDEP et al., June 2009).

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

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Citrus	2.94	1.80	1.85	1.96	2.08	2.21	-0.74	-25.00%
Hernando	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Lake[1]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Levy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Marion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Sumter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Total	**2.94**	**1.80**	**1.85**	**1.96**	**2.08**	**2.21**	**-0.73**	**-25.00%**

[1] Lake County projections derived from the Draft 2020 CFWI RWSP (March 202020).

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

4.0 Stakeholder Review

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

Section 5. Landscape/Recreation

1.0 Description of the Landscape/Recreation Water Use Sector

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

2.0 Demand Projection Methodology

Landscape/Recreation (L/R) baseline use data is from the WUWPD (SWFWMD, 2017). This database includes metered use for active individual/general permits and estimated use for General Permits by Rule. The projection methodologies are divided into those for golf and those for other landscape and recreation. A more detailed description of the methodologies used is contained in Appendix 3-5.

Based on comments from knowledgeable stakeholders that initial demand projections for golf may be too high, the District engaged the services of a respected golf industry consulting firm to develop county-level percent changes in demand for 18-hole equivalent golf courses for each five-year period of the planning period. The percent changes were then applied to the previous five-year period's pumpage beginning with the 2015 baseline pumpage. The projected percentage changes were based on projected socioeconomic factors such as, household income and ethnicity, and golf play rates associated with those socioeconomic factors.

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 5.29 mgd for the 5-in-10 condition is projected between 2015 and 2040, an increase of 35.4 percent. In 2015, golf water demand made up over 80 percent of total L/R water use in this planning region.

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. Comments received from the District's Agriculture and Green Industry Advisory Committee noted agreement with the golf portion of the projections remaining relatively flat to 2040. These projections are largely based on participation and course closure trends in the golf industry.

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

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Citrus	4.31	5.60	4.52	5.87	4.71	6.11	4.87	6.32	4.99	6.48	5.09	6.61	0.78	1.01	18.10%	18.04%
Hernando	4.22	5.44	4.32	5.56	4.40	5.67	4.48	5.77	4.55	5.86	4.61	5.93	0.39	0.49	9.24%	9.01%
Lake[1]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%
Levy	0.21	0.27	0.21	0.28	0.21	0.28	0.22	0.28	0.22	0.28	0.22	0.28	0.01	0.01	4.76%	3.70%
Marion	3.17	4.10	3.34	4.31	3.57	4.61	3.77	4.86	3.95	5.10	4.11	5.30	0.93	1.20	29.34%	29.27%
Sumter	3.03	3.92	3.70	4.77	4.41	5.70	5.05	6.53	5.66	7.32	6.20	8.01	3.17	4.09	104.62%	104.34%
Total	**14.96**	**19.33**	**16.09**	**20.79**	**17.31**	**22.36**	**18.38**	**23.75**	**19.37**	**25.03**	**20.23**	**26.13**	**5.29**	**6.80**	**35.36%**	**35.18%**

[1] Lake County projections derived from the Draft 2020 CFWI RWSP (March 2020).

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

Section 6. Summary of Projected Change in Demand

Chassahowitzka River

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

Table 3-6 shows that 50.4 mgd of additional water supply is needed from existing sources or will need to be developed to meet demand in the planning region through 2040. Public supply (PS) water use will increase by 36.8 mgd over the planning period. Agricultural and I/C, M/D, and PG water use will increase by a combined 8.4 mgd. L/R water use will increase by 5.3 mgd.

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

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

Water Use Category	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
PS	89.20	94.55	98.65	104.57	106.77	113.18	113.68	120.50	120.23	127.44	125.98	133.54	36.78	38.99	41.2%	41.2%
AG	18.44	22.68	20.17	24.92	21.65	26.85	23.18	28.81	24.95	31.16	26.71	33.47	8.27	10.79	44.8%	47.6%
I/C & M/D	6.35	6.35	6.52	6.52	6.70	6.70	6.87	6.87	7.03	7.03	7.19	7.19	0.84	0.84	13.2%	13.2%
PG	2.94	2.94	1.80	1.80	1.85	1.85	1.96	1.96	2.08	2.08	2.21	2.21	-0.73	-0.73	-24.8%	-24.8%
L/R	14.96	19.33	16.09	20.79	17.31	22.36	18.38	23.75	19.37	25.03	20.23	26.13	5.27	6.80	35.3%	35.2%
Total	**131.89**	**145.85**	**143.23**	**158.60**	**154.28**	**170.94**	**164.07**	**181.89**	**173.66**	**192.74**	**182.32**	**202.54**	**50.43**	**56.69**	**38.2%**	**38.9%**

Note: Summation and/or percentage calculation differences occur due to rounding.

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

Water Use Category	Planning Period						Change 2015-2040	
	2015	2020	2025	2030	2035	2040	mgd	%
Citrus								
PS	19.95	20.87	21.74	22.46	23.06	23.53	3.59	27.2%
AG	1.62	1.74	1.77	1.8	1.83	1.88	0.26	16.0%
I/C & M/D	0.22	0.23	0.23	0.24	0.24	0.25	0.03	13.0%
PG	2.94	1.80	1.85	1.96	2.08	2.21	-0.74	-25.0%
L/R	4.31	4.52	4.71	4.87	4.99	5.09	0.78	18.1%
Cumulative Total	**29.04**	**29.16**	**30.30**	**31.33**	**32.20**	**32.96**	**3.92**	**13.50%**
Hernando								
PS	24.32	26.2	27.94	29.42	30.75	31.88	7.57	31.1%
AG	1.87	2.07	2.25	2.53	2.78	3.04	1.17	62.6%
I/C & M/D	5.42	5.55	5.69	5.83	5.96	6.08	0.67	12.0%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	4.22	4.32	4.40	4.48	4.55	4.61	0.39	9.2%
Cumulative Total	**35.83**	**38.14**	**40.28**	**42.26**	**44.04**	**45.61**	**9.78**	**27.30%**
Lake								
PS	0.14	0.17	0.2	0.24	0.27	0.31	0.17	121.4%
AG	0.66	0.59	0.51	0.31	0.31	0.28	-0.38	-57.6%
I/C & M/D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Cumulative Total	**0.80**	**0.76**	**0.71**	**0.55**	**0.58**	**0.59**	**-0.21**	**-26.25%**
Levy								
PS	1.62	1.68	1.73	1.77	1.8	1.82	0.2	12.4%
AG	7.27	7.82	8.27	8.92	9.87	10.62	3.35	46.1%
I/C & M/D	0.01	0.01	0.01	0.01	0.01	0.01	0	11.0%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	0.21	0.21	0.21	0.22	0.22	0.22	0.01	4.8%
Cumulative Total	**9.11**	**9.72**	**10.22**	**10.92**	**11.9**	**12.67**	**3.56**	**39.08%**
Marion								
PS	15.21	16.69	18.01	19.16	20.25	21.29	6.07	39.9%
AG	1.7	2.99	4.13	5.31	6.27	7.4	5.7	335.3%
I/C & M/D	0.01	0.01	0.01	0.01	0.01	0.01	0	10.0%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	3.17	3.34	3.57	3.77	3.95	4.11	0.93	29.3%
Cumulative Total	**20.09**	**23.03**	**25.72**	**28.25**	**30.48**	**32.81**	**12.72**	**63.32%**
Sumter								
PS	27.96	33.05	37.15	40.63	44.1	47.14	19.18	68.60%
AG	5.32	4.96	4.72	4.31	3.89	3.49	-1.83	-34.4%
I/C & M/D	0.7	0.74	0.76	0.79	0.82	0.84	0.14	20.0%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	3.03	3.70	4.41	5.05	5.66	6.20	3.17	104%
Cumulative Total	**37.01**	**42.45**	**47.04**	**50.78**	**54.47**	**57.67**	**20.66**	**55.82%**
Region Total	**131.88**	**143.26**	**154.27**	**164.09**	**173.67**	**182.31**	**50.43**	**38.24%**

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

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

There are several notable differences between the 2015 and 2020 RWSP demand projections in the PS, AG, I/C & M/D, PG, and L/R water use sectors. This includes a reduction in demands for all sectors from those projections used in the 2015 RWSP. These differences are largely attributable to methodology changes and slower than anticipated regional population growth. Regarding the PS category, the 2015 RWSP projected an increase of 51.36 mgd for the 2010–2035 planning period, while the 2020 RWSP projects an increase of 36.77 mgd for 2015–2040 planning period. For AG projections, the 2015 RWSP projected an increase of 1.85 mgd for the 2010–2035 planning period, while the 2020 RWSP projects an increase of 8.26 mgd for the planning period. Differences in I/C & M/D demand projections included a 2015 RWSP projected increase of 1.54 mgd for this category, while the 2020 RWSP projects a 0.84 mgd increase. There was a 0.31 mgd increase in PG demand for the 2015 RWSP, whereas the 2020 RWSP projects a 0.74 mgd decrease. For L/R demand, the 2015 RWSP projected an increase of 7.78 mgd, while the 2020 RWSP projects just a 5.27 mgd increase.

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Chapter 4. Evaluation of Water Sources

This chapter presents the results investigations by the Southwest Florida Water Management District (District) to quantify the amount of water that is potentially available from all sources of water within the planning region to meet demands through 2040. Sources of water that were evaluated include surface water, stormwater, reclaimed water, seawater desalination, brackish groundwater desalination, fresh groundwater and conservation. The amount of water that is potentially available from these sources is compared to the demand projections for the planning region presented in Chapter 3 and a determination is made as to the sufficiency of the sources to meet demand through 2040.

Part A. Evaluation of Water Sources

Fresh groundwater from the Upper Floridan aquifer (UFA) currently is by far the major source of supply for all use categories in the planning region. In addition, the principal source of water to meet the projected 2040 demand is likely to be new quantities of fresh groundwater. However, localized impacts resulting from groundwater withdrawals in southwest Hernando and northern Sumter counties may limit future availability of groundwater in these areas. Establishment of minimum flows for first-magnitude springs may also limit the future availability of groundwater in certain areas. To ensure that low-cost groundwater supplies are available in the future, water users throughout the region are increasingly developing reclaimed water systems and implementing conservation measures. These measures will enable water supply systems to support more users with the same quantity of water and hydrologic stress. Although its likely to be beyond the 2040 planning period, the region’s continued growth will eventually require the development of alternative sources such as brackish groundwater, seawater and surface water with off-stream storage reservoirs. Efficient use of available groundwater quantities while meeting established minimum levels and flows will postpone the eventual need for these more costly alternative sources. The following discussion summarizes the evaluation of all water supply sources and the potential for those sources to be used to produce new water supplies in the planning region.

Section 1. Fresh Groundwater

Fresh groundwater from the UFA is the principal source of water supply for all use categories in the planning region. Although there is a surficial aquifer in the planning region, the lack of a confinement between the Upper Floridan and surficial aquifers in most places causes the aquifers to function as a single unit. In 2017, approximately 94 percent (121.3 million gallons per day [mgd]) of 128.9 mgd of water (including domestic self-supply [DSS]) used in the planning region was from groundwater sources. Approximately 65 percent (79.3 mgd) of the fresh groundwater was used for PS (permitted and DSS). The following is an assessment of the availability of fresh groundwater in the UFA and Lower Floridan aquifer (LFA) in the planning region.

1.0 Upper Floridan Aquifer

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

The bottom boundary of the freshwater flow system occurs in the middle and lower portion of the Avon Park Formation where gypsum beds are present over most of the Northern Planning Region. This unit forms the bottom confining bed of the freshwater flow system and is named Middle Confining Unit 2 (MCU II) (Miller, 1986). The LFA is found below MCU II, but groundwater is highly mineralized throughout much of the region and is not used.

Minimum flows and levels (MFLs) have been established for the Weeki Wachee, Chassahowitzka, Homosassa, Gum, Rainbow, and Kings Bay spring groups as well as several lakes in the planning region. The Chassahowitzka and Homosassa system MFLs were re-evaluated and revised minimum flows adopted for the spring groups in 2019. The Rainbow River and Rainbow Spring Group MFLs, originally adopted in 2017 as part of an emergency rulemaking process, were affirmed subsequent to the successful outcome of an administrative challenge.

Currently, all established MFLs are being met and all spring MFLs are projected to be met through 2040. For 2040 there is the possibility that MFLs for Lake Theresa (Weeki Wachee Prairie), and Hunters Lake in southwest Hernando County could be exceeded if the projected demand is met with groundwater from existing facilities. In addition, minimum levels for Lakes Miona, Okahumpka and Deaton in northeast Sumter County may be exceeded by 2040 if projected PS demand is met with groundwater from this area. In both counties, reductions in demand through the use of reclaimed water, the implementation of strict demand management measures (conservation) and the development of groundwater sources outside of these areas, or development of LFA groundwater, can prevent these MFLs from being exceeded. Future groundwater availability will be governed by compliance with these MFLs.

Computer flow modeling using the Northern District model has shown that groundwater from the UFA is available to meet demand through 2040 by utilizing conservation and reuse initiatives (Cardno-Entrix, 2019). The conservation initiatives include demand reductions of 10 percent for both PS and AG uses, and 20 percent for L/R uses. Reuse projects include those planned through 2040. The simulations analyzed the change in surficial and UFA water levels from pre-pumping conditions to 2040 using projections of future demand. In this model scenario, changes to spring flow and Withlacoochee River base flow, due to groundwater withdrawals from pre-pumping conditions to 2040, were 10 percent or less (see Tables 4-1 and 4-2). All springs with established minimum flows were also projected to be met. In most of the planning region, predicted drawdown within the surficial aquifer or UFA (where it is unconfined) is less than one foot, except in localized areas where concentrated groundwater withdrawals for PS occur in northeast Sumter and western Hernando counties. In these areas, management strategies such as increased monitoring, conservation, use of reclaimed water, and LFA groundwater extraction (Northern Sumter) are being promoted to offset potential future impacts to MFL water bodies.

Table 4-1. *Predicted flow changes for springs from non-pumping to 2040 conditions based on the Northern District Groundwater Flow Model (Cardno-Entrix, 2019)*

Spring Name	No Pumping Flow (cfs)	Predicted 2040 Flows (cfs)	2040 Percent Change	MFL Allowable Percent Flow
Weeki Wachee Spring Group	215.9	202.8	6.1	10.0
Chassahowitzka Spring Group	208.0	204.5	1.7	8.0
Homosassa Spring Group	261.9	256.3	2.1	5.0
Gum Slough[1]	98.8	94.7	4.2	6.0
Kings Bay Springs	449.0	441.8	1.6	11.0
Rainbow Springs and River	661.4	650.7	1.6	5.0

[1] Withdrawal impacts for Gum Slough flow based on estimated springflow contribution of 72 percent.

Table 4-2. *Predicted changes in baseflow contribution to rivers from non-pumping to 2040 conditions based on the Northern District Groundwater Flow Model (Cardno-Entrix, 2019)*

River Segment	No Pumping Flow (cfs)	Predicted 2040 Flow (cfs)	2040 Percent Flow Change
Withlacoochee River at Croom[1]	78.3	79.3	+1.3
Withlacoochee River near Holder	322.7	304.8	5.5

[1] Unadjusted 2040 demand results in a 0.2 cfs decline in flow at Croom. The addition of reclaimed water and conservation initiatives results in a small increase in flow.

1.1 Upper Floridan Aquifer Permitted/Unused Quantities

A number of PS utilities in the planning region currently are not using their entire permitted allocation of groundwater. The District anticipates that these utilities will eventually grow into these unused quantities to meet future demand. Based on a review of the unused quantities of water associated with PS water use permits, approximately 24 mgd of additional groundwater quantities are available to PS utilities from the UFA. However, to ensure that environmental impacts from groundwater withdrawals are minimized, it is the District's intent that the 2040 demand that will be met by groundwater will be significantly reduced by maximizing the efficient use of reclaimed water and implementing conservation measures.

2.0 Lower Floridan Aquifer

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

The MCU I and the LFA extend eastward from Sumter County into the St. Johns River Water Management District (SJRWMD).

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

The 2019 Regional Water Supply Plan update for the Withlacoochee Regional Water Supply Authority anticipated additional quantities of 4.1 mgd from the LFA for the City of Wildwood and 8.2 mgd from the LFA available for Marion County by 2040 (WRWSA, 2019). Additional data collection from exploratory drilling and testing that is planned over the next five years along with refinement of regional groundwater flow models will further understanding of withdrawal impacts and ultimate quantities available from the LFA. In those areas where it is demonstrated that development of groundwater quantities from the LFA can be done without exceeding any established MFLs, and will otherwise avoid harm caused by withdrawals, such LFA quantities are designated as nontraditional sources. Demonstration of meeting these requirements must be done on a case-by-case basis.

Section 2. Water Conservation

1.0 Non-Agricultural Water Conservation

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

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

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

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

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

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

The District's Utilities Services Group provides guidance and technical expertise to PS water utilities and helps identify and reduce water loss. The non-regulatory assistance and educational components of the program maximize water conservation throughout the PS water use sector and improve both local utility system efficiency and regional water resource benefits. Among the services provided upon request are comprehensive leak detection surveys, meter accuracy testing, and water audit guidance and evaluation. Since the program's inception, the leak detection team has conducted 154 comprehensive leak detection surveys throughout the District, locating 1,553 leaks of various sizes and totaling an estimated 5.9 mgd. In the Northern Planning Region, the District leak detection team has conducted 59 leak detection surveys, locating 676 leaks totaling an estimated 2.6 mgd.

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

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

Education is an important element of a successful conservation program. While the actual quantity of water saved as a result of customer education is not measurable, the effort greatly increases the success of all other facets of a conservation program by raising customer awareness and changing attitudes regarding water use. Educating the public is a necessary facet of every water conservation program, and conservation education programs accompanied with other effective conservation measures can be an effective supplement to a long-term water conservation strategy. On a Districtwide scale, water conservation efforts have contributed to declining unadjusted gross per capita use rates, from 115 gallons per day (gpd) per person in 2005 to 97 gpd per person in 2015. The per capita use rate for the District is the lowest of all five WMDs. The per capita trend for the Northern Planning Region is also declining as shown in Figure 4-1.

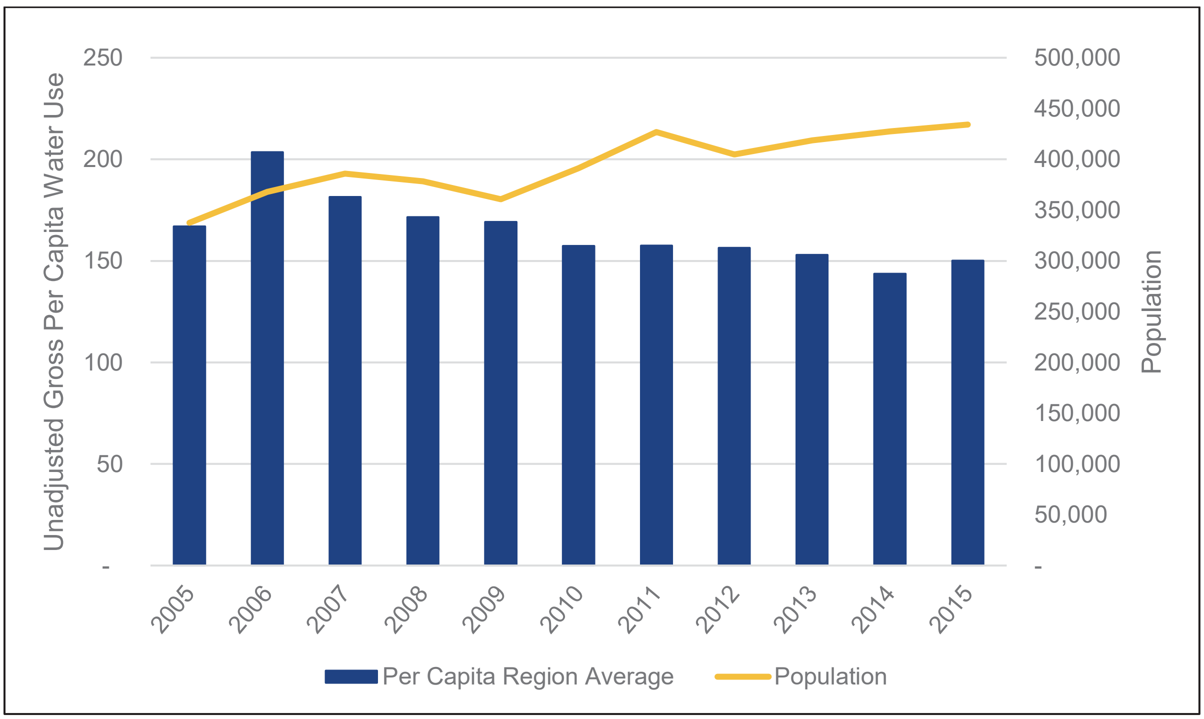


Figure 4-1. *Per capita water use rates in the Northern Planning Region, 2005-2015*

1.1 Public Supply

The PS sector includes all water users that receive water from public water systems and private water utilities. The PS sector may include non-residential customers such as hospitals and restaurants that are connected to a utility potable distribution system. Water conservation in the PS sector will continue to be the primary source of water savings in the District. Public supply (PS) systems lend themselves most easily to the administration of conservation programs since they measure each customer's water use and can focus, evaluate, and adjust the program to maximize savings potential. The success of the District's water conservation programs for PS systems to date is demonstrated by the 15.8 mgd in savings that has been achieved within the District since programs began in 1991. Within the region, it is estimated that savings for the PS sector could be 10.88 mgd by 2040 if all water conservation programs presented below are implemented (see Table 4-3).

1.1.1 Water Conservation Potential in the Northern Planning Region

Estimated conservation potential for the planning region is based in part on the Draft Withlacoochee Regional Water Supply Authority (WRWSA) 2019 Regional Water Supply Plan (RWSP). This plan uses the 2020-2040 planning horizon and the Water Conservation Tracking Tool (AWE Tool), that was originally developed by the Alliance for Water Efficiency, to calculate the savings and costs of both passive and active conservation for 10 benchmark utilities. The savings for these 10 benchmark utilities were then projected onto the additional 27 utilities within the WRWSA.

1.1.2 Assessment Methodology

WRWSA includes four counties (Citrus, Hernando, Marion, and Sumter) that lie primarily within the District, with a portion of Marion County (3 of the benchmark utilities) within the St. John's Water Management District (SJWMD). In order to assess the planning region's entire conservation potential excluding SJWMD demands, the District has projected the WRWSA estimates onto the District demands for these four counties, which are discussed in Chapter 3. However, the Northern Planning Region also includes portions of Lake and Levy counties, which are not addressed in the WRWSA 2019 RWSP Plan. Levy County estimates are derived by projecting the total WRWSA percent savings onto Levy County demands. Meanwhile, the conservation potential for the SWFWMD portion of Lake County is not addressed as a part of this 2020 RWSP. This is because the projected 2040 demand for the District's portion of Lake County is only 0.31 mgd for both PS and DSS, making any conservation savings insignificant in comparison with those of the rest of the region. Therefore, the sum of the estimates for Citrus, Hernando, Marion, Sumter, and Levy counties equates to the total estimated water conservation potential for the Northern Planning Region.

WRWSA divides water conservation into three tiers. Tier 1 is conservation that occurs passively. Tier 2 is Tier 1 conservation plus additional conservation that occurs actively through conservation activities that are already being implemented. Tier 3 includes both Tier 1and Tier 2 savings plus conservation that could occur through the implementation of additional conservation activities. In order to be consistent with the calculations for the other planning regions within the 2020 RWSP, Tier 2 and Tier 3 savings, excluding those attributable to Tier 1, are combined in this plan to yield one total estimate for active conservation. Passive and active conservation and the estimation methodology for each are described further below.

Passive Conservation

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

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

The percent of savings due to passive conservation seen for each county in the WRWSA 2019 RWSP Plan is applied to the District demand for the county in order to derive the passive savings expected to be seen in the planning region over the planning horizon. As previously mentioned, Levy County is not a member of WRWSA. Therefore, the passive savings percent for the entire WRWSA is used in lieu of a county-specific rate.

Active Conservation

Active water conservation encompasses a variety of measures, practices, and programs sponsored or encouraged by utilities and municipal governments which result in water use reductions. By their nature, active water conservation programs are typically funded and administered by PS utilities or other regional entities. Using the AWE Tool and other data provided by the benchmark utilities, WRWSA estimated the conservation potential and costs for several conservation activities that utilities could implement in single-family residential homes. It is important to note that not all conservation activities were considered in each county. Additionally, while only single-family homes were considered in the WRWSA analysis, some of these activities can also be implemented on multi-family, industrial, and commercial properties. Conservation activities included in the WRWSA analysis along with the corresponding counties can be found in Table 4-3 below.

Table 4-3. *Conservation activities in District counties*

Conservation Activity	Citrus County	Hernando County	Marion County	Sumter County	Levy County[1]
(HET) and Ultra-low Flow Toilets	Yes	Yes	Yes	Yes	-
Smart Irrigation Controllers	Yes	No	Yes	No	-
High-efficiency and Low-flow Showerheads	Yes	Yes	Yes	No	-
High-efficiency Clothes Washers	Yes	Yes	No	No	-
Landscape and Irrigation Evaluations/Audits	Yes	Yes	Yes	Yes	-
Rain Sensors	Yes	Yes	Yes	Yes	-
Faucet Aerators	Yes	Yes	Yes	No	-
Florida Water Star^{SM} for New Construction	No	No	Yes	No	-
Irrigation Restriction Ordinance[2]	Yes	No	No	No	-
Smart Irrigation Controllers in New Construction	Yes	No	No	No	-
Reclaimed Water	No	No	No	Yes	-

[1]Levy County is not part of the WRWSA and is therefore not considered in their analysis.
[2]Refers to an irrigation allowance of one day per week

While reclaimed water is included within the conservation estimates for Sumter County in the Draft 2019 WRWSA RWSP, it is not included as conservation in the District's 2020 RWSP. More information on the reclaimed water potential within the region can be found in Chapter 4 Section 1.1.3 below. The percent savings for each county due to current and potential active conservation activities found in the Draft 2019 WRWSA RWSP are applied to District demands and combined to determine the total active conservation potential for the planning region. Similar to the passive savings calculation, the authority's overall savings percentages are used for the Levy County estimate.

1.1.3 Results

After projecting the passive savings rates calculated in the 2019 WRWSA RWSP onto the District demands, it is estimated that approximately 10.88 mgd of combined active and passive PS savings could be achieved in the planning region by 2040 (Table 4-4). This equates to a 12.17 percent reduction in projected 2040 PS sector demand. This includes industrial and commercial entities that are connected to PS utilities.

Irrigation restriction ordinances were identified as a major potential source of water savings.

The bulk of savings are attributable to active conservation. This component represents approximately 76 percent of the PS savings available in the region. That's a 9 percent reduction in 2040 total demand, or about 8.24 mgd. The most impactful conservation activity identified was the irrigation restriction ordinance. Meanwhile, passive savings constitutes approximately 24 percent of total PS savings, which corresponds to a nearly 3 percent decrease in 2040 total demand. The drop in regional demand over time associated with both passive and active savings is shown in Figure 4-2below.

For the purposes of this RWSP, the cost effectiveness of the active conservation activities analyzed are calculated using SWFWMD methods rather than those of WRWSA. The unit cost is amortized at 8 percent and compared to the unit savings over the activity's anticipated service life. On average, the 10 conservation activities (excluding reclaimed water) cost $0.80 per thousand gallons. The region-wide total cost for active programs across the planning horizon is estimated at $12.8 million.

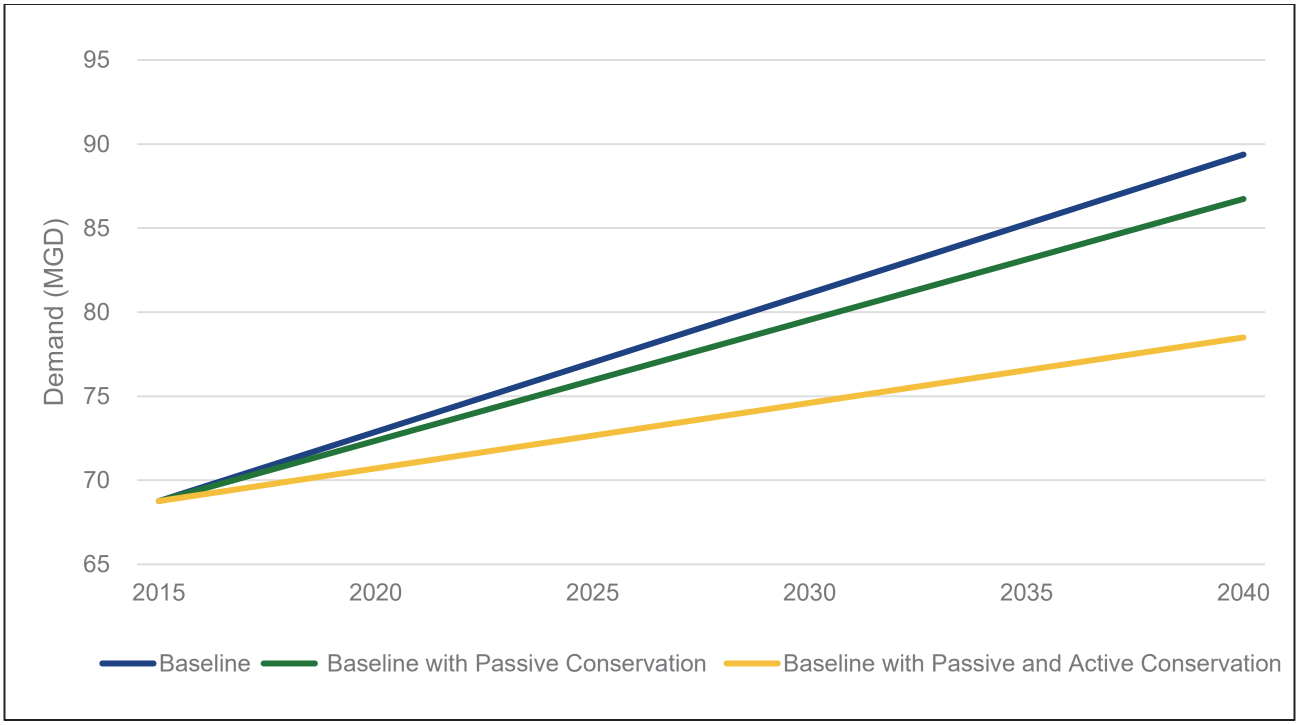


Figure 4-2. *Potential effects of conservation on projected PS demand*

1.1.4 Additional Considerations

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

1.2 Domestic Self-Supply

The DSS sector includes individual private homes and businesses that are not utility customers and receive their domestic water supply from a well or from a surface supply for uses such as irrigation. Domestic self-supply (DSS) wells do not require a District WUP, as the well diameters do not meet the District's requirement for a permit. Domestic self-supply (DSS) systems are commonly not metered and, therefore, changes in water use patterns are less measurable than those that occur in the PS sector. Only passive conservation was estimated for DSS systems in this RWSP. Within the region, it is estimated that passive savings for the DSS sector could be 0.89 mgd by 2040 (Table 4-4).

1.2.1 Domestic Self-Supply Assessment Methodology

To calculate DSS passive savings, it was assumed that the DSS sector will experience the same percent savings as the PS sector over the planning horizon. The percent of PS passive savings calculated was therefore applied to the SWFWMD DSS 2040 demand projection for the Northern Planning Region, excluding Lake County. In other words, the DSS 2040 demand (30.08 mgd) was multiplied by the PS passive savings rate (2.95 percent) to yield the DSS passive savings estimate (0.89 mgd).

1.3 Industrial/Commercial Self-Supply

This water use sector includes factories and other industrial enterprises that obtain water directly from surface water and/or groundwater sources through a WUP. Businesses try to minimize water use to reduce pumping, purchasing, treatment, and disposal costs. To date, the District has focused efforts on education, indoor and outdoor surveys, and commercial applications, such as spray valves and high-efficiency 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 0.16 mgd by 2040 (Table 4-4).

1.3.1 I/C Assessment Methodology

The I/C savings estimate utilized the same methodology outlined in the 2020 Draft Central Florida Water Initiative (CFWI) RWSP. This methodology was based on a study by Dziegielewski et al. (2000) that examined the impact of water audits on improving water efficiency within this sector. The lower-bound savings determined in this study was 15 percent, and this number was used in lieu of the higher estimate to be more conservative. The 15 percent participation rate used in the 2020 Draft CFWI RWSP was also assumed. Therefore, the self-supplied I/C 2040 demand (6.99 mgd) multiplied by both the savings and participation rates (15 percent for both) yields the estimated water savings over the planning horizon for the self-supplied I/C sector within the Northern Planning Region (0.16 mgd).

1.4 Landscape/Recreation

The L/R water use sector includes golf courses and large landscapes (e.g. cemeteries, parks, and playgrounds) that obtain water directly from groundwater and surface water sources rather than from a PS 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 savings for the L/R water use sector could be 1.18 mgd by 2040 (Table 4-4).

1.4.1 L/R Assessment Methodology

As with the self-supplied I/C sector, the estimate of the water conservation potential of the L/R sector was derived using the same methodology as the 2020 Draft CFWI RWSP. Conservation in this sector primarily comes from updating inefficient sprinkler heads and installing smart irrigation controllers, such as SMSs or weather-based controllers. Based on two studies by the University of Florida, it was determined that the lower-bound savings from retrofits and smart irrigation controllers are 10 percent and 20 percent, respectively. These values were used along with the 15 percent savings rate also assumed in the 2020 Draft CFWI RWSP to estimate self-supplied L/R water conservation. In other words, the 2040 L/R demand (26.13) was multiplied by the participation rate (15 percent), and this product was multiplied by each of the savings rates (10 percent and 20 percent). The sum of these final two numbers (0.39 mgd and 0.78 mgd) equates to the total L/R savings over the planning horizon (1.18 mgd). The 1-in-10 2040 demand projections were used instead of the 5-in-10 projections in an effort to be more conservative in our calculations.

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

Table 4-4 summarizes the potential non-agricultural water conservation savings in the Northern Planning Region. This table shows that, through the implementation of all conservation measures listed above for the PS, DSS, I/C, and L/R water use sectors, it is anticipated that approximately 13.10 mgd could be saved by 2040 at a total projected cost of $12.8 million. This is an 8.59 percent reduction in total demand.

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

Sector	2040 Demand (mgd)	Savings (mgd)	Percent Reduction in Demand (%)	Average Cost-Effectiveness ($/1kgal.)
Public Supply (PS) Total	89.37	10.87	12.17%	-
PS Passive	-	*2.64*	*2.95%*	-
PS Active	-	*8.24*	*9.22%*	*$0.80*
DSS	30.08	0.89	2.95%	-
I/C	6.99	0.16	2.25%	-
L/R	26.13	1.18	4.50%	-
Total	**152.58**	**13.10**	**8.59%**	**-**

2.0 Agricultural Water Conservation

The Florida Department of Agriculture and Consumer Services (FDACS) develops conservation projections as part of the Florida Statewide Agricultural Irrigation Demand (FSAID5) projections. Those conservation projections were based on historical trends (1973-2013) in irrigation of water applied per acre per year. The historical trend of the ratio was used to predict future irrigation conservation through 2040. The trend accounts primarily for gains in irrigation system distribution uniformity. However, future savings could still come from developing new technology, sensor-based automation, and scheduling changes.

This RWSP uses the trend as a percent reduction (approximately 13%) in 2040 demand. The county-by-county savings percentages derived from FSAID5 data were applied to the 2040 agricultural demands shown in Table 3-2 which are District specific demand projections and lower than FSAID5 demands. Results are shown below in Table 4-5**.**

Table 4-5. *Potential agricultural water conservation savings in the Northern Planning Region*

County	Projected 2040 demand (mgd)	Savings as a percentage (derived from FSAID5)	Agricultural Conservation Potential by 2040 (mgd)
Citrus	1.83	12.5%	0.23
Hernando	3.01	13.1%	0.40
Lake	0.27	13.4%	0.04
Levy	10.61	13.3%	1.41
Marion	7.34	13.0%	0.96
Sumter	1.70	12.6%	0.21
Total	**24.76**		**3.25**

These estimates should be considered potential conservation and should not be treated as “water supply” or directly removed from agricultural water demand estimates. Substantial investments will be necessary to realize these savings. District investment paired with other government assistance programs like FDACS and Natural Resources Conservation Service could accelerate the rate at which these savings occur. Water resource benefits from the Facilitating Agricultural Resource Management Systems (FARMS) Program are categorized as water resource development (WRD) or water conservation (gains in efficiency). Benefits associated with WRD (primarily tail water recovery) projects are estimated to be 0.06 mgd during the planning horizon. Additional information on the FARMS Program and its potential impact on water resources is located in Chapter 5 and 7.

Section 3. Reclaimed Water

Reclaimed water is defined by the Florida Department of Environmental Protection (FDEP) as water that is beneficially reused after being treated to at least secondary wastewater treatment standards by a domestic wastewater treatment plant (WWTP). Reclaimed water can be used to accomplish a number of goals, including decreasing reliance on potable water supplies, increasing groundwater recharge and restoring natural systems. Figure 4-2 illustrates the reclaimed water infrastructure, utilization and availability of reclaimed water within the District in 2015, as well as planned utilization that is anticipated to occur by 2025 as a result of funded projects.

Existing and funded projects are expected to result in reclaimed water increases of 6 mgd, bringing utilization within the planning region to approximately 18 mgd by 2025. Appendix 4-1 contains anticipated 2025 reclaimed water utilization.

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

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

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

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

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

Environmental enhancement and recharge involves using excess reclaimed water to enhance wetland habitat, meet 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, enables systems to serve a larger customer base.

Water resource benefit is the amount of potable-quality groundwater or surface water that is replaced by reclaimed water usage or the amount of reclaimed water used for environmental enhancement. Customers tend to use more reclaimed water than potable water because reclaimed water is generally less expensive and not as restricted as potable water. For example, a single-family residence with an inground irrigation system connected to potable water uses approximately 330 gpd for irrigation. However, if the same single-family residence converts to an unmetered, flat-rate, reclaimed water irrigation supply without day-of-week restrictions, it will use approximately two and one-half times this amount (804 gpd). In this example, the benefit rate would be 41 percent (330 gpd offset for 804 gpd reclaimed water utilization). Different types of reclaimed water use have different benefit potentials. For example, a power station or industry using one mgd of potable water for cooling or process water will, after converting to reclaimed water, normally use approximately the same quantity. In this example, the benefit rate would be 100 percent. Most reclaimed water utilities provide service to a wide variety of customers and, as a result, the average reclaimed water benefit rate is estimated to be 65 percent. The District is actively cooperating with utilities to help identify ways to increase reclaimed water utilization and benefit. For example, efficiency can be further enhanced with practices such as individual metering coupled with water-conserving rates, efficient irrigation design and irrigation restrictions.

The District's goal is to achieve 75 percent utilization of all WWTP flows and 75 percent benefit efficiency of all reclaimed water used by 2040. This goal is intended to reduce the overuse of reclaimed water and increase potable and groundwater benefits. Opportunities may exist for utilization and benefits to be even greater in some cases by utilizing methods such as customer base selection (i.e., large industrial), project type selection (i.e., recharge) and implementation of developing technologies.

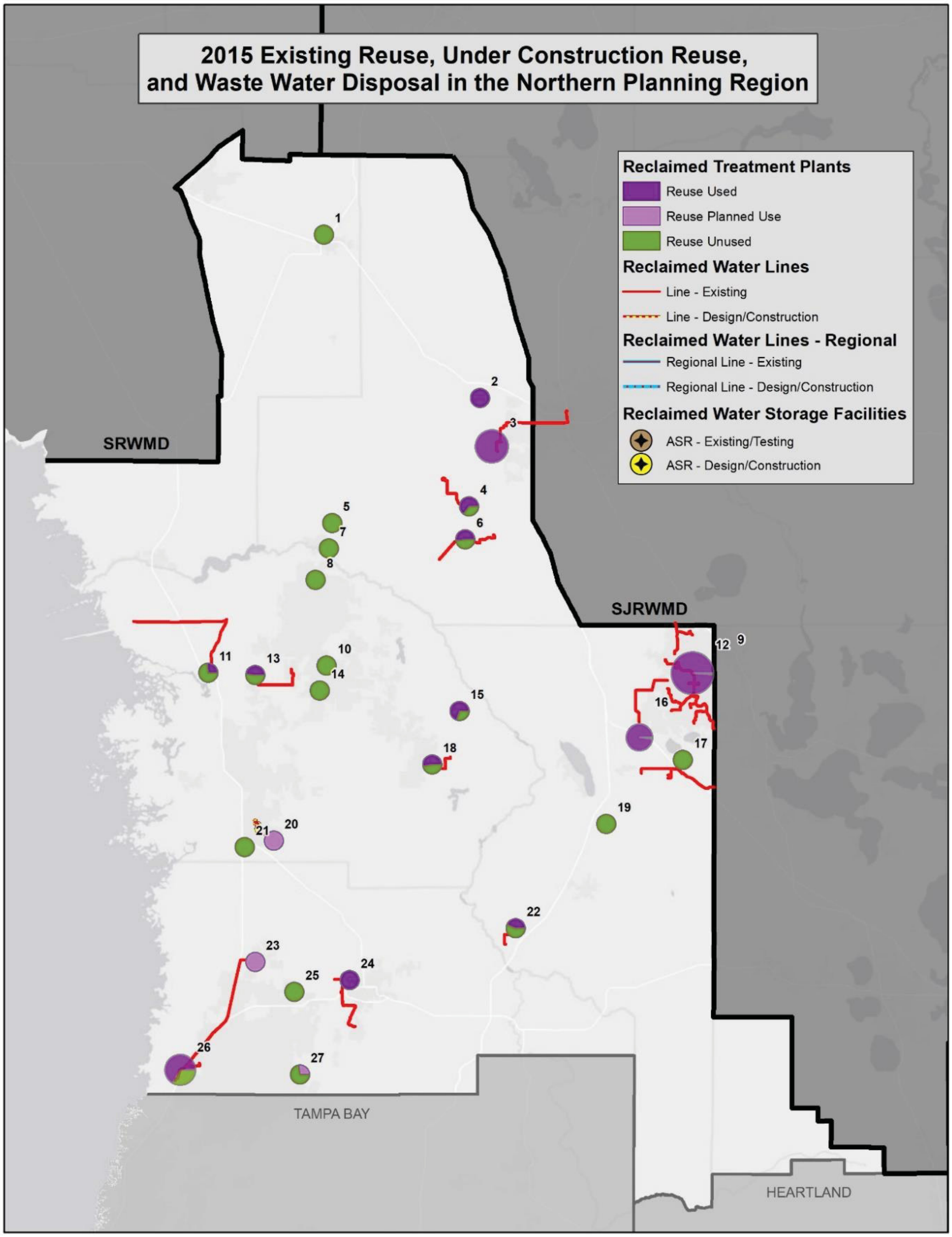


Figure 4-3. *Northern Planning Region reclaimed water map (information on numbered facilities is available at http://www.swfwmd.state.fl.us/conservation/reclaimed/*

1.0 Potential for Water Supply from Reclaimed Water

Table 4-6 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 2040. In 2015, there were 29 WWTPs in Levy, Citrus, Sumter, Marion, Hernando and Lake counties, collectively producing 19.1 mgd of wastewater. Of that quantity, 12.3 mgd was used resulting in 10 mgd of benefits to traditional water supplies. Therefore, only approximately 64 percent of the available reclaimed wastewater produced in the region was provided to customers for irrigation, industrial cooling or other beneficial purposes. By 2040, it is expected that more than 75 percent of reclaimed water available in the planning region will be used. It is further expected that efficiency of use will be close to 75 percent through a combination of measures such as customer selection metering, volume-based rates and education. As a result, by 2040, it is estimated that 20.9 mgd (more than 75 percent) of the 26.3 mgd of wastewater treated will be beneficially used. This will result in approximately 15.6 mgd of benefits, of which 5.6 mgd are post-2015 benefits (75 percent efficiency).

Table 4-6. *2015 actual versus 2040 potential reclaimed water availability, utilization and benefit (mgd) in the Northern Planning Region*

County	2015 Availability, Utilization and Benefit[1]				2040 Potential Availability, Utilization and Benefit[2]			
	Number of WWTPs in 2015	WWTP Flow in 2015	Utilization in 2015 (64%)	Potable-Quality Water Benefit in 2015 (81%)	2040 Total WWTP Flow	2040 Utilization (75%)[3]	2040 Potable-Quality Water Benefit (75%)[3]	Post 2015 Benefit
Levy	1	0.20	0.00	0.00	0.23	0.17	0.13	0.13
Citrus	9	3.21	0.75	0.61	4.65	3.49	2.61	2.00
Sumter	7	6.44	5.88	5.30	8.96	7.86	5.90	0.60
Marion	7	4.16	3.29	2.08	5.44	4.08	3.06	0.98
Hernando	8	5.14	2.40	2.01	7.07	5.30	3.97	1.96
Lake	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**29**	**19.14**	**12.33**	**10.00**	**26.34**	**20.90**	**15.67**	**5.67**

[1] Estimated at 81 percent Regionwide average.
[2] See Table 4-1 in Appendix 4.
[3] Unless otherwise noted.

Section 4. Surface Water

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

1.0 Criteria for Determining Potential Water Availability

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

2.0 Overview of the Withlacoochee River System

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

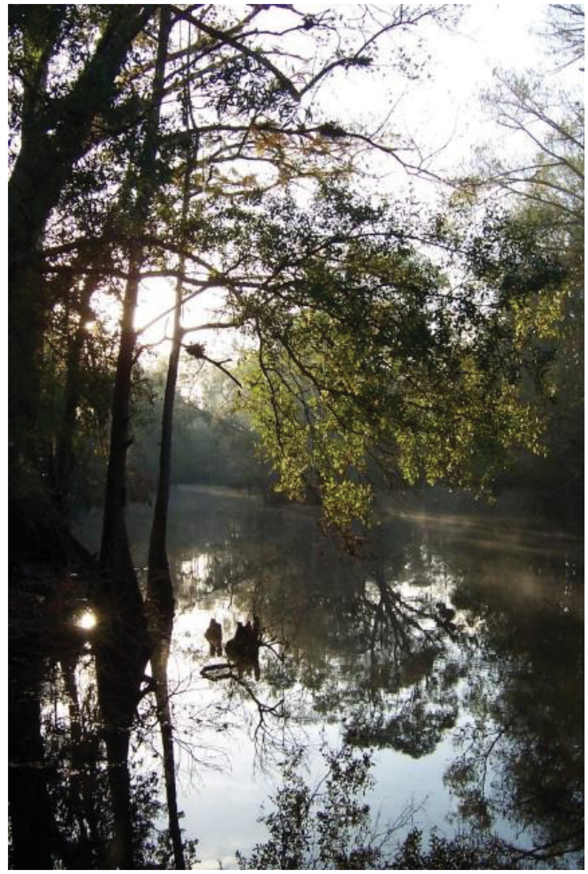
The upper reaches of the Withlacoochee River in the Green Swamp consist mostly of agricultural lands and wetlands. The river corridor is more developed near Dade City in Pasco County but, for the most part, it remains relatively rural in character. From the Lake Tsala Apopka area downstream to Dunnellon,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

Panasoffkee Outlet River

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

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

The WRWSA, in cooperation with the District, completed an update to their RWSP estimating the availability of surface water from the Withlacoochee River based on a draft minimum flow (Cardno Entrix, 2019). The WRWSA used a draft minimum flow because the District had not yet established a minimum flow for the river. The draft minimum flow was developed using data from the Croom and Holder U.S. Geologic Survey (USGS) gaging stations where the available flow record is most comprehensive. This study did not include development of a threshold for the lower Withlacoochee River, since it has been significantly altered by construction of the Inglis Dam and the Cross Florida Barge Canal. The most downstream point included in the WRWSA study was Holder, which excludes flow from the Rainbow River located further downstream. Because the Rainbow River was not included in the WRWSA study, it was not used to calculate surface water availability in this RWSP.



Withlacoochee River

The District applied planning level minimum flow criteria to flow data obtained from the USGS gage near Holder to make the calculation. Once minimum flows are established for the Withlacoochee River, water supply availability estimates will be refined. The average annual discharge at the gage near Holder is approximately 511 mgd (791 cubic feet per second) for the period 1965–2018. There are currently no permitted annual average withdrawals from the Withlacoochee River. Actual average annual diversions from the Withlacoochee River were not included in the surface water availability estimate because they are negligible. Based on the planning level minimum flow criteria, approximately 49.7 mgd of water supply is potentially available from the Withlacoochee River.

3.0 Potential for Water Supply from Surface Water

Table 4-7 summarizes potential surface water availability from the Withlacoochee River. The estimated surface water that could potentially be obtained from the Withlacoochee River in the planning region is approximately 49.7 mgd.Additional factors that could affect the quantities of water that are ultimately developed for water supply include the future establishment of minimum flows, variation in discharges to the river from outside sources, changes in groundwater pumping as more permits are issued, and the ability to develop sufficient storage capacity.

Section 5. Brackish Groundwater Desalination

Brackish groundwater suitable for water supply is available from two general sources within the District; in the UFA and intermediate aquifer system along coastal areas, and inland at greater depths within the LFA below MCU II. The coastal brackish groundwater is found as a depth-variable transition between fresh and saline waters. Figure 4-4 depicts the generalized location of the freshwater/saltwater interface (as defined by the 1,000 milligrams per liter (mg/L) isochlor) in the Avon Park high production zone of the UFA in the southern and central portions of the District. Generally, water quality declines to the south and west.

Table 4-7. *Summary of current withdrawals and potential availability of water from the Withlacoochee River in the Northern Planning Region (mgd) based on planning-level minimum flow criteria*

Water Body	In-stream Impoundment	Adjusted Annual Average Flow[1]	Potentially Available Flow Prior to Withdrawal[2]	Permitted Average Withdrawal Limits[3]	Current Withdrawal[4]	Unpermitted Potentially Available Withdrawals	Days/Year New Water Available[5]		
							Avg	Min	Max
Withlacoochee River near Holder	Yes	511	51.1	0.0	0.0	49.7	310	26	366
Total			**51.1**	**0.0**	**0.0**	**49.7**			

[1] Mean flow based on recorded USGS flow. Period of record used is 1965–2018.
[2] Based on 10 percent of mean flow.
[3] Based on individual WUP permit conditions, which may or may not follow current 10 percent diversion limitation guidelines.
[4] Equal to remainder of 10 percent of total flow after permitted uses allocated, with minimum flow cutoff for new withdrawals of P85 and maximum system diversion capacity of twice median flow (P50).
[5] Based on estimated number of days that any additional withdrawal is available considering current permitted quantities and withdrawal restrictions. The minimum and maximum are the estimated range of days that additional withdrawals would have been available in any particular year.

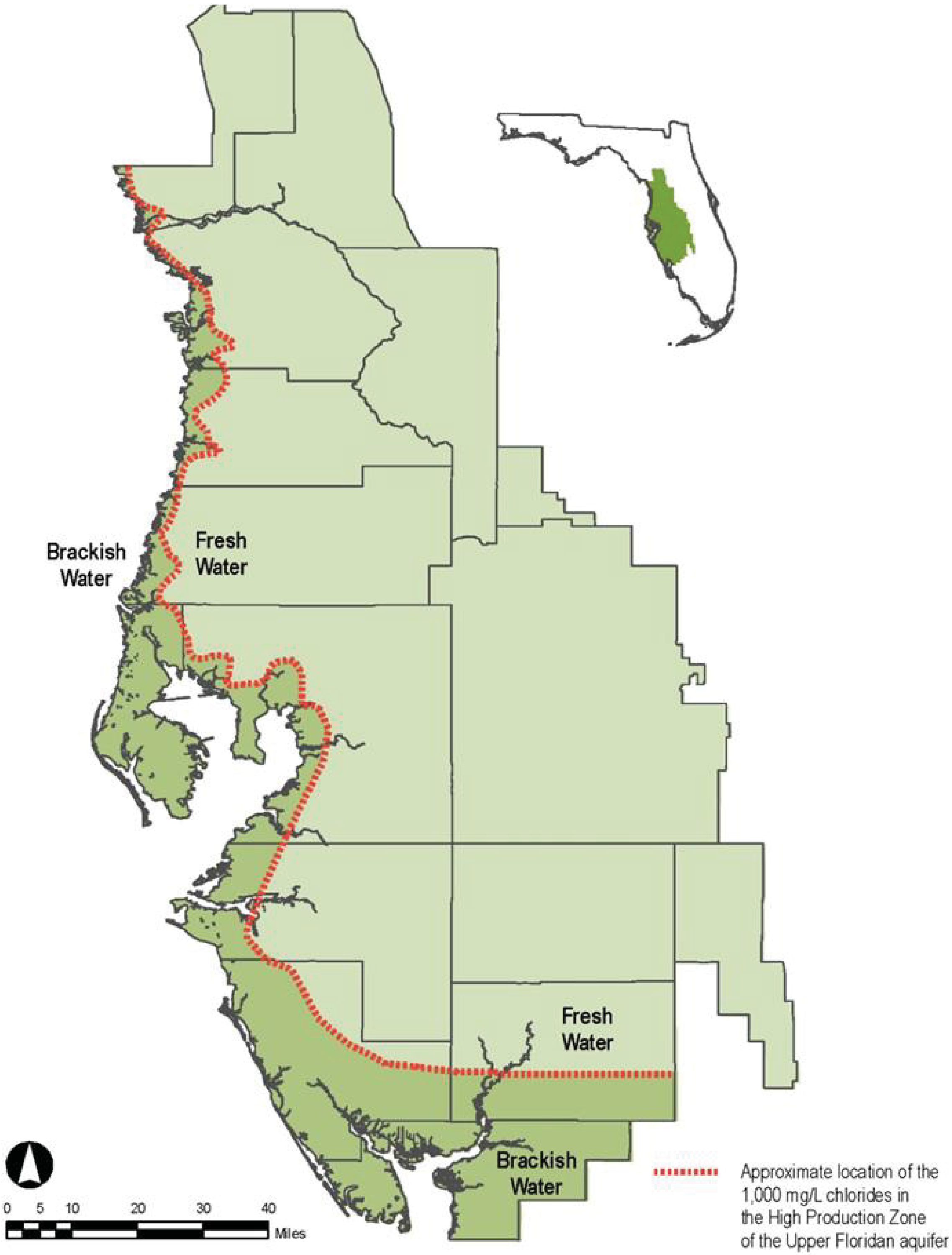


Figure 4-4. *Generalized location of the freshwater/saltwater interface in the District*

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

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

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

While RO is the most common brackish water treatment technology, electro-dialysis reversal (EDR) systems may also be viable and are in use within the District at the T Mabry Carlton facility in Sarasota County. The EDR method uses an electrical current to pull ionic minerals outward from water flowing through a gel membrane, and the electrical current is frequently reversed to prevent buildup in the membrane. Both RO and EDR systems should be considered in brackish water supply project conceptualization and feasibility studies.

Both RO and EDR treatment systems generate a concentrate byproduct that must be disposed of through methods that may include surface water discharge, deep-well injection, or dilution at a WWTP. Surface water discharges require a National Pollutant Discharge Elimination System (NPDES) permit and may be restrained by TMDL limitations. In some cases, brackish water treatment facilities have been required to run below their potential efficiencies to reduce the strength of the concentrate. Because of these environmental considerations, deep-well injection is becoming more prevalent. Deep-well injection may not be permittable in some areas with unsuitable geologic conditions. An additional but costly disposal option is zero liquid discharge (ZLD). zero liquid discharge (ZLD) is the treatment of concentrate for a second round of high recovery desalination, then crystallization or dehydration of the remaining brine. The resulting solids might have economic value for various industrial processes.

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

The District revised its Cooperative Funding Initiative policy in December 2007, recognizing brackish groundwater as an AWS and allowing for assistance with construction projects. Since then, the District has assisted constructing five brackish groundwater treatment projects in the cities of North Port, Oldsmar, Tarpon Springs, Clearwater, and Punta Gorda. Each City has a regionally interconnected water supply system. The District is also co-funding two additional brackish groundwater projects for the PRWC that are under design. The funding is intended to incentivize the development of integrated, robust, multijurisdictional systems that are reliable, sustainable, and utilize diverse water sources. While the District's regional water supply development processes have traditionally been based on meeting increasing demand projections, several brackish groundwater projects have been pursued for other needs: to blend permeate with treated surface water in order to meet finished water quality standards, to maintain viability of existing wellfields with deteriorating water quality, and to provide seasonal source substitution to meet an MFL. Future projects might also incorporate indirect potable reuse. The District recognizes the importance of maintaining the viability of existing supplies, but also encourages the consideration of alternate options based on economics and long-term regional benefit. A phased approach to brackish groundwater development is recommended that includes hydrogeologic evaluations to determine project viability, design phases that help refine the economic and permitting feasibility, and construction procured through a competitive bidding process.

1.0 Potential for Water Supply from Brackish Groundwater

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

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

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

Section 6. Aquifer Recharge

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

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

Sources of water for use in AR projects are often available seasonally and may include high quality reclaimed water, surface water and stormwater. Of the 796.7 mgd of reclaimed water used Statewide in 2018 (FDEP, 2019), 93.2 mgd was used for groundwater recharge, which constitutes approximately 12 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 FDEP water quality standards into an aquifer. Direct AR water recovery may occur through other wells constructed in the area. However, direct AR projects are often designed to improve aquifer conditions.

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

Recent experience with operational ASR projects incorporating oxygen degasification systems and post treatment stabilization have proven that metals mobilization can be minimized and controlled by reducing the dissolved oxygen content in the injection source water in addition to maintaining a negative oxygen-reduction potential (ORP). Aquifer Recharge (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 FDEP. Infiltration capacity and permeability of the soil, presence of drainage features, depth to the water table, local hydrogeology, locations of nearby drinking water wells, as well as locations of nearby wetlands and lakes are all important to identify, test and to determine the feasibility of indirect AR. In favorable regions, indirect AR can provide additional natural water quality treatment to the water as it percolates through sediments during infiltration, in addition to subsequently increasing aquifers levels. It is estimated by the District that 19.24 mgd of available reclaimed water (Districtwide) was being applied through RIBs for indirect AR as of 2018 (FDEP Reuse Inventory of 2019).

Section 7. Seawater Desalination

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

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

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

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

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

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

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

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

1.0 Potential for Water Supply from Seawater Desalination (NPR)

The District's 2015 RWSP identified an option for a 15 mgd seawater desalination facility in the planning region co-located at the Crystal River power station near the Gulf of Mexico in Citrus

County. This option was reevaluated for the WRWSA's 2019 RWSP Update, in cooperation with the District. Conceptual details and estimated costs of this project option have been modified due to operational changes at the Crystal River power station.

Lake Rousseau Dam

The Duke Energy Crystal River Energy Complex (CREC) contains a once-through seawater cooling water system capable of withdrawing over 1,800 mgd of seawater, and a canal discharge system that transports the cooling water flows over 2 miles from the shoreline. The once-through cooling system was historically used for the nuclear power generating unit and two coal-fired generating units. However, these units are in the process of being decommissioned. The CREC will continue operations utilizing generating units equipped with more efficient closed-cycle cooling systems. In late 2018, Duke Energy completed construction of the Citrus Combined Cycle Project (CCCP), a new natural gas-fired plant at the CREC. Due to the projected reduction in cooling water flow and elevated level of salinity in the discharge, using the cooling water stream for waste concentrate disposal is no longer feasible, as there is not enough water to achieve the necessary dilution factor for the desalination concentrate.

Given this, the WRWSA evaluated the siting of a seawater desalination facility at the Cross Florida Barge Canal north of the CREC in Citrus County. The feedwater for such a facility would be brackish surface water pumped from the Cross Florida Barge Canal rather than direct seawater, with waste concentrate disposal occurring through either deep well injection, zero liquid discharge technologies, or ocean outfall. Seawater desalination project option costs are presented in Chapter 5. The proposed location, along with other existing and proposed seawater and brackish groundwater desalination facilities within the District, is shown in Figure 4-5.

Section 8. Stormwater

The FDEP and the WMDs define stormwater as the flow of water which results from, and which occurs immediately following, a rainfall event and which is normally captured in ponds, swales, or similar areas for water quality treatment or flood control. Development of the natural landscape can result in significant changes to the characteristics of stormwater flows. Stormwater runoff can provide considerable volumes of water that can be captured and beneficially used, resulting in water supply, AR, water quality, and natural system benefits. Rule 62-40, Florida Administrative Code, defines "stormwater recycling" as the capture of stormwater for irrigation or other beneficial use. The reliability of stormwater can vary considerably depending upon climatic conditions and storage capability. Therefore, the feasibility of effectively utilizing stormwater as an AWS source often relies on the ability to use it in conjunction with another source (or sources) in order to decrease operational vulnerability to climatic variability (aka "conjunctive use"). Stormwater represents a potentially AWS at the local level, particularly for reclaimed water supplementation and irrigation water uses.

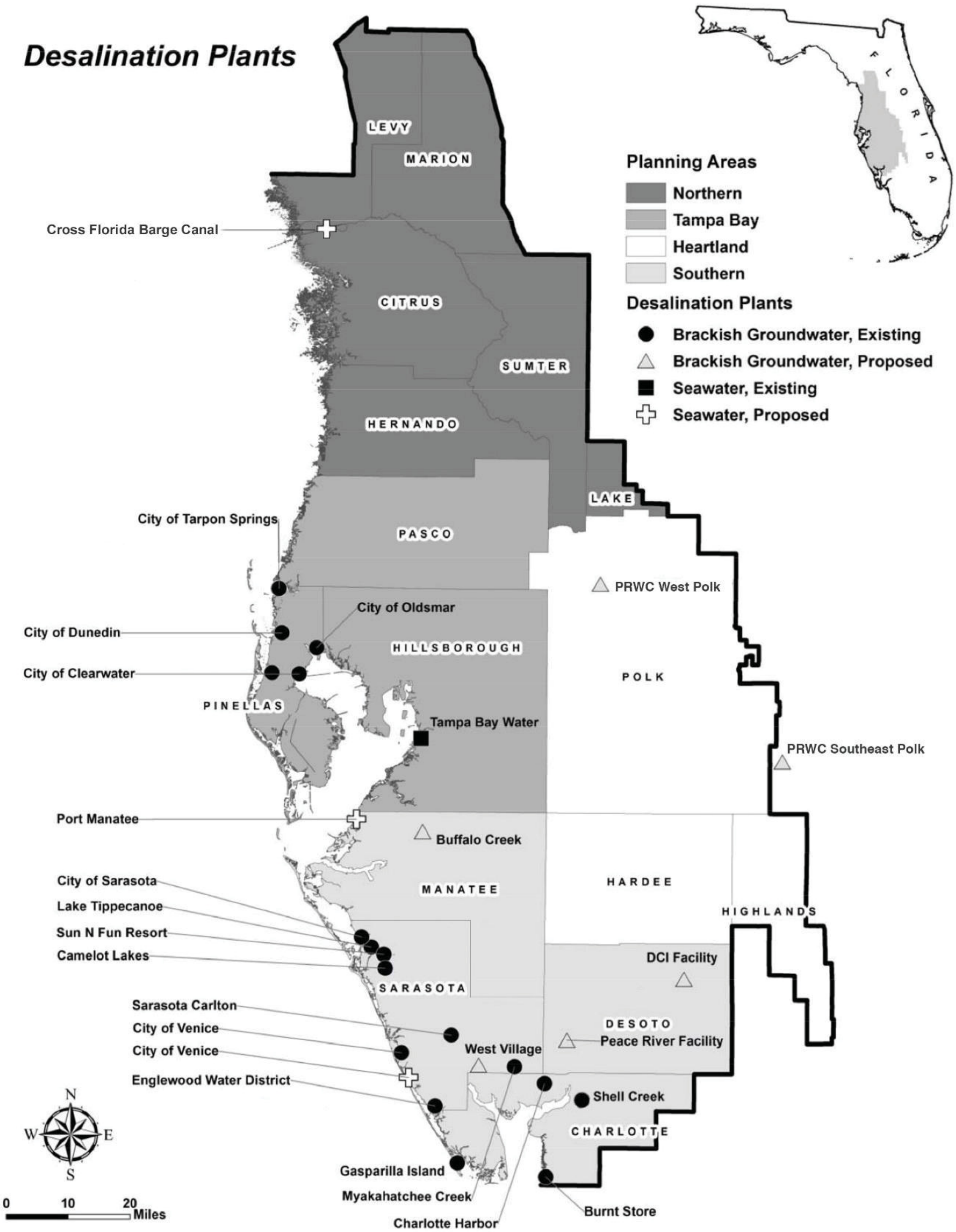


Figure 4-5. *Location of existing and potential seawater and brackish groundwater desalination facilities in the District*

In the Northern Region, the Villages has had historical success in developing stormwater supplies in conjunction with reclaimed water for landscape irrigation. As this area continues to develop, stormwater is expected to continue to be a significant source of water locally to meet landscape irrigation demands. A major future opportunity for stormwater development is the ability for local governments and utilities to partner with the Florida Department of Transportation (FDOT) on stormwater capture and harvesting projects. Presently, FDOT's Efficient Transportation Decision Making Process (ETDM) gives the WMDs and other agencies an opportunity to provide comments during the Planning Screen phase of a project. When FDOT projects advance to the Project Development and Environment (PD&E) phase, FDOT uses Environmental Look Arounds (ELAs) to proactively look for cooperative and regional stormwater management opportunities. ELAs can assist the districts, other agencies, and local utilities with identifying sources of stormwater for activities such as reclaimed water augmentation and MFL recovery.

Section 9. Summary of Potentially Available Water Supply

Table 4-8 is a summary of the additional quantity of water that will potentially be available from all sources of water in each county in the planning region from 2015 through 2040. The table shows that the total additional quantity available is 100.89 mgd.

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 2040 and demands calculated for the 2015 base year (Table 3-6). The projected additional water demand in the planning region for the 2015–2040 planning period is approximately 50.43 mgd. As shown in Table 4-8, up to 100.89 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 2040.

Table 4-8. *Potential additional water availability in the Northern Planning Region through 2040 (mgd)*

County	Surface Water[1]		Reclaimed Water	Desalination		Fresh Groundwater[3]		Water Conservation		Total
	Permitted Unused	Available Unpermitted	Benefits	Seawater	Brackish Groundwater	Surficial and Intermediate	Upper Floridan Permitted Unused	PS	AG	
Hernando	-	-	1.96	-	-	-	3.72	1.74	0.40	7.82
Citrus	-	-	2.00	15	-	-	3.65	5.39	0.23	26.27
Sumter	-	-	0.60	-	-	-	7.05	2.29	0.21	10.15
Levy	-	-	0.13	-	-	-	0.23	0.08	1.41	1.85
Lake	-	-	0.00	-	-	-	0.00	0.00	0.04	0.04
Marion	0.54	49.7	0.98	-	-	-	1.21	1.37	0.96	54.76
Total	**0.54**	**49.7**	**5.67**	**15**	**TBD**	**NA**	**15.86[2]**	**10.87**	**3.25**	**100.89**

[1] Available surface water from the Withlacoochee River is split between Citrus and Marion counties because the calculation was based on flows at a location between these two counties; however, future withdrawals from other counties may be available.

[2] Groundwater that is permitted but unused for PS. Based on 2018 Estimated Water Use (SWFWMD, 2019). It is anticipated that regional future demand can be met with groundwater, provided existing and anticipated local impacts are mitigated or avoided with conservation and reclaimed water use. The quantity of groundwater available in each county is equivalent to each county's projected 2040 demand.

[3] Fresh Groundwater does not include quantities potentially available from the LFA in portions of the planning region. These quantities will be further evaluated in future updates of this RWSP for the Northern Planning Region.

Chapter 5. Overview of Water Supply Development Options

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

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

Part A. Water Supply Development Options

The District developed the reclaimed water options in this chapter. Surface water/stormwater, fresh groundwater, and seawater desalination options were developed by the Withlacoochee Regional Water Supply Authority (WRWSA) as part of their 2019 RWSP, which was co-funded by the District. The water conservation options were developed as a collaborative effort between the District and the WRWSA.

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

The WRWSA's 2019 RWSP provided unit production cost estimates for the surface water, groundwater, and desalination options. Currency is based on 2018 U.S. dollars. Water production costs in $/1,000 gallons provided by the WRWSA are a function of the capital cost debt service based on a 30-year life cycle at 3.0 percent interest (2018 federal discount rate for water projects), annual operation and maintenance (O&M) costs, and amount of water produced.

Section 1. Fresh Groundwater Options

Fresh groundwater project options for the planning region were reevaluated as part of the WRWSA's 2019 RWSP Update. To assess the need for groundwater project options, an analysis was conducted to identify public supply (PS) utilities in the WRWSA's four-county region that were likely to experience water supply deficits by the year 2040. This was accomplished by comparing the 2040 projected demand for each utility (permitted for more than 0.1 million gallons per day (mgd) as of 2015) to their currently permitted groundwater quantities. Utilities with 2040 projected demands that exceed their currently permitted groundwater quantities were identified as having the potential for a water supply deficit. Ten utilities that met this criterion are shown in Table 5-1.

Table 5-1. *Utilities with 2040 demands exceeding permitted quantities*

Utility Name	2015 Demand (MGD)	2040 Demand (MGD)	Increase in Demand 2015-2040 (MGD)	Currently Permitted Quantity (MGD)	2040 Deficit (MGD)	Deficit as Percentage of 2040 Demand
Citrus County						
Citrus County - Sugarmill Woods	2.15	2.72	0.57	2.36	-0.36	13.24%
Marion County (SWFWMD)						
Bay Laurel Center Public Water Supply System	2.50	3.10	0.60	2.56	-0.54	17.42%
City of Dunnellon	0.84	1.16	0.32	1.12	-0.04	3.45%
Marion County (SJRWMD)						
Sunshine Utilities / South Marion Regional System	0.18	0.24	0.06	0.15	-0.09	37.50%
Marion County Utilities Consolidated Permit	5.18	7.62	2.44	6.44	-1.18	15.49%
Sumter County						
Lake Panasoffkee Water Association Inc.	0.23	0.59	0.35	0.41	-0.18	30.51%
City of Bushnell	0.38	1.44	1.06	1.37	-0.07	4.86%
City of Webster	0.12	0.28	0.16	0.10	-0.18	64.29%
City of Wildwood	2.21	9.42	7.20	6.44	-2.98	31.63%
City of Center Hill	0.12	0.32	0.20	0.17	-0.15	46.88%

Section 2. Water Conservation Options

1.0 Non-Agricultural Water Conservation

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

Some readily applicable conservation activities are not addressed due to the wide variance in implementation costs and the site-specific nature of their implementation. One such measure is water-conserving rate structures, which have savings potential but are not addressed as part of the 2020 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 (WUP) application or renewal process. The following is a description of each non-agricultural water conservation option. Savings and costs for each conservation activity evaluated in the 2020 RWSP are also summarized in Table 5-2 below.

The types of activities implemented in this region are expected to be similar to WRWSA as most PS demands in the region are part of WRWSA. Figure 5-1 below depicts which activities will produce what portion of the projected savings. It is understood that over time the breakout will change, but this is what is considered to be the best available information. It is important to note that the savings and costs in Table 5-2 and Figure 5-1 do not include those associated with Levy County, which is not a member of WRWSA.

Table 5-2. *Conservation activity options for PS sector*

Conservation Activity	2040 PS Savings (mgd)[1]	Average Cost Effectiveness ($/kgal)	Total Cost[2]
Residential			
High-efficiency and Ultra-low Flow Toilets	0.40	$1.95	$3,093,259
Smart Irrigation Controllers	0.51	$1.22	$1,455,828
High-efficiency and Low-flow Showerheads	0.06	$0.49	$41,834
High-efficiency Clothes Washers	0.08	$2.22	$741,273
Landscape and Irrigation Evaluations/Audits	2.86	$1.12	$5,930,422
Rain Sensors	0.57	$2.92	$1,432,708
Faucet Aerators	0.09	$0.30	$18,753
Florida Water Star^{SM} in New Construction	0.05	$0.09	$10,407
Irrigation Ordinance	3.24	$0.00	$0
Smart Irrigation Controllers in New Construction	0.31	$0.00	$0
Total PS	**8.17**	**$0.80[3]**	**$12,724,484**

[1]2040 PS savings do not include those estimated for Levy County, which is not a member of WRWSA.
[2]Total cost does not include cost estimates for active conservation in Levy County.
[3]Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.

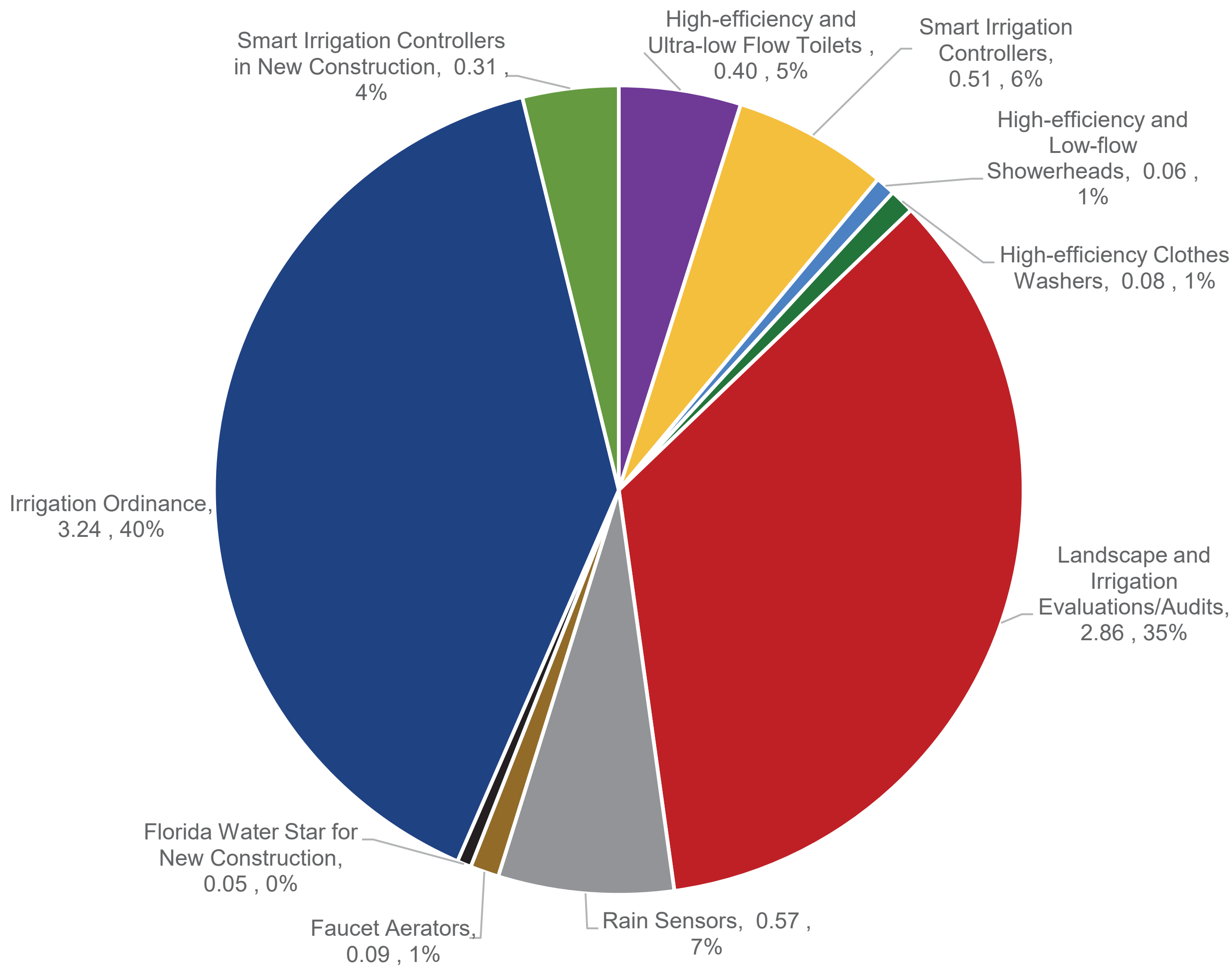


Figure 5-1. *Total 2040 active water savings (mgd) in Northern Region, by conservation activity*

1.1 Description of Non-Agricultural Water Conservation Options

1.1.1 Ultra Low-Flow Toilet and High-Efficiency Toilet Rebates (Residential)

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

1.1.2 High-Efficiency and Low-Flow Showerheads

This practice involves installing EPA WaterSense®-labeled, high-efficiency showerheads. This is a low-cost conservation option that is easy to implement for both residential and I/C users. Savings figures shown in this chapter reflect upgrading 2.5 gallons per minute (gpm) showerheads to a 2.0 gpm WaterSense®-labeled version.

1.1.3 Landscape and Irrigation Evaluations/Audits

Water-efficient landscape and irrigation evaluations (evaluations) generate water savings by evaluating individual irrigation systems, providing expert tips on opportunities to increase water efficiency, optimizing run times, pointing out broken heads and leaks, and sometimes offering targeted rebates or incentives based on those recommendations. Evaluations can focus on three areas: (1) operation, (2) repair, and (3) design. They are normally only available to high-use accounts that have inground irrigation systems and are likely over-watering.

Irrigation system evaluations were identified as a major potential source of water conservation.

1.1.4 Rain Sensors

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

1.1.5 Smart Irrigation Controllers

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

1.1.6 High-efficiency Clothes Washers

Clothes washer conservation programs involve the replacement of old, inefficient clothes washers with EPA Energy Star rated ones. Energy Star clothes washers not only save energy, but also use less water per load of laundry. Water use is measure by an Integrated Water Factor (IWF), which is defined as gallons of water per cycle per cubic foot. Energy Star washers have an IWF of 4.2 or less, depending on the model, compared to inefficient washers that have an IWF of up to 22.

1.1.7 Faucet Aerators

This practice involves installing EPA WaterSense®-labeled, high-efficiency kitchen and bathroom faucet aerators. Similar to showerheads, this is a low-cost conservation option that can be easily implemented. Efficient aerator flow rates are 1.5 gpm for bathroom faucets and 2.5 gpm for kitchen faucets.

1.1.8 Florida Water Star℠ for New Construction

Florida Water Star ℠ (FWS) is a certification program for both residential and commercial buildings. Certified buildings uphold higher standards for water conservation and efficiency, both indoors and outdoors. The primary water saving feature of FWS is the limit on high volume irrigation (maximum of 60 percent of the irrigable area). Savings estimated in this plan are based on mandating FWS certification for all new construction.

1.1.9 Irrigation Ordinances

Many utilities choose to enact irrigation ordinances that restrict residential irrigation to certain days of the week. Violation of the ordinances typically results in a written notice and subsequent fines to the homeowner. In this 2020 RWSP, a one day per week irrigation allowance is considered as a potential active conservation measure in the estimates for Citrus County.

1.1.10 Smart Irrigation Controllers for New Construction

This activity serves as a supplement to the smart irrigation controller activity discussed previously. Rather than provide incentives for smart irrigation controller installations, this measure mandates that all new construction automatically have smart irrigation controllers installed from the beginning. In this 2020 RWSP, this mandate is considered as a potential active conservation measure in the estimates for Citrus County.

1.1.11 New Construction Ordinances?

Municipalities have the ability to pass ordinances that govern the type and amount of landscaping (i.e. turf) for new construction. The District has no authority over this, but could assist municipalities with development of ordinances and technical expertise.

2.0 Agricultural Water Conservation Options

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

2.1 Facilitating Agricultural Resource Management Systems

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 best management practices (BMPs) that involve both water-quantity and water-quality aspects. It is intended to expedite the implementation of production-scale agricultural BMPs that will help farmers become more efficient in their water use, improve water quality and restore and augment natural systems. The FARMS Program is a public/private partnership among the District, FDACS, and private agriculturalists. Reimbursement cost-share rates for agriculturalists are based on the degree to which they implement both water quantity and water quality BMPs. The FARMS program achieves resource benefits through two main types of projects: (1) alternative water supply (AWS); and (2) conservation through precision irrigation. These types of projects will be discussed below. The goal for the FARMS Program is to offset 40 mgd of agricultural groundwater use for agriculture in the Southern Water Use Caution Area. Out of 194 operational FARMS projects, there are nine operational projects within the Northern Planning Region.

2.2 Facilitating Agricultural Resource Management Systems Conservation Potential

Districtwide, as of September 2019, FARMS has funded more than 200 projects with agricultural cooperators, for a total estimated reduction in groundwater use of more than 29 mgd. In the Northern Planning Region, there are nine operational projects with an estimated reduction in groundwater use of approximately 0.243 mgd. The actual offset for these operational projects is approximately 0.302 mgd. While the rate of FARMS participation has varied over time, difficulties within the citrus industry and the nature of agriculture in the Northern Planning Region has resulted in a decreasing FARMS participation trend. Historically funded project information (2004-2019) was used to develop a long-term trend line as a means of estimating potential future program activity. With the decreasing participation trend, during the current planning horizon from fiscal year (FY) 2015 through FY2040, the FARMS program has the potential to reduce groundwater use by approximately 0.06 mgd through development of AWSs. There is not enough data to detect a trend in precision agriculture projects in the Northern Planning Region.

Typical FARMS Project - Tailwater Recovery

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

An example of a tailwater recovery project is the Blueberry Hill blueberry farm in Lake County. The farm is permitted to withdraw up to 0.140 mgd of groundwater to irrigate 53 acres of blueberries. The goal of the project is to reduce groundwater withdrawals through the use of two tailwater recovery/surface water collection reservoirs. The project was implemented in two phases with two reservoirs, includes two surface water pump stations, filtration, and infrastructure necessary to operate and connect the reservoir to an existing irrigation system. The projected reduction in groundwater withdrawals is 50 percent, or 0.07 mgd of its permitted quantities.

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

2.3 Mobile Irrigation Laboratory

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

2.4 Best Management Practices

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

Section 3. Reclaimed Water Options

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

- **Augmentation with Other Sources:** introduction of another source (stormwater, surface water, groundwater) into the reclaimed water system to expand available supply
- **Distribution:** expansion of a reclaimed water system to serve more customers
- **Efficiency/Research:** the study of how utilities can maximize efficiency and offset potential of reclaimed water systems to conserve water (rate structures, telemetry control, watering restrictions, metering and others) and research (water quality and future uses)
- **Interconnect:** interconnection of systems to enhance supply and allow for better utilization of the resource or to enable agricultural or other WUP exchanges
- **Natural System Enhancement/Recharge:** introduction of reclaimed water to create/restore natural systems and enhance aquifer levels (indirect potable reuse)

- **Saltwater Intrusion Barrier:** injection of reclaimed water into an aquifer in coastal areas to create a salinity barrier
- **Storage:** reclaimed water storage in ground storage tanks and ponds
- **Streamflow Augmentation:** introduction of reclaimed water downstream of water withdrawal points as replacement flow to enable additional utilization of the surface water supply
- **System Expansion:** construction of multiple components (transmission, distribution, and storage) necessary to deliver reclaimed water to more customers
- **Transmission:** construction of large mains to serve more customers
- **Potable reuse:** purification of reclaimed water to meet drinking water standards prior to introduction

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 5 reclaimed water project options for the planning region with input from utilities and other interested parties. The District determined the quantity of reclaimed water available for each option based on an analysis of wastewater flows anticipated to be available in 2040 at a utilization rate of 75 percent (Chapter 4 Appendix, Table 4-1). It is recognized that the viability of some options depends on whether certain other options are developed, and not all options can be developed because some would use the same reclaimed water source. The options are listed in Table 5-3.

Flow and capital cost data for the 39 funded reclaimed water construction projects identified as being under development (2015-2020) within the District were used to develop a representative cost per 1,000 gallons supplied and capital cost for each option. The data show that, for the 39 new reclaimed water projects anticipated to come online between 2015 and 2025, the average capital cost is approximately $10.27 million for each 1 mgd supplied. This figure was used in cost calculations for individual reclaimed water options, unless specific cost data were available.

Table 5-3. *List of reclaimed water options for the Northern Planning Region*

Option Name and Entity	County	Type	Supply (mgd)	Offset (mgd)	Capital Cost (Millions)
Citrus Co./Inverness Holden Park Reuse	*Citrus*	*System Expansion*	*0.05*	*0.04*	*$0.30*
Wildwood-Continental Country Club Golf Reuse	*Sumter*	*System Expansion*	*0.12*	*0.09*	*$0.50*
Brooksville-Hernando Oaks Golf Reuse	*Hernando*	*System Expansion*	*0.25*	*0.20*	*$0.60*
Brooksville-Cascades Residential Reuse	*Hernando*	*System Expansion*	*0.07*	*0.05*	*$0.25*
Villages-Reuse Interconnection with Leesburg	*Sumter, Lake*	*Interconnection*	*2.10*	*2.10*	*$21.57*
Totals: 5 Options			***2.59***	***2.48***	***$23.22***

The use of italics denotes SWFWMD estimations.
Benefit = (if estimated) Annualized Supply: 1. x 75% for Ag, & R/A/C, 2. x 100% for I/C, NSR, & PG. 3. x 75% for Variety and 4. for RES is number of customers X 330 gpd.

Section 4. Surface Water/Stormwater Options

Chapter 4 discusses the availability of surface water in the Withlacoochee River Basin for PS water use. Use of surface water entails specific treatment, reliability of quantity and quality of source waters, and management of any associated environmental impacts to downstream ecology and water resources. These characteristics should be identified and addressed at the planning level. The surface water options identified below are based on the Withlacoochee River System's flow characteristics, future demand for water supply in the region, and associated environmental resource data. More detail on all the surface water options can be found in the WRWSA 2019 RWSP update (WRWSA, 2019).

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

- Entity Responsible for Implementation: WRWSA

This option is for a surface water supply facility that could provide up to 25 mgd conjunctive use facility with a raw water reservoir. A transmission system would serve customers in the City of Wildwood and The Villages. The proposed intake structure would be located on the Withlacoochee River in northern Sumter County, approximately 1.8 miles upstream of Wysong-Coogler Dam. During low-flow periods when withdrawals from the river would be limited, the facility would be supplemented by groundwater withdrawals in Sumter County. The use of surface water would extend the availability of groundwater by reducing the frequency and duration of groundwater withdrawals. The proposed location of the facility is on property owned by the District west of Lake Panasoffkee and north of the Outlet River. Conceptual project components include a river intake and raw water pump station, a storage reservoir with an area of approximately 461 acres, a raw water transfer pump station, a water treatment facility, two 10-million gallon tanks for finished water storage, a finished water pumping station, and approximately 22 miles of finished water transmission mains. See Table 5-4 for a summary of this option's potential costs.

Table 5-4. *Withlacoochee River Surface Water Supply Facility option costs (Northern Sumter County)*

Quantity Produced (mgd)	Capital Cost	Capital Cost/mgd	Total Cost/1,000 Gallons	O&M Annual Costs
25	$397,783,310	$15,911,332	$4.10	$17,100,000

Issues:

- A detailed study of the effect of the river intake on the natural environment in the area and on the river flow regime will need to be performed in order to determine the exact location and design of the intake structure.
- Minimum lake levels have been established for Lake Panasoffkee and the Tsala Apopka Chain of Lakes. Impacts to these lakes will be an important consideration during the process to permit additional groundwater and surface water withdrawals in the vicinity.
- Further geologic evaluation of the proposed reservoir area will be needed. Due to the high permeability of geologic units in the area, a reservoir liner to prevent excessive water loss was included in the conceptual design.

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

- Entity Responsible for Implementation: WRWSA

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

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

Quantity Produced (mgd)	Capital Cost	Capital Cost/mgd	Total Cost/1,000 Gallons	O&M Annual Costs
25	$470,391,830	$18,815,673	$4.50	$17,100,000

Issues:

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

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

- Entity Responsible for Implementation: WRWSA

There are two options for a surface water supply facility with a capacity of 25 mgd with the potential to serve customers in the City of Ocala and northwest Citrus and western Hernando counties. Water would be withdrawn directly from Lake Rousseau and pumped north of the lake, approximately four miles, to a water treatment plant in southern Levy County on property owned by the FDACS. An off-stream reservoir is not included because of the year-round high-volume inflow from Rainbow Springs via the Rainbow River. Project components include a river intake and pumping station, a raw water transmission main, a water treatment facility, finished water storage tanks, a finished water pumping station, and approximately 63 miles of finished water transmission main. There are two options to achieving a facility with the capacity of 25-mgd. The first project option requires significantly less raw transmission main, while the second option provides more area for expansion and flexibility for potential growth. See Table 5-6 for a summary of this option's potential costs.

Table 5-6. *Surface Water Treatment Facility at Lake Rousseau option costs*

Quantity Produced (mgd)	Capital Cost	Capital Cost/mgd	Total Cost/1,000 Gallons	O&M Annual Costs
Option 1: 25	$344,865,500	$13,794,620	$3.80	$17,100,000
Option 2: 25	$361,732,400	$14,469,296	$3.90	$17,100,000

Issues:

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

Section 5. Brackish Groundwater Desalination Options

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

Section 6. Seawater Desalination Options

As discussed in Chapter 4, the WRWSA again evaluated options for development of a seawater desalination facility with the Crystal River power station as part of its 2019 RWSP. Operational changes at the power station have necessitated conceptual modifications to the project options, as the high-capacity flows for once-through cooling at the power station have already or are in the process of being decommissioned. These changes have reduced the benefits of using the station's existing intake and discharge facilities for dilution of concentrate byproduct. The WRWSA's 2019 RWSP includes conceptual design alternates using similar production capacity and distribution configurations with a variety of concentrate disposal options, including deep well injection, ocean outfall, and zero-liquid discharge systems. The option utilizing deep well injection for concentrate disposal was found to be the most economically feasible and is presented below.

Seawater Desalination Option #1. Crystal River Power Station

- Entity Responsible for Implementation: WRWSA

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

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

The treatment and appurtenant facilities would require a 10-acre site. Two storage tanks would be provided on site for plant downtime and transmission system interruptions. A deep well injection system would pump concentrate into confined subsurface rock formations, likely thousands of feet below surface, and capital expenses would include a geological evaluation at the site. The conceptual project costs, as shown below in Table 5-7, include approximately 34 miles of transmission lines to provide regional supply to multiple demand centers and include easement acquisitions. Due to the difference in chemistry between treated seawater and treated groundwater supplies at existing utility systems, blending stations capable of stabilization for corrosion control and disinfection byproducts would be necessary at utility connection points.

Table 5-7. *Crystal River Power Station options and costs*

Disposal Option and Quantity Produced (mgd)	Capital Cost	Capital Cost/mgd	Total Cost/1,000 Gallons	O&M Annual Costs
Deep Well Injection - 15	$258,878,480	$17,258,565	$6.22	$21,300,000
Zero Liquid Discharge - 15	$393,063,140	$26,204,209	$12.60	$49,552,000
Ocean Outfall - 15	$354,978,700	$23,665,247	$7.08	$21,217,000

Issues:

- Changing land uses at and near the Crystal River power station and Barge Canal may impact the feasibility of the desalination option; including operation of the current power station and other future developments.

Chapter 6. Water Supply Projects Under Development

This chapter is an overview of water supply projects that are under development in the Northern Planning Region. Projects under development are those the Southwest Florida Water Management District (District) is co-funding and are either (1) actively in the planning, design, or construction phase, or (2) not yet in the planning phase, but have been at least partially funded through FY2019, or (3) have been completed since the year 2015 and are included to report on the status of implementation since the previous Regional Water Supply Plan (RWSP).

The demand projections presented in Chapter 3 show that approximately 50.4 million gallons per day (mgd) of new water supply will need to be developed during the 2020 to 2040 planning period to meet demand for all use sectors in the planning region. As of 2019, it is estimated that at least 14 percent of that demand (6.7 mgd) has either been met or will be met by projects that meet the above definition of being “under development.” In addition to these projects under development, it is probable that additional water supplies are being developed by various entities in the planning region outside of the District’s funding programs.

Section 1. Water Conservation

1.0 Non-Agricultural Water Conservation

1.1 Indoor Water Conservation Projects

Since 2015, the District has cooperatively funded the distribution of approximately 1,141 ultra low-flow or high-efficiency fixtures within the Northern Planning Region. These programs have cost the District and cooperating local governments a combined $153,256 and have yielded a potable water savings of approximately 24,144 gallons per day (gpd). Table 6-1 provides information on indoor water conservation projects that are under development in the planning region.

1.2 Outdoor Water Conservation

Since 2015, the District has cooperatively funded 2,023 outdoor devices and programs, including rain sensor rebates, landscape and irrigation evaluations, and smart irrigation controller rebates, in the planning region. These programs have cost the District and cooperating local governments a combined $836,324 and have yielded a potable water savings of approximately 255,915 gpd. Table 6-1 also provides information on outdoor water conservation projects that are under development.

Table 6-1. *Water conservation projects under development in the Northern Planning Region*

Cooperator	Project Number	General Description	Savings (gpd)	Devices and Rebates	Total Cost[1]	District Cost	$/1,000 gal Saved
Indoor Projects							
Citrus County	N634	Toilet Rebate	3,388	191	$19,208	$6,397	$1.58
Marion County	N639	Toilet Rebate	2,614	142	$19,364	$9,682	$2.07
Marion County	N678	Toilet Rebate	2,917	150	$21,466	$10,733	$2.05
Marion County	N779	Toilet Rebate	5,035	258	$29,218	$14,609	$1.62

Marion County	N999	Toilet Rebate	10,190	400	$64,000	$32,000	$1.75
Indoor Total			*24,144*	*1,141*	*$153,256*	*$73,421*	*$1.77*[2]
Outdoor/Other Projects							
Citrus County	N620	Rain Sensor Rebate	1,506	107	$4,216	$1,393	$1.92
WRWSA	N640	Irrigation System Evaluation	20,169	140	$70,102	$35,051	$2.38
Bay Laurel	N757	Smart Irrigation Controller Rebate	14,004	300	$79,486	$39,743	$2.32
WRWSA	N822	Irrigation System Evaluation	86,944	416	$200,000	$100,000	$1.58
Citrus County	N860	Smart Irrigation Controller Rebate	16,658	75	$33,750	$16,875	$0.83
Bay Laurel	N921	Smart Irrigation Controller Rebate	22,794	300	$87,520	$43,760	$1.57
Bay Laurel	N922	Florida Water Star Rebate	7,920	75	$52,500	$26,250	$2.71
Citrus County	N958	Smart Irrigation Controller Rebate	11,106	50	$33,750	$16,875	$1.24
North Sumter County	Q018	Rain Sensor Rebate	9,600	120	$40,000	$20,000	$2.86
WRWSA	Q040	Irrigation System Evaluation	38,740	260	$145,000	$72,500	$2.57
Citrus County	Q070	Smart Irrigation Controller Rebate	26,474	180	$90,000	$45,000	$1.39
Outdoor/Other Total			*255,915*	*2,023*	*$836,324*	*$417,447*	*$1.83*
Total			**280,059**	**3,164**	**$989,580**	**$490,868**	**$1.90**

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

2.0 Agricultural Water Conservation Projects

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

2.1 Institute of Food and Agricultural Sciences Research and Education Projects

The District provides funding for Institute of Food and Agricultural Sciences (IFAS) to investigate a variety of agriculture/ urban issues that involve water conservation. These include, but are not limited to, development of tailwater recovery technology, determination of crop water use requirements, evaluation of alternative irrigation methods, field irrigation scheduling, frost/freeze protection, residential irrigation, and urban water use. The results of research conducted by IFAS is then promoted to the agricultural community. The District has funded research on strawberries, citrus, tomatoes, potatoes, peaches, biofuel grasses, turf grass, peppers, blueberries, and various landscape and nursery ornamental plants and trees. Of the 58 research projects, 48 have been completed. Completed projects include 10 projects dealing with urban landscape issues and 38 involving various agricultural commodities. While the research projects are not specific to each planning region, they are specific to a commodity group that has a strong presence in each region. The research will help develop best management practices that will conserve water Districtwide. Specific benefits to the planning region are dependent on the commodities dominant in that planning region. The 10 ongoing projects are described in Table 6.2.

Table 6.2. *List of water conservation research projects*

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

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

Section 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 6-3 is a list, description and summary of the benefits and costs that have been or will be realized by three reclaimed water projects currently under development and another six estimated to experience additional future supply growth. It is anticipated that these projects will be online by 2025.

Table 6-4 includes general descriptions and a summary of 10 research projects for which the District has provided more than $1,026,000 in funding. The District has also committed to developing a comprehensive reclaimed water education strategy. All reclaimed water construction projects funded by the District require education programs that stress the value and benefits of efficient and effective water use, regardless of the source. To provide reclaimed water information to a broader audience, the District has developed a web page which is one of the top internet sources of reuse information, including GIS and other data. The District also produces reclaimed water publications that are offered to residents, utilities, engineering firms, environmental agencies and other parties interested in developing and expanding reclaimed water systems.

Construction of Crystal River to Duke Energy reclaimed water pipeline

Table 6-3. *List of Reclaimed water projects under development in the Northern Planning Region*

Cooperator	General Project Description	Reuse (mgd)			Customer (#)		Costs	
		Produced	Benefit	Stored	Type	Total	Total	District[1]
Citrus County								
Citrus County Point O Woods	Growth of Flow to Golf Course	0.01	0.01	-	GC	1	Prior	Prior
City of Crystal River	Growth of Flow to Power Plant	0.53	0.53	Prior	IND	1	Prior	Prior
Citrus Sugarmill Woods	Trans/Store/Pump	0.50	0.375	1	GC	2	$3,918,000	$1,959,000
Hernando County								
Hernando County	Trans N696	0.30	0.30	NA	GC	1	$12,000,000	$9,000,000
Hernando County	Trans Q047	0.20	0.12	NA	Rec	1	$400,000	$200,000
City of Brooksville	Growth of Flow to Mine	0.24	0.24	NA	Ind	1	Prior	NA
Marion County								
Marion County NW	Growth of Flow to Golf Course	0.03	0.02	NA	GC	1	Prior	NA
Sumter County								
Villages	Growth of Flow to Golf Courses	0.63	0.47	Prior	GC	TBD	Prior	NA
Wildwood	Growth of Flow to Villages	4.01	3.00	Prior	GC	TBD	Prior	Prior
Total	**9 Projects**	**6.45**	**5.07**	**1.00**		**8**	**$16,318,000**	**$11,159,000**

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

Table 6-4. *List of reclaimed water research projects co-funded in the District*

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

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

Section 3. Brackish Groundwater

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

Section 4. Aquifer Recharge

1.0 Indirect Recharge

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

Chapter 7. Water Resource Development Component

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

Part A. Overview of Water Resource Development Efforts

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

Section 1. Data Collection and Analysis Activities

The District budgets significant funds annually to implement the water resource development data collection and analysis activities, which support the health of natural systems and water supply development. Table 7-1 displays the fiscal year (FY) 2020 budget and anticipated five-year funding levels for Districtwide data collection and analysis activities. Approximately $40.8 million will be allocated toward these activities annually for a five-year total of approximately $204 million. Because budgets for the years beyond FY2020 have not yet been developed, but are projected to be fairly constant, future funding estimates for activities are set equal to FY2020 funding. Funding for these activities is primarily from the Governing Board's allocation of ad valorem revenue collected within the District. In some cases, additional funding is provided by water supply authorities, local governments, and the U.S. Geological Survey (USGS). The activities listed in Table 7-1 are described in subsections 1.0 through 5.0, below.

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

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

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

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 808 surface water level gauging sites, and cooperative funding with the USGS for discharge and water-level data collection at 129 river, stream and canal sites. The data is available to the public through the District's Water Management Information System, and through the USGS Florida Water Science Center Web Portal.

1.2 Geohydrologic Data Well Network

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

1.3 Meteorologic Data

The meteorologic data monitoring program consists of measuring rainfall totals at 171 rain gauges, most of which provide near real-time data. Annual funding is for costs associated with measurement of rainfall, including sensors, maintenance, repair, and replacement of equipment. Funding allows for the operation of one District evapotranspiration (ET) station for reference near Lake Hancock, and for District participation in a cooperative effort between the USGS and all five Florida water management districts (WMDs) to map statewide potential and reference ET using data measured from the Geostationary Operational Environmental 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 380 wells across the District to monitor saltwater intrusion and/or the upwelling of mineralized waters into potable aquifers.

1.5 Groundwater Levels

The District maintains 1,618 monitor wells in the data collection network, including 856 wells that are instrumented with data loggers that record water levels once per hour, and 762 that are measured manually by field technicians once or twice per month.

1.6 Biologic Data

The District monitors ecological conditions as they relate to both potential water use impacts and changes in hydrologic conditions. Funding for biologic data collection includes support for routine monitoring of approximately 150 wetlands and a five-year assessment of over 400 wetlands to document changes in wetland health and assess level of recovery in impacted wetlands. Funding also supports an effort to map the estuarine hard bottom of Tampa Bay, as well as SWIM program efforts for mapping of seagrasses in priority water bodies including Tampa Bay, Sarasota Bay, Charlotte Harbor, and the Springs Coast area.

1.7 Data Support

This item provides administrative and management support for the WQMP, hydrologic and geohydrologic staff support, the District's chemistry laboratory, and the District's LoggerNet data acquisition system.

2.0 Minimum Flows and Levels Program

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

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

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

As of August 2019, the District has preliminarily planned to monitor and assess the status of 210 adopted MFLs, including MFLs for 23 river segments, 10 springs or spring groups, 127 lakes, 41 wetlands, 7 wells in the Northern Tampa Bay Water Use Caution Area, and the Upper Floridan aquifer (UFA) in the most impacted area (MIA) of the SWUCA and in the Dover/Plant City Water Use Caution Area (DPCWUCA). The District is scheduling the establishment or reevaluation of 96 additional MFLs and one reservation through FY2029. The District's annual MFL Priority List and Schedule and Reservations List and Schedule is approved by the Governing Board in October, submitted to FDEP for review in November, and subsequently published in the Consolidated Annual Report. The approved and proposed priority lists and schedules are also posted on the District's Minimum Flows and Levels Documents and Reports webpage at: https://www.swfwmd.state.fl.us/projects/mfl/documents-and-reports

3.0 Watershed Management Planning

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

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

4.0 Quality of Water Improvement Program

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

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

5.0 Stormwater Improvements: Implementation of Storage and Conveyance Best Management Practices

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. As stormwater is a primary contributor of water quality degradation in older urban areas, the District seeks opportunities to retrofit or improve these systems to reduce impacts to receiving waters. The FY2020 funding includes new storage and conveyance projects in the Tampa Bay area, particularly in Hillsborough and Pasco county, as well as several continuing Tampa Bay projects.

Section 2. Water Resource Development Projects

As of FY2020, the District has 20 ongoing projects that meet the definition of water resource development "projects." The projects are listed in Table 7-2, below, along with their funding to date, total costs, participating cooperators, the estimated water quantity to be become available, and the planning region benefitted by the project. The total cost of these projects is approximately $150 million and a minimum of 78 million gallons per day (mgd) of additional water supply will be produced or conserved.

These projects include feasibility and research projects for new alternative water supply (AWS), Facilitating Agricultural Resource Management Systems (FARMS) projects to improve agricultural water use efficiency, and environmental restoration (ER) 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.

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

1.1 South Hillsborough Aquifer Recharge Program (SHARP) (N287)

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

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

Water Resource Development Projects		Prior District Funding through FY2019	Total Project Cost (District + Cooperator)	Funding Source	Water to Become Available	Planning Region of Benefit
1) AWS Feasibility Research and Pilot Projects						
1.1	South Hillsborough Aquifer Recharge Program (SHARP) (N287)	$1,382,500	$2,765,000	SWFWMD, Hillsborough County	2 mgd	TBPR
1.2	Bradenton Aquifer Protection Recharge Well (N842)	$1,500,000	$5,050,000	District, City of Bradenton	5 mgd	TBPR
1.3	PRMRWSA Partially Treated Water ASR (N854)	$495,500	$7,755,000	District, PRMRWSA	3 mgd	SPR
1.4	Southern Hillsborough Aquifer Recharge Expansion (SHARE) Phase 1 (N855)	$4,500,000	$9,700,000	District, Hillsborough County	4 mgd	TBPR
1.5	Braden River Utilities ASR Feasibility (N912)	$2,736,250	$5,995,000	District, Braden River Utilities	TBD	SPR
1.6	Hydrogeologic Investigation of Lower Floridan Aquifer in Polk County (P280)	$11,375,000	$12,000,000	SWFWMD	TBD	HPR
1.7	Optical Borehole Imaging Data Collection from LFA Wells (P925)	$100,200	$167,000	District, USGS	NA	HPR
1.8	Sources/Ages of Groundwater in LFA Wells (P926)	$368,300	$555,800	District, USGS	NA	HPR
1.9	City of Venice Reclaimed Water Aquifer Storage Recovery (Q050)	$0	$5,065,000	District, City of Venice	0.17 mgd	SPR
1.10	Direct Aquifer Recharge-North Hillsborough Aquifer Recharge Program Phase 2 (Q064)	$0	$1,500,000	District, Hillsborough County	TBD	TBPR
1.11	Direct Aquifer Recharge-South Hillsborough Aquifer Recharge Program Phase 3 (Q088)	$0	$13,000,000	District, Hillsborough County	6 mgd	TBPR
2) FARMS						
2.1	FARMS Projects	$40,780,456	$71,791,225	SWFWMD, FDACS, State of FL, private farms	29 mgd	All
2.2	Mini-FARMS Program	$616,237	$150,000 (annual)	SWFWMD	2 mgd	All

3) ER and MFL Recovery						
3.1	Lower Hillsborough River Recovery Strategy (H400)	$5,464,712	$10,857,462	SWFWMD, City of Tampa	3.1 mgd	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 (H04)	$3,668,040	$700,000	SWFWMD	3.9 mgd	TBPR
3.4	Haines City Reclaimed Water MFL Recharge & Advanced Treatment Feasibility Study (N888)	$225,000	$357,710	SWFWMD, Haines City	0.7 mgd	HPR
3.5	Lake Hancock Lake Level Modification (H008)	$9,989,166	$10,428,490	SWFWMD, State of FL, Federal	TBD	HPR, SPR
3.6	Lake Jackson Watershed Hydrology Investigation (N554)	$260,000	$400,000	SWFWMD, City or Sebring, Highlands County	NA	HPR
3.7	Upper Myakka / Flatford Swamp Hydrologic Restoration and Implementation (H089)	$5,044,012	$31,000,000	SWFWMD	6.0 mgd	SPR, HPR

Note: Tampa Bay Planning Region (TBPR); Southern Planning Region (SPR); Heartland Planning Region (HPR)

1.2 Bradenton Aquifer Protection Recharge Well (N842)

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

1.3 PRMRWSA Partially Treated Water ASR (N854)

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

1.4 Southern Hillsborough Aquifer Recharge Expansion (SHARE) Phase 1 (N855)

This project is for a third-party review of the County's 30 percent design, completion of design and permitting, and the initiation of construction for Phase 1 of the South Hillsborough Aquifer Recharge Expansion (SHARE) project. Pending third-party review and approval, project will construct 9,500 feet of transmission mains, two reclaimed water recharge wells (2 mgd each), eight monitoring wells, and associated appurtenances. The SHARE project expands upon the county's current recharge project (N287).

1.5 Braden River Utilities ASR Feasibility (N912)

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

1.6 Hydrogeologic Investigation of LFA in Polk County (P280)

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

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

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

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

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

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

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

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

This project includes completion of a direct aquifer recharge feasibility study, which includes the construction and testing of three exploratory wells necessary to evaluate recharge locations for the North Hillsborough Aquifer Recharge Program (NHARP). If approved, the study will aid in the determination of the hydrogeological characteristics and water quality of the targeted Avon Park Formation of the UFA and the approximate depth of the base of the underground source of drinking water in the general vicinity of NHARP.

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

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

2.0 Facilitating Agricultural Resource Management Systems (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. The purpose of the FARMS initiative is to provide an incentive to the District's agricultural community to implement agricultural BMPs that will provide resource benefits including water quality improvement, reduced UFA withdrawals, and enhancements to the water resources and ecology.

The FARMS Program has five specific goals: (1) offset 40 mgd of groundwater within the SWUCA; (2) improve surface water quality impacted by mineralized groundwater within the Shell, Prairie and Joshua Creek watersheds (SPJC); (3) improve natural systems impacted by excess irrigation and surface water runoff within the Flatford Swamp region of the upper Myakka River watershed; (4) prevent groundwater impacts within the northern areas of the District; and (5) reduce frost-freeze pumpage by 20 percent within the DPCWUCA. 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 also 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 September 2019, there were 208 approved FARMS projects including nine in the Northern Planning Region (NPR). The projects are projected to have a cumulative groundwater offset of 29.0 mgd Districtwide and 0.24 mgd for the projects within the NPR.

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

Project Description	District Budget FY2015-2019	Benefit (mgd)
M & B Products, Inc	$247,596	Pilot Project for Nutrient reduction Benefits
BLUEBERRY HILL - PHASE 2	$262,651	0.050
Total	**$510,247**	**0.050**

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

2.2 Mini-FARMS Program

Mini-FARMS is a scaled down version of the District's FARMS cost-share reimbursement program to implement agricultural BMPs on agricultural operations of 100 irrigated acres or less to conserve water and protect water quality within the District. Mini-FARMS is intended to assist in the implementation of the SWUCA Recovery Strategy, DPCWUCA Recovery Strategy, the Shell and Prairie Creek WMP, and the District's Strategic Plan. Much like the FARMS projects, the Mini-FARMS Program implements BMPs on agricultural operations to reduce UFA groundwater use and/or improve water quality conditions throughout the District. The maximum cost-share amount available from Mini-FARMS projects is $8,000 per agricultural operation per year, and the maximum cost-share rate is 75 percent of project costs.

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

2.3 FARMS Irrigation Well Back-Plugging Program

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

A total of 85 wells have been back plugged in the SWUCA through FY2014, with 63 of these wells located in the SPJC priority watersheds. Analytical results for all back-plugged wells indicated conductivity, total dissolved solids, 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.

3.0 Environmental Restoration and Minimum Levels and Flows Recovery Projects

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

3.1 MFL Recovery Lake Hancock Design, Permit, Mitigation to Raise Lake (H008)

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

3.2 MIA Recharge SWIMAL Recovery at Flatford Swamp (H089)

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

3.3 Lower Hillsborough River Recovery Strategy (H400)

The District established revised MFLs for the Lower Hillsborough River in 2007. Because the MFLs were not being met, the District incorporated a recovery strategy for the river into Rule 40D-

80.073(8), F.A.C. As part of the recovery strategy, the District entered into a joint funding agreement and additional project-specific agreements with the City of Tampa to assess and implement projects associated with diversion of water from various sources to meet minimum flow requirements in the river.

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

3.4 Lake Jackson Watershed Hydrology Investigations (N554)

Lake Jackson is a 3,412-acre lake located in the City of Sebring and is one of nine lakes in Highlands County with an established MFL. Residents and local officials have voiced concerns over persistent low water levels potentially related to storm water canal structures, potential flow through the shallow aquifer to the canals, and possible leakage in the lake's hardpan bottom. This project is a hydrologic investigation, including data collection, to identify the causes of low water level in Lake Jackson and Little Lake Jackson over the last decade and develop cost-effective recovery strategies.

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

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

Chapter 8. Overview of Funding Mechanisms

This chapter provides an overview of mechanisms available to generate the necessary funds to implement the water supply and water resource projects proposed by the District and its cooperators to meet the water supply demand projected through 2040 and restore minimum flows and levels (MFLs) to impacted natural systems.

Table 8-1 shows the projected increase in demand for each planning region for the planning period, as described in Chapter 3 of each volume of the Regional Water Supply Plan (RWSP). The table shows that approximately 209.8 million gallons per day (mgd) of new water supply is needed to meet user demands and to restore natural systems.

Table 8-1. *Summary of total projected increases in demand (5-in-10) (mgd) by each planning region from base year 2015 to 2040*

Planning Region	Projected Demand Increase
Heartland	38.9
Northern	50.4
Southern	44.4
Tampa Bay	76.1
Total	**209.8**

Note: Summation differences occur due to decimal rounding.

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

To prepare an estimate of the capital cost for projects needed to meet the portion of demand not yet under development, the District has compiled a list of large-scale WSD projects (Table 8-2) through the District. No large-scale WSD projects are listed for the Northern Planning Region because a significant portion of water demand in the region will be met with fresh groundwater, conservation, and reclaimed water initiatives available to the region. The District anticipates that a large portion of the remaining demand will be met through projects that users will select from the water supply options listed in Chapter 5 of this RWSP.

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

Part A. Statutory Responsibility for Funding

Section 373.705, Florida Statutes (F.S.), describes the responsibilities of the Water Management Districts (WMDs) in regard to funding WSD 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 water resource development (WRD) projects. As discussed in Chapter 7, the District considers its WRD activities to include resource data collection and analysis, as well as projects. In terms of WSD, the District has typically funded the development, storage, and transmission of non-traditional sources of water, including reclaimed water and conservation. Potential sources of funding for WSD and WRD projects are addressed below.

Part B. Funding Mechanisms

Section 1. Water Utilities

Water supply development (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 variety of revenue sources, such as connection fees, tap fees, impact fees (system development charges), base and minimum charges, and volume charges. Connection and tap fees generally do not contribute to WSD or treatment capital costs. Impact fees are generally devoted to the construction of source development, treatment and transmission facilities. Base charges generally contribute to fixed customer costs, such as billing and meter replacement. However, a high base charge, or a minimum charge, which covers the cost of the number of gallons of water use, may also contribute to source development, treatment, and transmission construction cost debt service. Volume charges contribute to both source development/treatment/transmission debt service and operation and maintenance (O&M).

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

While some utility revenues will go to pay existing facility debt service, most of that service will be retired in various stages over the next 20 years, and debt service for new projects will be added. Projects built late in the 20-year planning period will continue to generate revenues for debt service for many years after the planning period. Financing through volume-related charges is the most economically efficient means to finance new WSD. Volume charge financing provides consumers and businesses the greatest degree of direct control over water-related costs and a direct incentive to conserve. Such financing increases utility revenue stream variability, but such variability may be reduced through the development of rate stabilization or reserve funds.

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

Conservation incentivized by block rate structures, in combination with collecting project revenues in advance of construction, can distribute price increases more evenly over time and buffer price fluctuations inherent in common water-pricing practices. This allows customers to adjust water

use practices and technology over time. Indexing of prices is another means of distributing price increases over time. If changes to water rates are revenue-neutral, additional conservation can still occur, as the difference between average and marginal price blocks for larger water users increases. There are a number of additional means available to mitigate the impact of higher cost sources to customers. Many of these are addressed in the American Water Works Association's publications Avoiding Rate Shock: Making the Case for Water Rates (AWWA, 2004) and Thinking Outside the Bill: A Utility Manager's Guide to Assisting Low-Income Water Customers (AWWA, 2014).

Section 2. Water Management District

The District's Governing Board provides significant financial assistance for conservation, planning, and AWS 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 Facilitating Agricultural Resource Management Systems (FARMS) Program, and FDEP funding for the Springs Initiative.

1.0 Cooperative Funding Initiative

The primary funding mechanism is the District's CFI, which includes funding for major regional water supply and WRD projects and localized projects throughout the District's 16-county jurisdiction. The Governing Board, through its regional subcommittees, 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. This program, which has been highly successful since 1988, has resulted in a combined investment (District and cooperators) of approximately $3.3 billion for a variety of water projects addressing the District's four areas of responsibility: (1) water supply, (2) natural systems, (3) flood protection, and (4) water quality. From fiscal year (FY) 2016 through FY2020, the District's adopted budget included an average of $56.8 million in ad valorem tax dollars for the CFI program, of which $30 million (53 percent) was for WRD and WSD assistance.

2.0 District Initiatives

Projects funded through the District Initiatives program are of great importance or a regional priority. The District can increase its percentage match and, in some cases, provide total funding for the project. Examples of these initiatives include: (1) the Quality of Water Improvement Program to plug deteriorated, free-flowing wells that waste water and cause inter-aquifer contamination, (2) the Utilities Services Group to conserve water by assisting utilities in controlling their water loss, (3) data collection and analysis to support major District initiatives such as the MFL program, and (4) the FARMS program and other various agricultural research projects designed to increase the water-use efficiency of agricultural operations, (5) water resource development investigations and MFL Recovery projects which may not have local cooperators, and (6) the Water Incentives Supporting Efficiency program launched in 2019 offers cost-share funding for a wide variety of water conservation projects (max of $20 thousand per project) to a wide variety of non-agricultural entities. From FY2016 through FY2020, the District's adopted budget included an average of $24.5 million in ad valorem tax dollars for District Initiatives, of which $9 million (37 percent) was for WRD and WSD assistance.

The average total commitment from FY2016 through FY2020 for CFI and District Initiatives was approximately $81.3 million. The continued level of investment for these programs depends on various economic conditions, resource demands, and the District's financial resources. However, the District believes its resources are sufficient to ensure the long-term sustainability of the region's water resources moving forward.

Section 3. State Funding

1.0 The Springs Initiative

The FDEP Springs Initiative is a special legislative appropriation that has provided revenue for protection and restoration of major springs systems. The District has allocated Springs Initiative funding to implement projects to restore aquatic habitats, to reduce groundwater withdrawals and nutrient loading within first-magnitude springsheds, and to improve the water quality and quantity of spring discharges. Projects include the reestablishment of aquatic and shoreline vegetation near spring vents, construction of infrastructure necessary to convey wastewater currently treated in septic systems or package plants to a centralized wastewater treatment facility which may increase reclaimed water production and implementation of other best management practices within springshed basins.

The Northern Planning Region contains several unique first-magnitude springs

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

2.0 Water Protection and Sustainability Program

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

Program funds are applied toward a maximum of 20 percent of eligible project construction costs. In addition, the Legislature established a goal for each WMD to annually contribute funding equal to 100 percent of the state funding for alternative WSD assistance, which the District has exceeded annually. The legislation also requires that a minimum of 80 percent of the WPSPTF funding must be related to projects identified in a district water supply plan. The District's Regional Water Supply Plan (RWSP) is utilized in the identification of the majority of WPSPTF-eligible projects.

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

3.0 The Florida Forever Program

The Florida Forever Act, as originally passed by the Florida Legislature in 1999, established the 10-year $3 billion statewide Florida Forever Program. The Program was extended by the Legislature during the 2008 legislative session, allowing the Program to continue for 10 more years at $300 million annually. Since 1999, the District has allocated $95 million ($81.6 million for land acquisition and $13.4 million for water body restoration) of Florida Forever funding Districtwide in support of WRD. A "water resource development project" eligible for funding is defined in Section 259.105, F.S. , as a project that increases the amount of water available to meet the needs of natural systems and the citizens of the state by enhancing or restoring aquifer recharge, facilitating the capture and storage of excess flows in surface waters, or promoting reuse. Implementation of eligible projects under the Florida Forever Program includes land acquisition, land and water body restoration, aquifer storage and recovery (ASR) facilities, surface water reservoirs, and other capital improvements. Numerous tracts have been acquired in the northern region including Potts and Flying Eagle preserves, Three Sisters Springs, and coastal preserves at Weeki Wachee and Chassahowitzka Rivers. A primary example of how the funds were used by the District for WRD was the purchase of lands around Lake Hancock within the Peace River watershed, as the first step in restoring minimum flows to the Upper Peace River. In addition, the District Governing Board has expended $35.7 million in ad valorem-based funding to complete the acquisition of lands associated with the Lake Hancock project, acquired on a voluntary basis and through eminent domain proceedings.

4.0 State Funding for the Facilitating Agricultural Resource Management Systems Program

Operating under Chapter 40D-26, Florida Administrative Code, the FARMS Program, through the District, utilizes additional state funding when available. Since the inception of the program, the District has received $6.4 million in state appropriations and $1.3 million from the Florida Department of Agriculture and Consumer Services (FDACS). No funding was provided by the state from FY2016 through FY2020.

5.0 West-Central Florida Water Restoration Action Plan

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

Section 4. Federal Funding

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

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

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

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

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

The District's FARMS Program works cooperatively with the NRCS EQIP, AWEP, and RC&D programs on both financial and technical levels, and dual cost-share projects have been coordinated whenever possible. By an agreement between the District, FDACS, and the NRCS, the maximum funding for using both FARMS and EQIP is 75 percent of total project cost. As of FY2019, 41 FARMS projects Districtwide have involved some level of dual cost-share with EQIP, AWEP, and/or the RC&D, with several additional cooperative projects expected in the near future. On a technical level, agency interaction includes using the NRCS mobile irrigation lab to investigate using FARMS cost-share for improvements to overall irrigation system efficiency, using NRCS engineering designs for regulatory agricultural exemptions, whenever possible, and coordinating cost-share on specific project related infrastructure. For example, FARMS may assist with an alternative source of irrigation water and EQIP assists with an upgrade to an irrigation delivery system. The relationship is mutually beneficial, extends cost-share dollars, and provides more technical assistance to participants in both programs.

Section 5. Public-Private Partnerships and Private Investment

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

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

1.0 Public-Private Utility Partnerships

Two advantages of public-private partnerships are 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, TBW undertook a public-private partnership with Veolia Water, formerly USFilter, to design, build, and operate its surface water treatment plant that has been in operation since 2002. Veolia assumed all risks for cost, schedule, plant design and construction, equipment supply, startup services, and facility performance through O&M. The cost savings over the life cycle of the contract is expected to be significant.

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

2.0 Cooperatives

Cooperatives are arrangements where multiple self-supplied water users pool their resources to construct water facilities that they could not technically or economically undertake on their own. They also share the risks. Such private or public/private cooperative institutions are more common where lengthy transmission systems are required, such as in the western U.S. where surface water is distributed to water districts and for irrigation. Water is usually obtained from a supplier at a cost and then distributed among members by the water district. Members cooperatively fund the construction of transmission and distribution facilities. As groundwater resources become increasingly limited and reclaimed water systems expand, the same type of economic forces that created irrigation and water districts in the west could develop in portions of Florida. Cooperatives may also shift financial risk by entering into design, build, and operate arrangements with contractors. One example of this structure is the Polk Regional Water Cooperative, formed in 2016 to address the development and provision of alternative water sources to its member local governments. Other forms of cooperative institutions in Florida, such as drainage districts and grower cooperatives, have effectively reduced competition and litigation over resources (OPPAGA, 1999).

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

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

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

Section 1. Projection of Potentially Available Funding

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

1.0 Cooperative Funding Initiative

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

2.0 District Initiatives

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

3.0 Springs Initiative

The amount of future state funding for the Springs Initiative cannot be determined at this time. Any funding allocated to this District will be used for projects for the protection and restoration of major springs systems, including projects to reduce groundwater withdrawals and improve stormwater systems.

4.0 Water Protection and Sustainability Trust Fund

The amount of future state funding for this program cannot be determined at this time. As economic conditions improve and the state resumes funding, any funding allocated for this District will be used as matching funds for the development of alternative water supply projects.

5.0 Florida Forever Trust Fund

The amount of future state funding for the Florida Forever Trust Fund cannot be determined at this time. Any funding allocated for this District will be used for land acquisition, including land in support of WRD.

If funding allocations remain consistent with the previous five years, approximately $1.62 billion could potentially be generated or made available to fund CFI and District Initiative projects necessary to meet the water supply demand through 2040 and to restore MFLs for impacted natural systems. This figure may be conservative, since it is not possible to determine the amount of funding that may be available in the future from the federal government and state legislative appropriations.

Section 2. Evaluation of Project Costs to Meet Projected Demand

Of the 209.8 mgd of Districtwide projected demand increases during the 2015 to 2040 planning period to meet the demand for all users and to restore MFLs for impacted natural systems, it is estimated that 46 mgd, or 22 percent of the demand, has either been met or will be met by reclaimed water and conservation projects that are under development. The total District share of cost for the projects currently under development including regional transmission, ASR, and brackish groundwater treatment systems is $490 million.

To develop an estimate of the capital cost of projects necessary to meet demand, the District compiled a list of large-scale WSD projects proposed for development within the 2040 planning timeframe. Projects proposed by the PRMRWSA, Tampa Bay Water, and Polk Regional Water Cooperative could produce up to 105 mgd of water supply. There were no major WSD projects proposed for development by the Withlacoochee Regional Water Supply Authority through 2040 in the Northern Planning Region, as traditional sources, conservation, and reclaimed water initiatives are projected to meet demands in the region. Estimated costs and the quantity of water these projects will produce are listed in Table 8-2. The categories shown each contain several projects that could be chosen for development to meet future needs. Many of these are AWS projects that would be eligible for co-funding by the District. The table shows the estimated total cost of the 100 to 105 mgd of water supply that will be produced by these projects is up to $1.57 billion.

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 AWS options, including reclaimed water and conservation projects, which can help meet future demands in the Northern Planning Region and help prevent negative impacts on water resources from occurring. The potential water supply project options are discussed in Chapter 5.

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

Project	Entity to Implement	Quantities (mgd)	Capital Costs
Peace River Facility Surface Water System Expansion and Regional Reservoir	PRMRWSA	15	$208
Regional Loop System and ASR Projects	PRMRWSA	10	$189
Flatford Swamp Hydrologic Restoration	TBD	10	$44-96
Southeast Wellfield and West Polk County Lower Aquifer Deep Wells	PRWC	45	$650
Big Bend Desalination	TBW	10-12.5	$244
Enhanced Surface Water Expansion from Alafia River	TBW	10-12.5	$88
New Regional Feed Line to Balm Area	TBW	N/A	$76-97
Subtotal Southern Planning Region		**35**	**$441-493**
Subtotal Heartland Planning Region		**45**	**$650**
Subtotal Tampa Bay Planning Region		**20-25**	**$408-429**
Total – Districtwide		**100-105**	**$1,499-1,572**

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

The conservative estimate of $2.66 billion in cooperator and District financial resources that will be generated through 2040 for funding is sufficient to meet the projected $1.50 to $1.57 billion total cost of the large-scale projects listed in Table 8-2. State and federal funding sources may also assist with any remaining and/or high-end costs for future alternative water supply projects and water conservation measures where fresh groundwater resources are limited. Although it is not currently anticipated in the planning timeframe, future funding for major AWS projects in the Northern Planning Region can be planned for in a similar manner. These financial projections are subject to economic conditions that may affect the level of District ad-valorem tax revenue and the availability of federal and state funding; however, such conditions may similarly affect future water demand increases.

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Chapter 7

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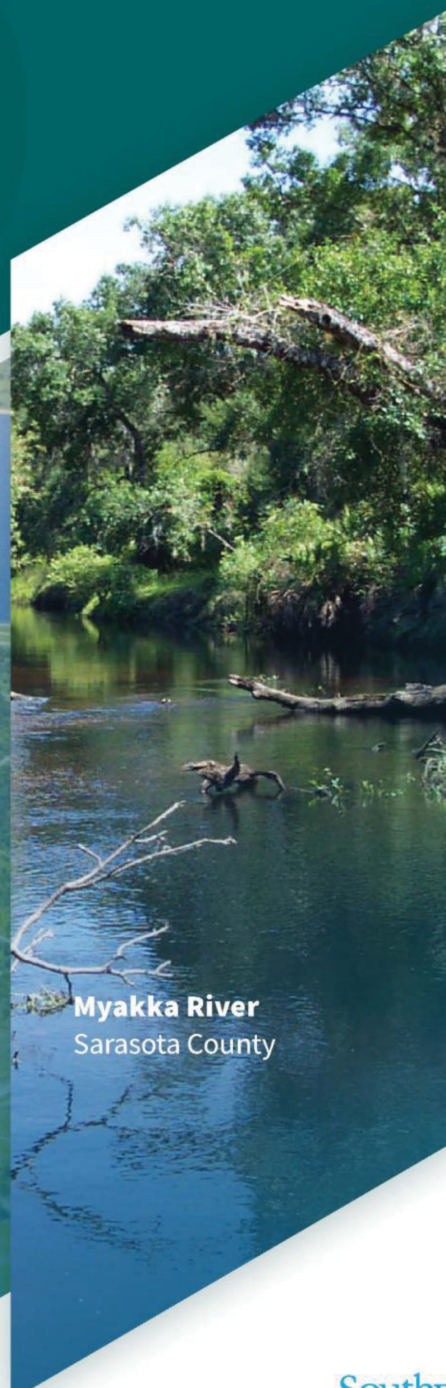
2020 Regional Water Supply Plan

Southern Planning Region

April 2020

Terra Ceia
Manatee County

PRMRWSA
DeSoto County



Myakka River
Sarasota County

Agricultural Conservation
Charlotte County

Southwest Florida
Water Management District

The Southwest Florida Water Management District (District) does not discriminate on the basis of disability. This nondiscrimination policy involves every aspect of the District's functions, including access to and participation in the District's programs, services and activities. Anyone requiring reasonable accommodation, or would like information as to the existence and location of accessible services, activities, and facilities, as provided for in the Americans with Disabilities Act, should contact Donna Kaspari, Sr. Performance Management Professional, at 2379 Broad St., Brooksville, FL 34604-6899; telephone (352) 796-7211 or 1-800-423-1476 (FL only), ext. 4706; or email ADACoordinator@WaterMatters.org. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1-800-955-8771 (TDD) or 1-800-955-8770 (Voice). If requested, appropriate auxiliary aids and services will be provided at any public meeting, forum, or event of the District. In the event of a complaint, please follow the grievance procedure located at WaterMatters.org/ADA.

2020 Regional Water Supply Plan
Southern Planning Region

Public Review Draft

April 2020

For further information regarding this plan, please contact the Water Supply Section at:

2379 Broad Street
Brooksville, FL 34604-6899
(352) 796-7211 or
(800) 423-1476 (Florida Only)

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Southwest Florida Water Management District

2020 Regional Water Supply Plan

This report is produced by the Southwest Florida Water Management District

April 2020 – Public Review Draft

District Project Manager: Joseph Quinn, AICP

District Contributors

Anthony Andrade
Ron Basso, P.G.
Mike Bray
April Breton
Miurel Brewer
Joel Brown
Mike Cacioppo
Cortney Cameron
Donna Campbell
Jake Cuarta
Corey Denninger, GISP
Don Ellison, P.G.
Randy Emberg
Carole Estes, P.G.
John Ferguson, P.G.
Mark Fulkerson, Ph.D., P.E.
Frank Gargano
Yonas Ghile
Jim Golden, AICP
Mohamed Hersi
Mary Margaret Hull, APR
Doug Leeper
Tamera McBride, P.G.
Lisann Morris, P.E., PMP
Cassidy Hampton
Mike Hancock, P.E.
Jerry Harding
Darrin Herbst, P.G.
Jay Hoecker, PMP
Ashlee Hollifield
Thomas Kiger, P.E.
Luke LeMond, P.G.
Josh Madden
Lydia Manos
Cara Martin, APR
Jeremy McKay
Jason Patterson
Ryan Pearson
Robert Peterson, P.G.
Amy Poxson
Dennis Ragosta
Patricia Robertshaw
Cindy Rodriguez
Danielle Rogers
Carmen Sanders
George Schlutermann, P.G.
Andrea Shamblin
Virginia Singer
Claire Stapley
Susanna Martinez Tarokh
Chris Tumminia
Don Weaver
Jeff Whealton, P.W.S.
Brent White
Kevin Wills
Marra Wood
Lei Yang
Allen Yarbrough
Chris Zajac

Other Contributors

Wade Trim, Inc.
Sarah Mastison
Brad Cornelius, AICP, CPM
Amanda Warner, AICP

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You may send a request for a printed copy to info@watermatters.org

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List of Abbreviations

AADF	Annual Average Daily Flow
AG	Agriculture
AMO	Atlantic multidecadal oscillations
AR	Aquifer Recharge
ASR	Aquifer Storage and Recovery
AWE	Alliance for Water Efficiency
AWEP	Agriculture Water Enhancement Program
AWS	Alternative Water Supply
BEBR	Bureau of Economic and Business Research
BG	Billion Gallons
BMP	Best Management Practice
CAR	Consolidated Annual Report
CDD	Community Development District
CFI	Cooperative Funding Initiatives
CFS	Cubic Feet per Second
CFWI	Central Florida Water Initiative
CHAMP^{SM}	Conservation Hotel and Motel Program
CII	Commercial, Industrial, and Institutional
CIP	Capital Improvement Plan
DCI	DeSoto Correctional Institute
DO	Dissolved Oxygen
DOH	Department of Health
DPCWUCA	Dover/Plant City Water Use Caution Area
DSS	Domestic Self Supply
DWRM	Districtwide Regulation Model
ECFT	East-Central Florida Transient
ECFTX	East-Central Florida Transient Expanded
EDR	Electrodialysis Reversal
ELA	Environmental Look Arounds
ENSO	El Nino Southern Oscillations
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
ETDM	Efficient Transportation Decision Making
F	Fahrenheit
F.A.C.	Florida Administrative Code
F.S.	Florida Statutes
FARMS	Facilitating Agricultural Resource Management Systems
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FFL	Florida Friendly Landscaping
FPL	Florida Power & Light Company
FSAID	Florida Statewide Agricultural Irrigation Demand

FTMR	Focus Telescopic Mesh Refinement
FWS	Florida Water Star
FY	Fiscal Year
GIS	Geographic Information System
GOES	Geostationary Operational Environmental Satellites
GPD	Gallons per Day
GPF	Gallons per Flush
GPM	Gallons per Minute
GRP	Gross Regional Product
HET	High Efficiency Toilets
HRWUCA	Highlands Ridge Water Use Caution Area
I/C	Industrial/Commercial
IFAS	Institute of Food and Agricultural Sciences
IPCC	Intergovernmental Panel on Climate Change
L/R	Landscape/Recreation
LFA	Lower Floridan aquifer
LiDAR	Light Detection and Ranging
M/D	Mining/Dewatering
MAL	Minimum Aquifer Level
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
MG/YR	Million Gallons per Year
MGD	Million Gallons per Day
MG/L	Milligrams per Liter
MIA	Most Impacted Area
MIL	Mobile Irrigation Lab
NHARP	North Hillsborough Aquifer Recharge Program
NOAA	National Oceanic and Atmospheric Administration
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
PD&E	Project Development and Environment
PG	Power Generation
PRF	Peace River Facility
PRIM	Peace River Integrated Model
PRMRWSA	Peace River Manasota Regional Water Supply Authority
PRWC	Polk Regional Water Cooperative
PS	Public Supply
PTW	Partially Treated Water
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 and Monitor-well Program
RPC	Regional Planning Council
RWSP	Regional Water Supply Plan
SAS	Surficial Aquifer System
SHARE	Southern Hillsborough Aquifer Recharge Expansion
SHARP	South Hillsborough Aquifer Recharge Program
SLR	Sea Level Rise
SPJC	Shell, Prairie and Joshua Creek
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
TMDL	Total Maximum Daily Loads
UFA	Upper Floridan aquifer
UMRW	Upper Myakka River Watershed
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geologic Survey
WISE	Water Incentives Supporting Efficiency
WMD	Water Management District
WMIS	Water Management Information System
WMP	Watershed Management Program
WPSPTF	Water Protection and Sustainability Program Trust Fund
WQMP	Water Quality Monitoring Program
WRAP	Water Resource Assessment Project or West-Central Florida Water Restoration Action Plan
WRD	Water Resource Development
WSD	Water Supply Development
WTF	Water Treatment Facility
WTP	Water Treatment Plant
WUCA	Water Use Caution Area
WUE	Water Use Efficiency
WUP	Water Use Permit
WUWPD	Water Use Well Package Database
WWTP	Wastewater Treatment Plant
ZLD	Zero Liquid Discharge

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Chapter 1. Introduction

The Regional Water Supply Plan (RWSP) for the Southwest Florida Water Management District (SWFWMD) (District) is an assessment of projected water demands and potential sources of water to meet these demands for the period from 2020 through 2040. The RWSP has been prepared in accordance with the Florida Department of Environmental Protection's (FDEP) 2019 Format and Guidelines for Regional Water Supply Planning. The RWSP consists of four geographically based volumes that correspond to the District's four designated water supply planning regions: Northern, Tampa Bay, Southern and Heartland (Figure 1-1). This volume is the 2020 RWSP update for the Southern Planning Region, which includes DeSoto, Manatee and Sarasota counties and the portion of Charlotte County within the District. The District completed RWSPs in 2001, 2006, 2010, and 2015 that included the Southern Planning Region.

The purpose of the RWSP is to provide the framework for future water management decisions in the District. The RWSP for the Southern Planning Region shows that sufficient alternative water sources (sources other than fresh groundwater from the Upper Floridan aquifer [UFA]) exist to meet future demands and replace some of the current fresh groundwater withdrawals causing hydrologic stress. The RWSP also identifies hundreds of potential options and associated costs for developing alternative sources as well as fresh groundwater. The options are not intended to represent the District's most "preferable" options for water supply development (WSD). They are, however, provided as reasonable concepts that water users in the planning region can pursue to meet their water supply needs. Water users can select a water supply option as presented in the RWSP or combine elements of different options that suit their water supply needs, provided such options are consistent with the intent and direction of the RWSP. Additionally, the RWSP provides information to assist water users in developing funding strategies for water supply projects.

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

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

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

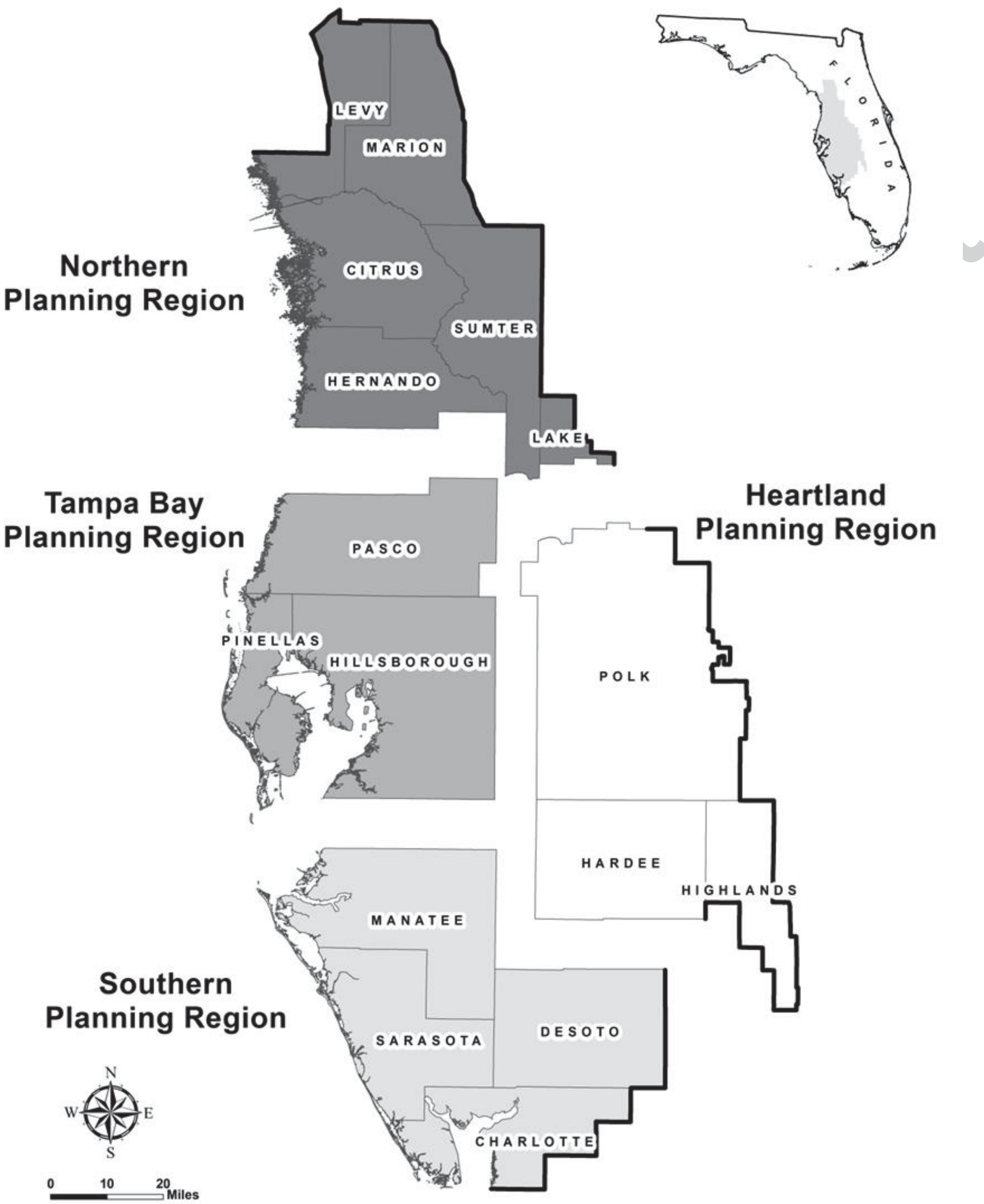


Figure 1-1. *Location of the four water supply planning regions within the District*

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

The following describes the content of the Southern Planning Region RWSP. Chapter 1, Introduction, contains an overview of the District's accomplishments in implementing the water supply planning objectives of the 2015 RWSP; description of the land use, population, physical characteristics, hydrology and geology/hydrogeology of the area; and a description of the technical investigations that provide the basis for the District's water resource management strategies. Chapter 2, Resource Protection Criteria, addresses the resource protection strategies the District has implemented or is considering implementing, including water use caution areas (WUCAs) and the minimum flows and levels (MFLs) program. Chapter 3, Demand Estimates and Projections is a quantification of existing and projected water supply demand through the year 2040 for public supply, agricultural, industrial/commercial, mining/dewatering, power generation, 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, contains a list of alternative WSD options for local governments, utilities and other water users that includes 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 WSD projects that are currently under development and receiving District funding assistance. Chapter 7, Water Resource Development Component, is an inventory of the District's ongoing data collection and analysis activities and water resource projects that are classified as water resource development (WRD). Chapter 8, Funding Mechanisms, provides an estimate of the capital cost of WSD and WRD projects proposed by the District and its cooperators to meet the water supply demand projected through 2040 and to restore MFLs to impacted natural systems. An overview of mechanisms available to generate the necessary funds to implement these projects is also provided.

Part B. Accomplishments since Completion of the 2015 Regional Water Supply Plan

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

Section 1. Alternative Water Supply, Conservation and Reuse Development

1.0 Alternative Water Supply

The Peace River Manasota Regional Water Supply Authority (PRMRWSA) provides regional planning efforts to its four member-counties, and is a wholesale water supplier to Sarasota, Charlotte, and DeSoto counties. The PRMRWSA's services are critical to the District's Southern Water Use Caution Area (SWUCA) recovery strategy, which promotes the use of alternative water supplies to meet growing public supply demands, while reserving limited groundwater supplies for agriculture and other inland users.

The PRMRWSA continues to expand its Regional Integrated Loop System to meet future demands and assure reliability of water supply in the four-county region. The District is cooperatively funding two ongoing Loop System projects: The Phase 1 Interconnect between Punta Gorda's water treatment facility on Shell Creek and DeSoto County's Project Prairie regional pump station, and the Phase 3B Interconnect in central Sarasota County. As future demands necessitate, the Loop System may be extended north from the Phase 3B terminus to allow deliveries of PRWMRWSA water to Manatee County. Future segments of the Loop System may also extend into rapidly developing portions of Charlotte County.

The PRMRWSA's water supply is provided by the 51 million gallons per day (mgd) Peace River Facility in DeSoto County. The facility has a 6.5 billion-gallon offstream reservoir system and a 6.0 billion gallon Aquifer Storage and Recovery (ASR) wellfield storage system which can hold approximately one year's worth of the facility's demand for drought reliability. The PRMRWSA has an ongoing testing/permitting effort for a partial-treatment ASR injection system, which may allow some treatment capacity reserved for the ASR recharge to become available to meet customer demands. In 2019, the PRMRWSA's water use permit (WUP) increased from 34.9 mgd to 80 mgd (annual average), allowing for future facility expansions to meet most of the region's public supply demands.

2.0 Water Conservation

The District continues to promote and cooperatively fund water conservation efforts to more efficiently use existing water supplies. In the public supply sector, for fiscal years 2015 to 2019, this includes cooperatively funded projects for toilet rebates, rain sensors, soil moisture sensors, line looping to reduce flushing, advanced metering analytics customer portals, and conservation kits. The District has funded conservation projects undertaken by Manatee County, Braden River Utilities, and the cities of Venice, North Port, and Arcadia.

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, FARMS is a cost-share reimbursement program for production-scale best management practices to reduce groundwater use and improve water quality. These projects predominantly include tailwater recovery systems as an alternative water supply (AWS), and precision irrigation systems.

3.0 Reclaimed Water

The District has continued its highly successful program to cooperatively fund projects that make reclaimed water available for beneficial reuse. These include more than 385 projects between fiscal year (FY) 1987 and FY2020 for the design and construction of transmission, distribution, recharge, natural system enhancement, storage and pumping facilities, metering, feasibility studies, reuse master plans, and research projects. As a consequence of District and utility cooperation, reuse projects have been developed that will result in the 2025 Districtwide utilization of more than 228 mgd and a water resource benefit of more than 137 mgd (FDEP, 2015) beneficial reuse plus growth and projects currently under construction. Utilities are on their way to achieving the 2040 Districtwide goals of 353 mgd utilization (75 percent) and 269 mgd of water resource benefit (75 percent efficiency).

Within the Southern region in 2015, utilities were utilizing approximately 52 percent or 35 mgd of the 68 mgd of available wastewater treatment plant flows, resulting in an estimated 25 mgd of water resource benefits (70 percent efficiency). There are five reclaimed water supply projects under development and another two that are estimated to experience additional future supply growth. The projects will supply more than 8 mgd of reclaimed water that will result in 7 mgd of potable-quality water benefits at a total cost of approximately $16 million.

Section 2. Support for Water Supply Planning

The PRMRWSA completed the most recent update to its *Integrated Regional Water Supply Master Plan* in 2020 which addresses water demands, water supply project needs and connectivity issues for its service area. The update, cooperatively funded by the District, assesses future needs through 2040 and includes recommended WSD options to address the region's projected growth.

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

Section 3. Minimum Flows and Levels Establishment

1.0 Established Minimum Flows and Levels

No additional minimum flows and water levels (MFLs) were established in the planning region during or since 2015; however, the District continues to reevaluate MFLs per the Priority List and Schedule for the Establishment of Minimum Flows, Minimum Water Levels, and Reservations (see Chapter 2 Appendix).

2.0 Minimum Flows and Levels Recovery Initiatives

The District's SWUCA recovery strategy, approved in 2006 (SWFWMD, 2006) with effective rules in 2007, relies on a variety of activities that are collectively aimed at achieving MFLs for all priority water resources in the SWUCA by 2025. Resource monitoring is ongoing and a SWUCA progress report is provided to the Governing Board annually. In 2018, the District completed its second five-year assessment of the SWUCA recovery strategy (SWFWMD, 2018). The purpose of the five-year assessment as required by rule is to evaluate and assess the recovery in terms of resource trends; trends in permitted and used quantities of water; and completed, ongoing, and planned projects. The assessment provides the information necessary to determine progress in achieving recovery and protection goals and allows the District to revise its approach to respond to changes in resource conditions and issues. Results from the second five-year assessment indicate the District continues to make progress toward recovery, but challenges to full recovery by 2025 remain. Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing Water Resource Development Projects designed to augment or preserve existing flows and water levels.

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

Since the 1970s, the Quality of Water Improvement Program (QWIP) has prevented waste and contamination of water resources (both groundwater and surface water) by reimbursing landowners for plugging abandoned or improperly constructed artesian wells. The program focuses on the southern portion of the District where the UFA is under artesian conditions, creating the potential for mineralized water to migrate upward and contaminate other aquifers or surface waters. The program reimburses approximately 200 well-pluggings per year and, Districtwide, more than 6,800 well-pluggings have been reimbursed since inception. In the Southern Planning Region, 4,828 well-pluggings have been reimbursed since the QWIP program began.

A related effort, now part of the FARMS Program, involves the rehabilitation (or back-plugging) of agricultural irrigation wells to improve water quality in groundwater and surface waters and improve crop yields. The program initially targeted the Shell Creek, Prairie Creek, and Joshua Creek watersheds to decrease the discharge of highly mineralized water into Shell Creek. Shell Creek is the City of Punta Gorda's municipal water supply. The program has rehabilitated 85 wells as of September 2018, with 63 of these in the target watersheds. A total of 79 agricultural wells were rehabilitated in the Southern Planning Region.

Part C. Description of the Southern Planning Region

Section 1. Land Use and Population

The Southern Planning Region is characterized by a diversity of land-use types (Table 1-1). These range from urban built-up areas, such as the cities of Bradenton, Palmetto and Longboat Key in Manatee County; the cities of Sarasota, Venice and North Port in Sarasota County; and Punta Gorda in Charlotte County, to predominantly agricultural land uses in the inland portions of these counties and in most of DeSoto County. Significant phosphate mining activities occur in the planning region, primarily in Manatee County; however, mining operations are moving southward into DeSoto County as phosphate reserves at existing mines are depleted.

The population of the planning region is projected to increase from approximately 1,123,883 in 2015 to 1,472,277 in 2040. This is an increase of approximately 348,394 new residents, which represents a 31 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 Southern Planning Region (2017)*

Land-Use/Land-Cover Types	Acres	Percent
Urban and Built-up	334,930.71	21.22
Agriculture	489,576.75	31.02
Rangeland	147,317.24	9.33
Upland Forest	174,307.62	11.04
Water	65,939.92	4.18
Wetlands	297,014.05	18.82
Barren Land	2,232.48	0.14
Transportation, Communication and Utilities	26,094.44	1.65
Industrial and Mining	30,819.60	1.95
TOTAL	**1,578,232.80**	**100.00**

Based on: SWFWMD 2017 LULC layer (SWFWMD, 2019)

Section 2. Physical Characteristics

Land surface elevations gradually increase from sea level at the gulf coast to a high of 136 feet in northeastern Manatee County. This change in topography over this area is evidence of former marine shorelines, called terraces. Each terrace consists of poorly drained flatlands with many swamps, ponds and lakes. Over large areas of Charlotte and Manatee counties, canals were constructed to drain some of these swampy areas for agriculture. Further to the east, DeSoto County is topographically very similar to Charlotte and Manatee counties, with poorly drained marine terraces increasing in elevation to the east. Most of the undeveloped sections of the planning region are pine flatwoods, saw palmetto, and prairie grassland.

Section 3. Hydrology

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

1.0 Rivers

The planning region contains all or part of eight major drainage basins defined by the U.S. Geological Survey (USGS) including the Little Manatee River, Manatee River (including its tributary the Braden River), Sarasota/Lemon Bay, Myakka River (including its tributary Myakkahatchee Creek), Peace River (including its

Manatee River Control Structure

tributaries Horse, Charlie, Joshua, and Shell creeks), and Charlotte Harbor drainage. There are many smaller tributaries to these larger systems, as well as several coastal watersheds drained by many small tidally influenced or intermittent streams. The Braden, Manatee, and Peace rivers and Myakkahatchee and Shell creeks are utilized as public water supply sources.

2.0 Lakes

There are few named lakes with extensive water-level data in the planning region. Most large lakes were created through impoundment of rivers or from off-stream diversions such as Lake Parrish in Manatee County. The largest lake is Lake Manatee which was created through an impoundment on the Manatee River. Other large lakes include Upper Myakka and Lower Myakka in Sarasota County. Lakes greater than 20 acres in size are included in Figure 1-2. Most small lakes are surface depressions connected to the surficial aquifer that are hydraulically separated from the underlying confined aquifers. Many of the lake systems are connected to river systems through natural streams or man-made canals.

3.0 Springs

There are no first-magnitude springs (discharge exceeds 100 cubic feet per second [cfs]) and only one second-magnitude spring (discharge between 10 and 100 cfs) located within the planning region. Warm Mineral Springs is located near the City of North Port in Sarasota County. Periodic measurements indicate that average discharge is approximately 10 cfs (Roseneau et al., 1977). The warm temperature and mineralized quality of the spring water indicates that its source is much deeper in the Floridan aquifer than springs further to the north, which tend to have shallow flow systems formed by karst geology.

Warm Mineral Springs near North Port

4.0 Wetlands

Prior to significant development, approximately 54 percent of Florida was covered by wetlands. However, due to drainage and development, only approximately 30 percent of the state currently remains covered by wetlands. Wetlands can be grouped into saltwater and freshwater types. Saltwater wetlands are found bordering estuaries, which are coastal wetlands influenced by the mixing of freshwater and seawater. Saltmarsh grasses and mangroves are common estuarine plants. In the Southern Planning Region, Charlotte Harbor, Sarasota Bay, and the southernmost portion of Tampa Bay are estuaries of national significance that have been included in the National Estuary Program.

Freshwater wetlands are common in inland areas of Florida. Hardwood-cypress swamps and marshes are two major freshwater wetland systems. Both systems are found either bordering lakes and rivers or standing alone as isolated wetlands. The hardwood-cypress swamps are forested systems with water at or above land surface for a considerable portion of the year. Marshes are typically shallower systems vegetated by herbaceous plants rather than trees. Wet prairies, also present in interior Florida, 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 within the Myakka River watershed. Other less extensive swamps, as well as isolated wetlands, occur throughout the planning region.

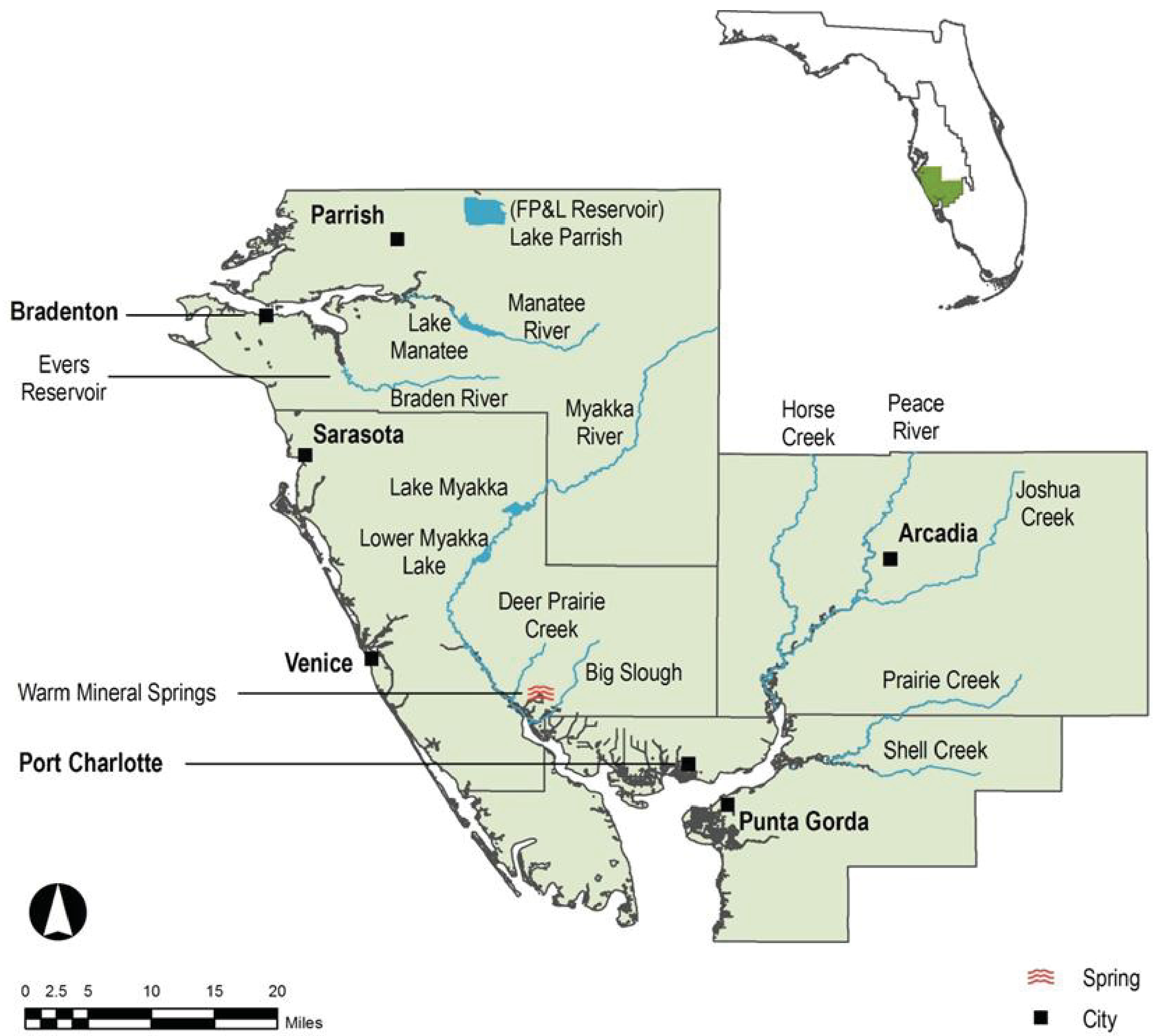


Figure 1-2. *Major hydrologic features in the Southern Planning Region*

Section 4. Geology/Hydrogeology

Three principal aquifers, the surficial, intermediate, and UFA, are present throughout the planning region and are used as water supply sources. Figure 1-3 is a generalized north-south cross section showing the hydrogeology of the District and Figure 1-4 shows the West-Central Florida groundwater basins. As seen in the figures, the Southern West-Central Florida Groundwater Basin (SWCFGWB) encompasses the southern portion of the District where the intermediate aquifer system and its associated clay confining units separate the surficial aquifer from the UFA and tightly confine the UFA across the entire planning region.

The surficial aquifer system (SAS) is contained within near-surface deposits that mainly consist of undifferentiated sands, clayey sand, silt, shell, and marl of Quaternary age. The aquifer produces relatively small quantities of water, which are generally used for low-volume irrigation or domestic water supply. Surficial deposits range in thickness from 10 feet in coastal areas to greater than 100 feet further along the Lake Wales Ridge (SWFWMD, 1993).

Underlying the SAS is the confined intermediate aquifer system with its associated confining units. This aquifer consists predominantly of discontinuous sand, gravel, shell, limestone, and dolomite beds of the Hawthorn Group and contains up to three confined or semi-confined production zones throughout much of the planning region (Wolansky, 1983). The production zones are separated by low-permeability sandy clays, clays, and marls. These confining beds restrict vertical movement of groundwater between individual water-bearing zones in the intermediate aquifers and the overlying surficial and underlying UFA. In general, the thickness of the intermediate aquifer system increases from north to south across the District. Thickness varies from approximately 50 feet in northern Manatee County to more than 600 feet in Charlotte County (Duerr et al., 1988). The intermediate aquifers are utilized extensively for public supply, agricultural irrigation, and recreational, domestic and industrial water uses, especially in the southern coastal portions of the planning region where its water quality is better than the UFA.

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

The Middle Confining Unit 2 (MCU II) of the Floridan aquifer lies near the base of the Avon Park Formation (Miller, 1986). It is composed of evaporate minerals such as gypsum and anhydrite, which occur as thin beds or as nodules within dolomitic limestone that overall has very low permeability. MCU II is generally considered to be the base of the freshwater production zone of the aquifer, except in coastal areas of Manatee and Sarasota counties, southern DeSoto, and Charlotte counties. In this area, water quality within the Avon Park Formation is mineralized or saline with sulfate or chloride concentrations exceeding 1,000 mg/L.

There is generally no recharge to the UFA along the coast, southern DeSoto County, and Charlotte County because the area is a zone of discharge. Further inland, recharge to the aquifer system increases from zero to a few inches per year (Sepulveda, 2002). This low recharge rate is due to the clay confining layers within the intermediate aquifer system that overlie the UFA and restrict the vertical exchange of water between the surficial and UFA across most of the planning region (SWFWMD, 1993). Groundwater is highly mineralized throughout much of the aquifer in the southern portions of the planning region. In these areas, groundwater from the shallower intermediate aquifers are used extensively for water supply.

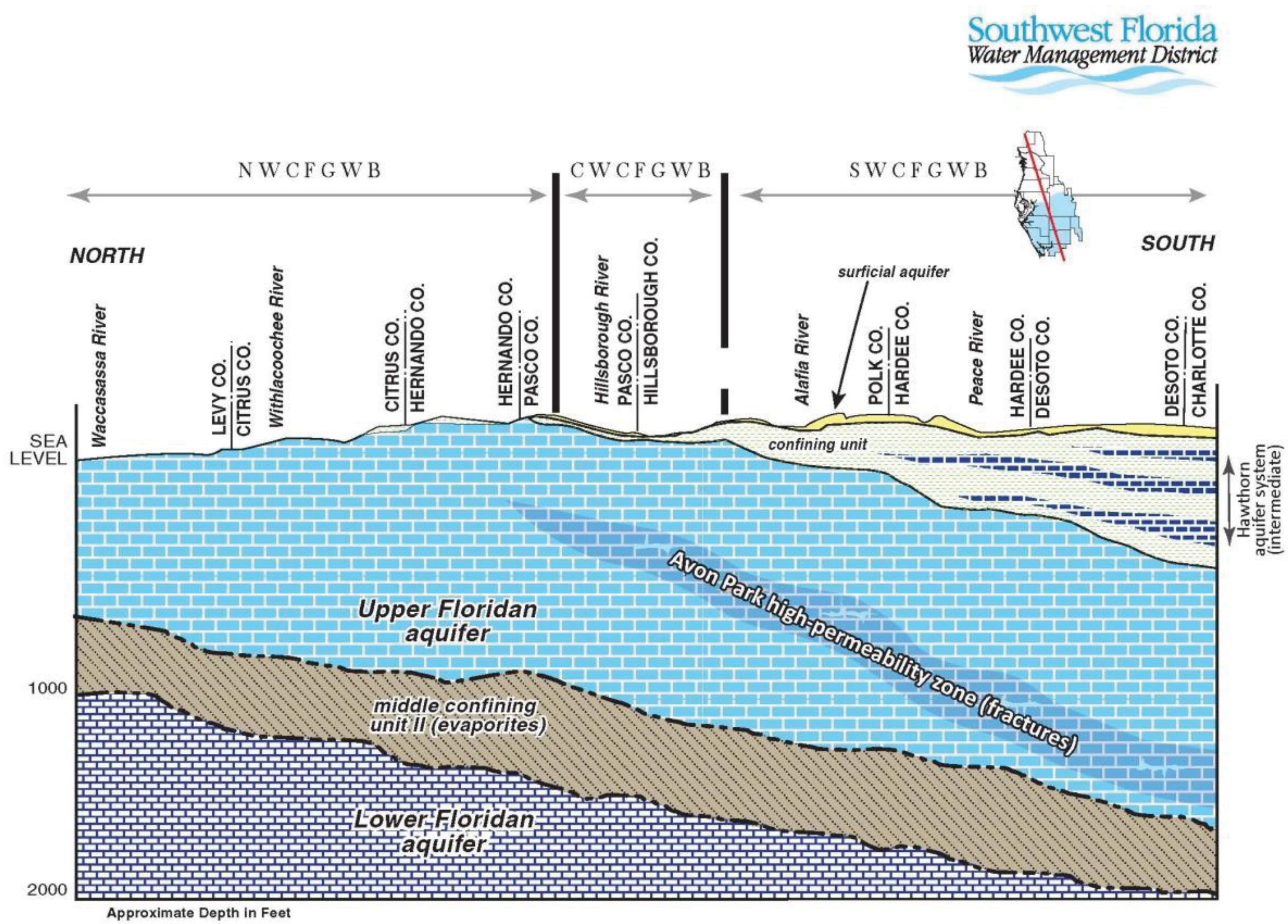


Figure 1-3. *Generalized north-south geologic cross section through the District*

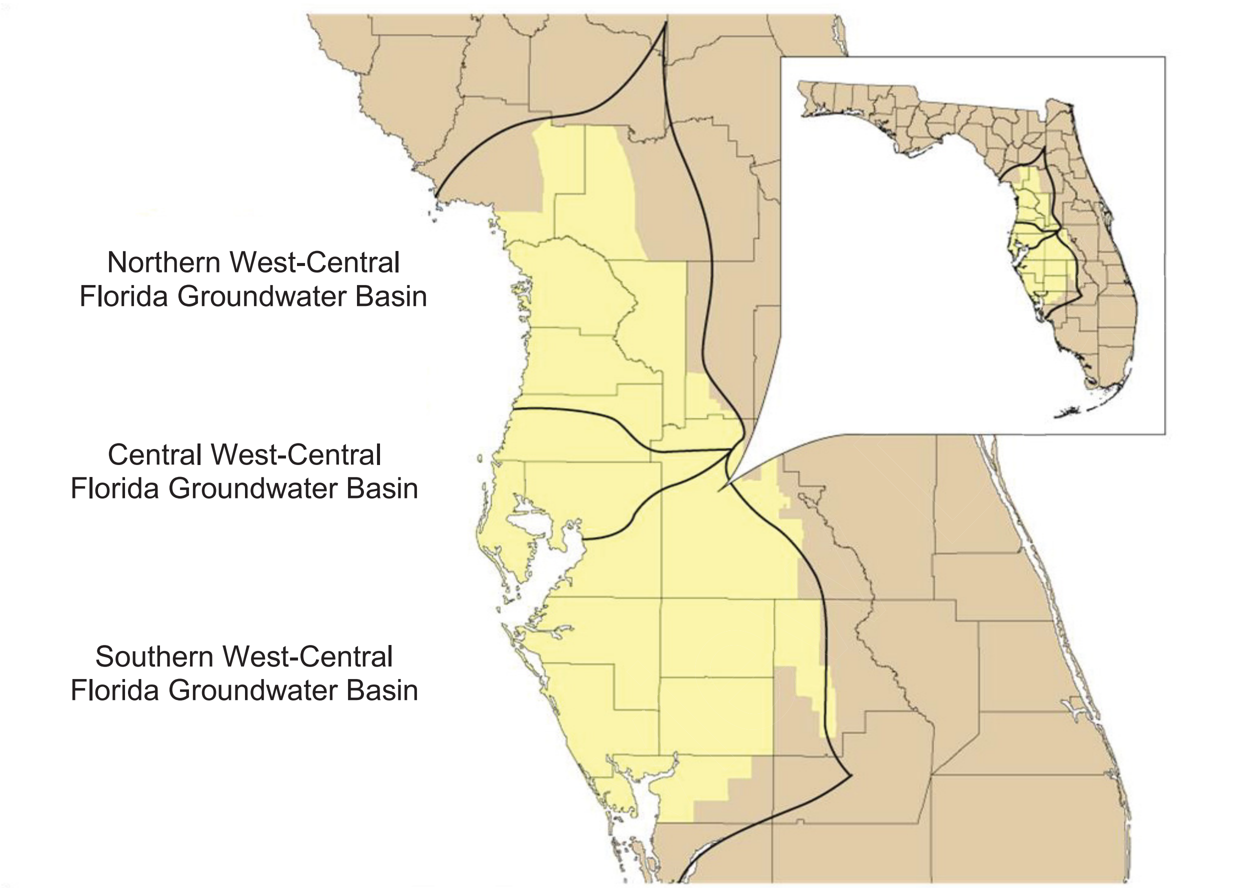


Figure 1-4. *Southwest Florida Water Management District and West-Central Florida Groundwater Basins*

Part D. Previous Technical Investigations

The 2020 RWSP builds on a series of cornerstone technical investigations that were undertaken by the District and the USGS beginning in the 1970s. These investigations provide District staff with an understanding of the complex relationships between human activities (i.e., surface and groundwater usage and large-scale land-use alterations), climatic cycles, aquifer and surface water interactions, aquifer and surface hydrology, and water quality. Investigations conducted in the Southern Planning Region and in areas adjacent to it are listed by categories and briefly outlined below.

Section 1. Water Resource Investigations

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

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

During the 1980s, hydrologic and biologic monitoring from the District's expanded data collection networks began to reveal water resource impacts in other areas. In the late 1980s, the District initiated water resource assessment projects (WRAPs) for the Eastern Tampa Bay (ETB) 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 Floridan aquifer in the ETB area.

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

The District established MFLs for several water bodies in the SWUCA and adopted a SWUCA Recovery Strategy (SWFWMD, 2006a) to address depressed aquifer levels causing saltwater intrusion along the coast, reduced flows in the upper Peace River, and lower lake levels in areas of Polk and Highlands Counties. The initial five-year assessment of the recovery strategy for FY2007-2011 was completed in 2013 (SWFWMD, 2013), with the latest five-year assessment for

FY2012-2016 completed in 2018 (SWFWMD, 2018). The District continues to work with key stakeholders and the public on implementation of current strategies and to develop additional options to address resource recovery within the SWUCA.

Section 2. U.S. Geological Survey Hydrologic Investigations

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

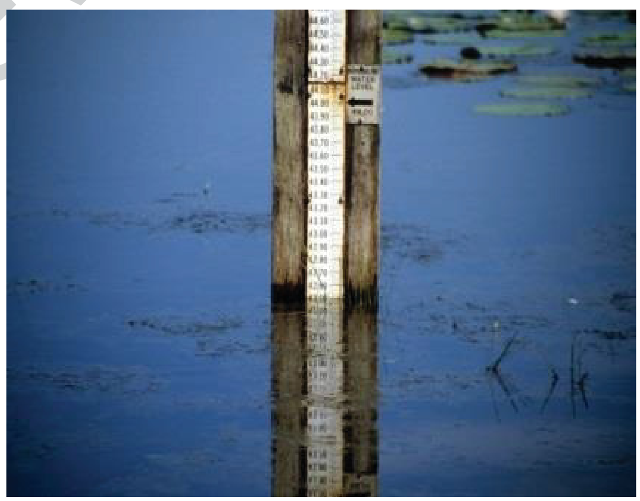
Table 1-2. *District/USGS cooperative hydrologic investigations and data collection activities applicable to the Southern Planning Region*

Investigation Type	Description
Completed Investigations	
Groundwater	Regional Groundwater Flow System Models of the SWFWMD, Highlands Ridge WUCA, and Hardee and DeSoto Counties
	Hydrogeologic Characterization of the Intermediate Aquifer System
	Hydrogeology and Quality of Groundwater in Highlands County
Surface Water	Effect of Kart Development on Peace River Flow
	Hydrologic Assessment of the Alafia River
	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
	Charlie Creek Watershed Hydrologic Characterization
Groundwater and Surface Water	Effects of Using Groundwater for Supplemental Hydration of Lakes and Wetlands
	Effects of Development on the Hydrologic Budget in the SWUCA
Ongoing Investigations/Data Collection Activities	
Data Collection	MFLs Data Collection
	Surface Water Flow, Level, and Water Quality Data Collection
	Statewide Light Detection and Ranging (LiDAR) Mapping
	Mapping Actual Evapotranspiration Over Florida Model Support
	Statewide Geostationary Operational Environmental Satellites (GOES) Evapotranspiration (ET) Project

Section 3. Water Supply Investigations

Water Supply investigations for the planning region were initiated in the 1960s as part of the United States Army Corps of Engineers (USACE) Four River Basins project. The Four River Basins project began as a flood control project developed in response to severe coastal and inland flooding caused by Hurricane Donna in September 1960. The District was formed in 1961 to help implement this federal project, which led to development of several large control structures including the Tampa Bypass Canal (TBC), the Lake Tarpon and Tsala Apopka Outfalls, and the Masaryktown Canal. Following a period of drought conditions in the mid-1960s that led to numerous dry well complaints, along with findings of project-related ecological studies, there was an apparent need for a broader-based approach to water management than just flood control. The scope of the Four River Basins project was expanded into a more comprehensive effort to assess water resources in the region and determine ways to utilize excess surface water and groundwater for regional water supply solutions. The revised approach led to changes for the TBC design to allow surface water transfers to the City of Tampa; the use of land preservations for water recharge and natural flood attenuation; and the cancellation of other structural projects that would have greatly altered environmental resources.

Since the 1970s, the District conducted numerous hydrologic assessments designed to assess the effects of groundwater withdrawals and determine the availability of groundwater in the region. In the late 1980s, the Florida Legislature directed the WMDs to conduct a Groundwater Basin Resource Availability Inventory (Ch. 373.0395 F.S.) covering areas deemed appropriate by the WMDs' 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.



Water level gauge

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 five years, and that each RWSP shall be based on a minimum 20-year timeframe (Section 373.0361, F.S.). In response to the amended statutes, the District completed a Water Supply Assessment in 1998 that quantified water supply needs through the year 2020 and identified areas where future demand could not be met with traditional groundwater sources (SWFWMD, 1998). The District published its first RWSP in 2001 for the 10 counties located in the SWUCA and Northern Tampa Bay Water Use Caution Area (SWFWMD, 2001). The 2001 RWSP quantified water supply demands through the year 2020 within these counties and identified water supply options for developing sources other than fresh groundwater.

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

The District's 2010 and 2015 RWSP updates extended the planning horizon to 2030 and 2035, respectively, and included four regional volumes covering all counties of the District. It was concluded that the Northern Planning Region demand for water through 2035 could be met with fresh groundwater; however, the need for additional fresh groundwater supplies could be minimized through the use of available reclaimed water and implementation of comprehensive water conservation measures. This could result in averting impacts such as those witnessed in other regions. For the three remaining planning regions, both the 2010 and 2015 RWSPs adopted several AWS options that were developed or are currently under development by the respective regional water supply authorities in those regions (SWFWMD, 2010; SWFWMD, 2015).

Section 4. Minimum Flows and Levels Investigations

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

Section 5. Modeling Investigations

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

1.0 Groundwater Flow Models

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

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

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

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

The District-Wide Regulatory Model (DWRM) was developed to produce a regulatory modeling platform that is technically sound, efficient, reliable, and has the capability to address cumulative impacts. The DWRM was initially developed in 2003 (Environmental Simulations, Inc., 2004). It is mainly used to evaluate whether requested groundwater withdrawal quantities in WUP applications have the potential to cause unacceptable impacts to existing legal users, off-site land uses and environmental systems on an individual and cumulative basis. The DWRM Versions 1, 2, 2.1, and 3 (Environmental Simulations, Inc., 2004, 2007, 2011, 2014) incorporate Focused Telescopic Mesh Refinement (FTMR), which was developed to enable DWRM to be used as a base model for efficient development of smaller scale sub-models (FTMR models). The FTMR uses a fine grid around a well or group of wells and increasing grid spacing out to the edge of the model. It was specifically designed to enhance WUP analysis. DWRM Version 3 simulates groundwater flow of the entire District using a quasi-3D conceptualization of the Modular Finite-Difference Groundwater Flow Model code (MODFLOW2005). DWRM3 simulates groundwater flow in the surficial, intermediate, UFA and LFA. DWRM3 supports current regulatory functions as a core business process addressed in the District's Strategic Plan.

2.0 Saltwater Intrusion Models

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

In support of establishing a minimum aquifer level to protect against saltwater intrusion in the most impacted area (MIA) of the SWUCA, a fully three-dimensional, solute transport model of the ETB area was developed by HydroGeoLogic, Inc. in 2002 (HydroGeoLogic, Inc., 2002). The model encompassed all of Manatee and Sarasota counties and the southern half of Hillsborough and Pinellas counties and simulated flow and transport in the UFA. The model was calibrated from 1990 to 2000, although there is only water quality data for the period from 1990 to 2000. The model was used to derive estimates of the number of wells and amount of water supply at risk to future saltwater intrusion under different pumping scenarios.

3.0 Integrated Groundwater/Surface Water Models

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

The Myakka River Watershed Initiative was a comprehensive watershed study and planning effort to address environmental damage caused by excess water attributed to agricultural operations and land use alterations in the watershed. The Myakka River Watershed Water Budget Model was a component of this initiative. The objectives of the model were to estimate quantities and timing of excess flows in the upper Myakka River; investigate linkages between land use practices and excess flows; develop time-series of flow rates sufficient for pollutant load modeling; evaluate alternative management scenarios to restore natural hydrology; and simulate hydroperiods for the Flatford Swamp under historic, existing and proposed flow conditions. The model is complete and has been calibrated and verified. The period of record of the model has been updated to 2014.

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Chapter 2. Resource Protection Criteria

This chapter addresses the primary strategies the District employs to protect water resources, which include water use caution areas (WUCAs), minimum flows and levels (MFLs), prevention and recovery strategies, reservations 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 Statues (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 MFLs within 20 years, a recovery or prevention strategy must be implemented as part of the regional water supply plan (RWSP). Figure 2-1 depicts the location of the District's WUCAs. In order to determine whether an area should be declared a WUCA, the Governing Board must consider the following factors:

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

In the late 1980s, the District determined that certain interim resource management initiatives could be implemented to help prevent existing problems in the water resource assessment project (WRAP) areas from getting worse prior to the completion of each WRAP. As a result, in 1989, the District established three WUCAs: Northern Tampa Bay (NTBWUCA), Eastern Tampa Bay (ETBWUCA) and Highlands Ridge (HRWUCA). For each of the initial WUCAs, a three-phased approach to water resource management was implemented, including: (1) short-term actions that could be put into place immediately, (2) mid-term actions that could be implemented concurrent with the ongoing WRAPs and (3) long-term actions that would be based upon the results of the WRAPs. In addition to the development of conservation plans, cumulative impact analysis-based permitting and requiring withdrawals from stressed lakes to cease within three years, the District developed management plans for each WUCA to stabilize and restore the water resources in each area through a combination of regulatory and non-regulatory efforts. One significant change that occurred as a result of the implementation of the management plans was the designation of the most impacted area (MIA) in the ETBWUCA. The MIA consists of the coastal portion of the SWUCA in southern Hillsborough, Manatee, and northern Sarasota counties. 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 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 Water Use Caution Area (DPCWUCA) 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 has declared a priority water resource caution area adjacent to the District boundary in Lake and Marion counties.

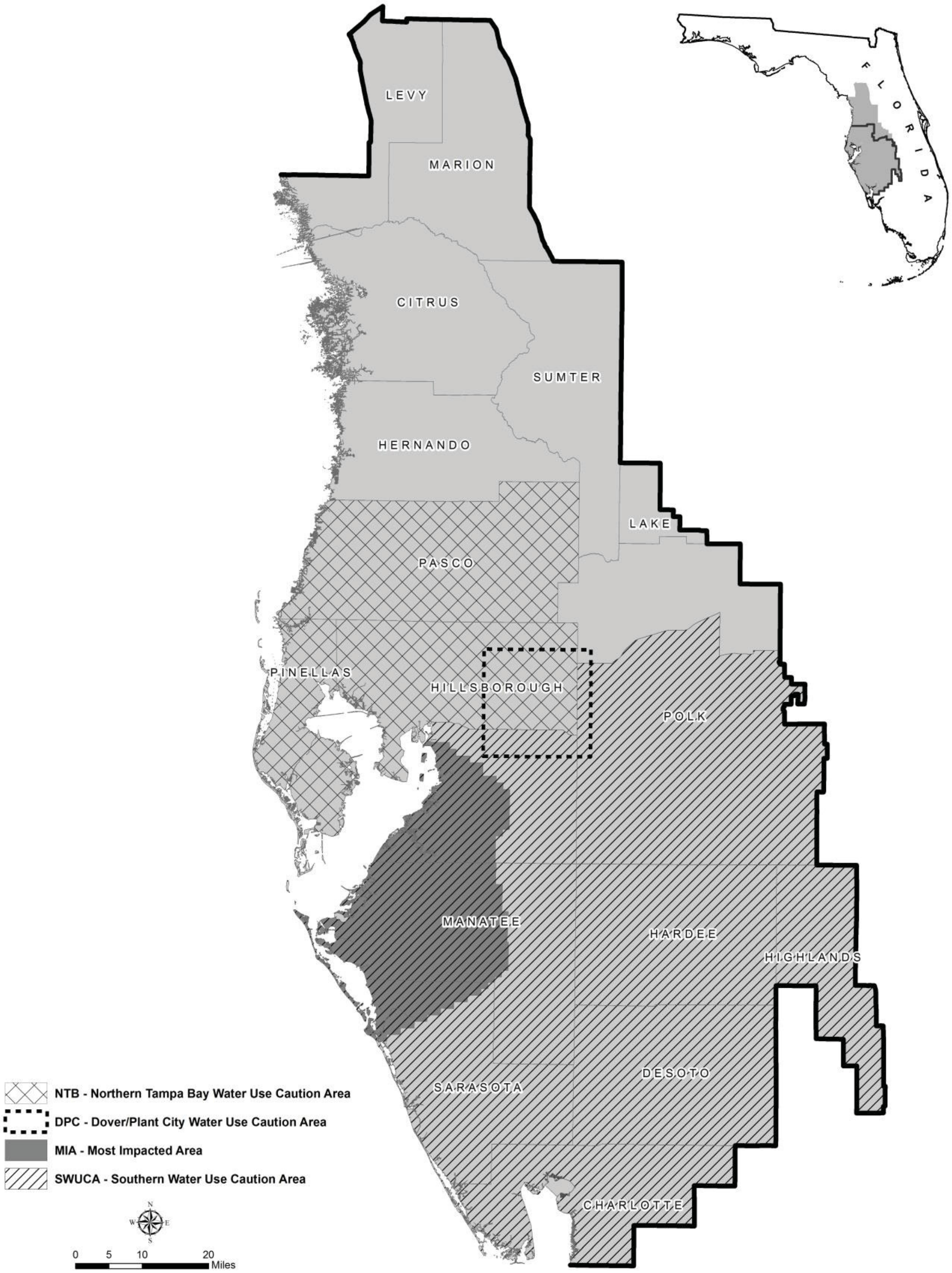


Figure 2-1. *Location of the District's water use caution areas and the MIA of the SWUCA*

1.0 Southern Water Use Caution Area

Since the early 1900s groundwater withdrawals have steadily increased in the Southern West-Central Florida Groundwater Basin (Figure 2-2) in response to growing demands for water from the mining and agricultural industries and later from public supply, power generation and recreational users. 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 lake levels in some lakes within upland areas in Polk and Highlands counties. In response to these resource concerns, the District established the SWUCA in 1992. The SWUCA encompasses all or portions of eight counties in the southern portion of the District, including all of the ETBWUCA and HRWUCA, and the MIA within these counties. Although groundwater withdrawals in the region have stabilized over the past few decades as a result of management efforts, area water resources continue to be impacted by the 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 (MAL) and to allow renewal of existing permits, while gradually reducing permitted quantities as a means to recover aquifer levels to the established minimum level. A number of parties filed objections to parts of the rule and an administrative hearing was conducted. In March 1997, the District received the Final Order upholding the MAL, 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 MAL. The minimum aquifer level was withdrawn because parts of the rule linked the level to the provisions for reallocation of permitted quantities and preferential treatment of existing users over new permit applications, both of which were ruled to be invalid.

In 1998, the District initiated a reevaluation of the SWUCA management strategy and, in March 2006, established minimum "low" flows for the upper Peace River, minimum levels for eight lakes along the Lake Wales Ridge in Polk and Highlands counties, and a SWIMAL for the UFA in the MIA. Since most, if not all, of these water resources were not meeting their adopted 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 is 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. The District completed the first five-year review of the SWUCA recovery strategy in 2013 (SWFWMD 2013). Because adopted MFLs for many water bodies were still not being met, the District initiated a series of stakeholder meetings to review results of the technical assessments and identify potential recovery options.

Four meetings were held in 2015 to address issues associated with MFLs recovery in the MIA and Ridge Lakes areas. Meeting participants represented all the major water use groups, a variety of environmental organizations, state agencies and other interested parties. For the MIA, six options were identified to help meet the SWIMAL goal. The Governing Board voted to support five options (listed below) and directed staff to gather more information on the exploration of aquifer recharge (AR) and aquifer storage and recovery (ASR). There was also subsequent approval of an increase to the District's cost share to 75 percent for the Facilitating Agricultural

Resource Management Systems (FARMS) projects in the MIA for a period of three years to encourage participation in the program.

MIA Options:

1. Continue monitoring
2. Update analytical tools
3. Promote water conservation initiatives
4. Expand FARMS
5. Expand beneficial reuse

For the Ridge Lakes area, the Governing Board supported all three identified options, as listed below.

Ridge Lakes Options:

1. Continue monitoring
2. Reevaluate established minimum lake levels
3. Evaluate options for individual lakes

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

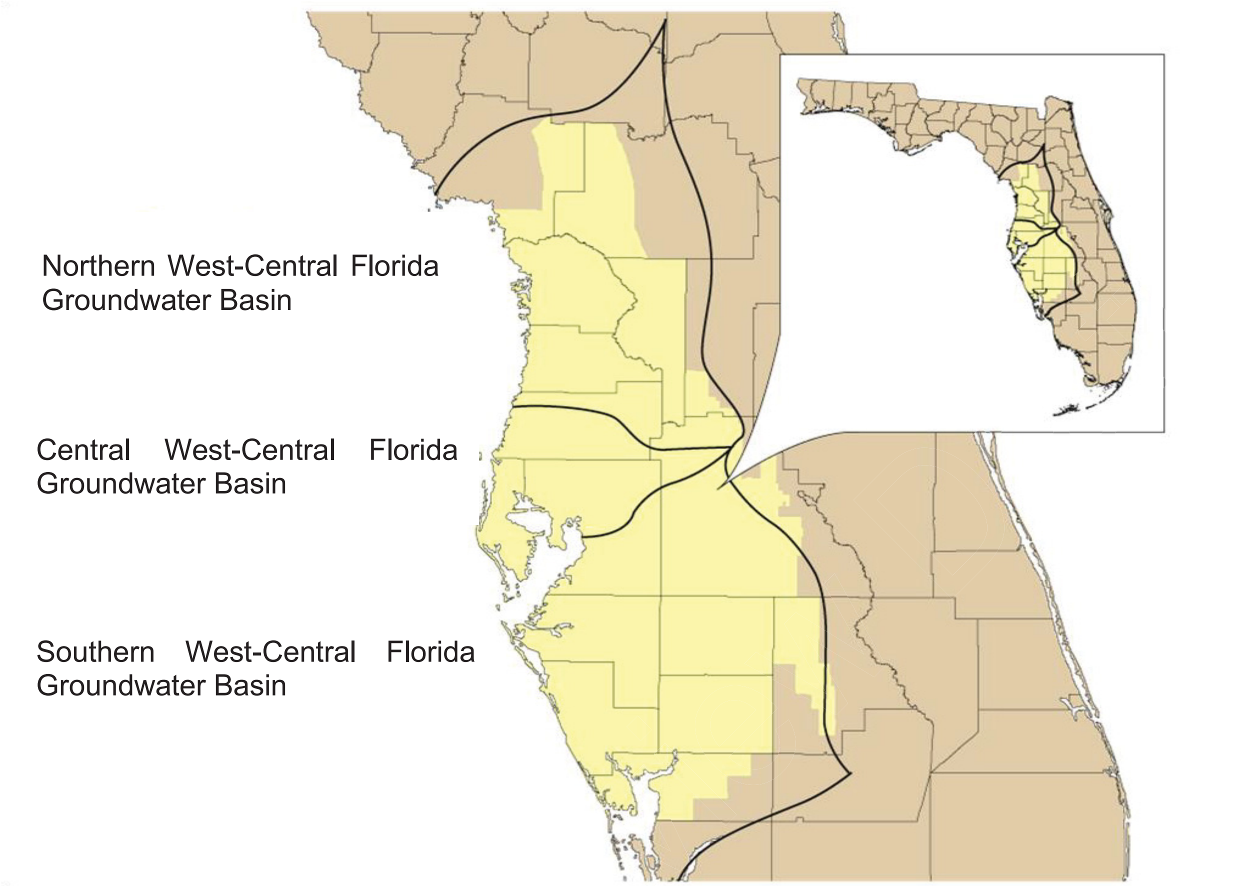


Figure 2-2. *Southwest Florida Water Management District and West-Central Florida Groundwater Basins*

Part B. Minimum Flows and Levels

Section 1. Definitions and History

Section 373.042 of the Florida Water Resources Act of 1972 (Chapter 373, F.S.), directs the Florida Department of Environmental Protection (FDEP) or the water management districts (WMDs) to establish minimum flows or minimum water levels, i.e., MFLs, for priority water bodies using the best available information. The minimum flow for a given watercourse is defined by statute as the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. The minimum water level of an aquifer or surface waterbody is similarly defined by statute as the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

Minimum flows and levels (MFLs) are established and used by the District for water resource planning; as one of the criteria used for WUP applications; and for the design, construction and use of surface water management systems. Minimum flows and levels (MFLs) are also implemented through District funding of water resource and water supply development projects that are part of a recovery or prevention strategy identified for achieving an established MFL. The

District's MFLs program addresses all MFLs-related requirements expressed in the Florida Water Resources Act and the Water Resource Implementation Rule (Chapter 62-40, Florida Administrative Code [F.A.C.]).

Section 2. Priority Setting Process

In accordance with Sections 373.036(7) and 373.042(2), F.S., the District annually updates its Priority List and Schedule for the Establishment of Minimum Flows, Minimum Water Levels, and Reservations. As part of determining the priority list and schedule, which also identifies water bodies scheduled for development of reservations, the following factors are considered:

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

The updated priority list and schedule is submitted to FDEP for approval by November 15 of each year and, as required by statute, is published in the District's Consolidated Annual Report. The District's current priority list and schedule is also posted on the District website and is included in the Chapter 2 Appendix to this RWSP.

Section 3. Technical Approach to Minimum Flows and Levels Establishment

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

The District's technical approach for MFLs development assumes that alternative hydrologic regimes may exist that differ from historic conditions but are sufficient to protect water resource features from significant harm. For example, consider a historic condition for an unaltered river or lake system with no groundwater or surface water withdrawal impacts. A new hydrologic regime for the system would be associated with each increase in water use, from small withdrawals that have no measurable effect on the historic regime to large withdrawals that could substantially alter the regime. A threshold hydrologic regime may exist that included water levels or flows that are lower or less than those of the historic regime, but which protects the water resources and ecology of the system from significant harm. This threshold regime could conceptually allow for water withdrawals, while protecting the water resources and ecology of the area. MFLs established based on such a threshold hydrologic regime may therefore represent minimum acceptable, rather than historic or potentially optimal, hydrologic conditions.

1.0 Scientific Peer Review

Section 373.042(4), F.S., permits affected parties to request independent scientific peer review of the scientific and technical data and methodologies used to establish MFLs. In addition, the District or FDEP may decide to voluntarily subject MFLs to independent scientific peer review, based on guidelines provided in Rule 62-40.473, F.A.C.

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

Section 4. Established and Proposed Minimum Flows and Levels

Figure 2-3 depicts priority MFLs for water resources that are in or partially within the Southern Planning Region. A complete list of water resources with established MFLs throughout the District is provided in the Chapter 2 Appendix to this RWSP.

The following information is based on the 2018 MFLs list as published by the District in 2019. An updated list based on 2019 data will be published by the District in 2020.

Priority water resources with established MFLs in or partially within the planning region include:

- Braden River (upper segment)
- Dona Bay/Shakett Creek System
- Myakka River (lower segment)
- Myakka River (upper segment, partially located in the Heartland Planning Region)
- Peace River (lower segment)
- Peace River (middle segment, partially located in the Heartland Planning Region)
- SWUCA SWIMAL (partially located in the Tampa Bay Region Planning Area and affected by withdrawals in the Southern Planning Region, Heartland Planning Region, and Tampa Bay Planning Region)

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

- Braden River (lower segment)
- Horse Creek (partially located in the Heartland Planning Region)
- Little Manatee River (upper segment, partially located in the Tampa Bay Planning Region)
- Manatee River (lower segment)
- Peace River (lower segment; reevaluation)
- Prairie Creek
- Shell Creek (lower segment)
- Shell Creek (upper segment)

- SWUCA SWIMAL (partially located in the Tampa Bay Region Planning Area and affected by withdrawals in the Southern Planning Region, Heartland Planning Region, and Tampa Bay Planning Region)

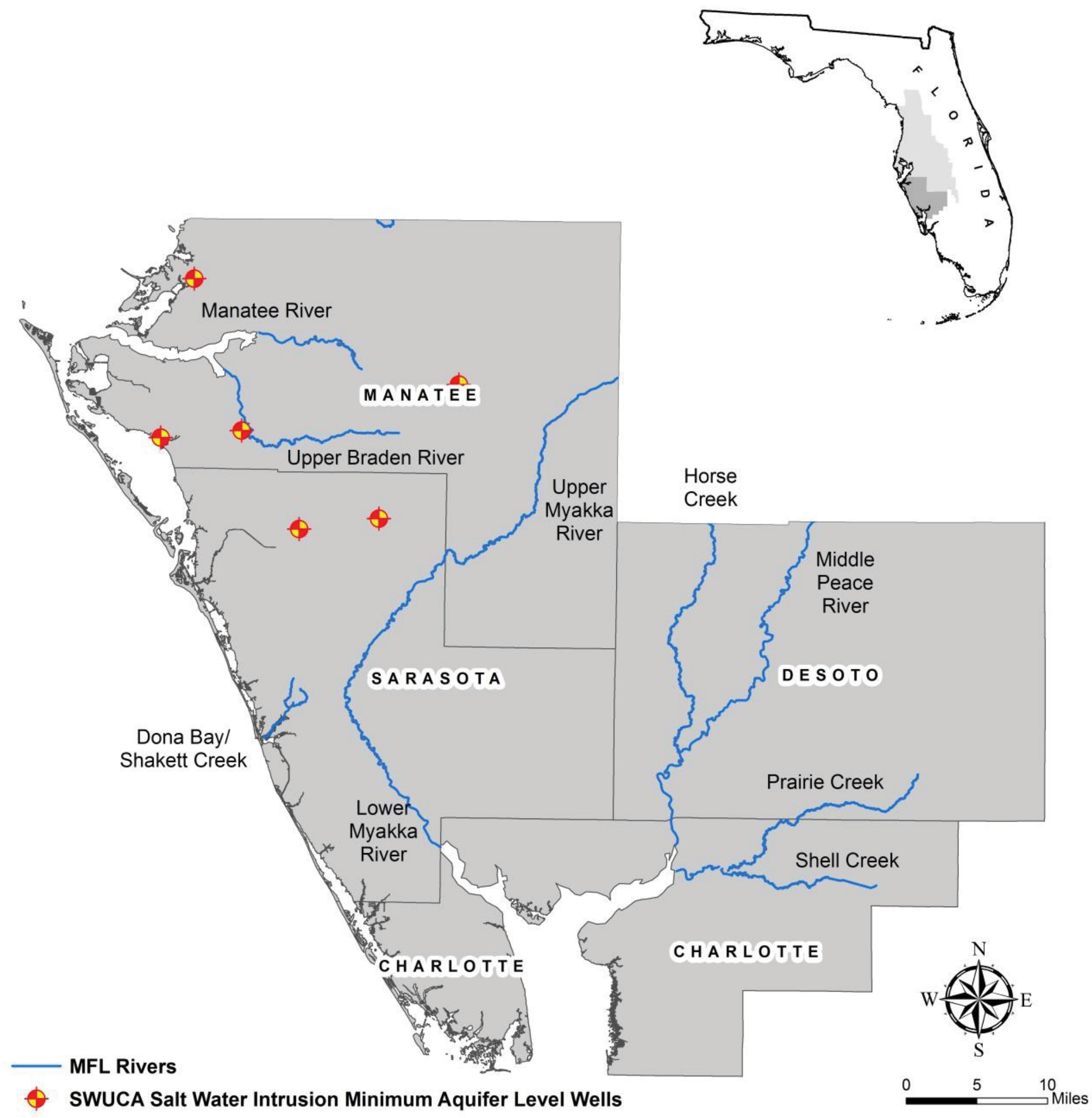


Figure 2-3. *MFL priority water resources in the Southern Planning Region*

Part C. Prevention and Recovery Strategies

Section 1. Prevention Activities

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

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

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 the recovery strategy, is not expected to be met based on future water-use demand projections, 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 the MFL 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 following is a description of the District's SWUCA recovery strategy – the only recovery strategy adopted in the planning region to date.

1.0 Southern Water Use Caution Area

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

Resource recovery projects, such as the project to raise the levels of Lake Hancock for release to the upper Peace River during the dry season, are actively being implemented and considered. 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 SWUCA recovery strategy will be determined through continued monitoring of area resources. The District uses an extensive monitoring network to assess actual versus anticipated trends in water levels, flows and saltwater intrusion. Additionally, the District assesses the cumulative impacts of factors affecting recovery. Information developed as part of these monitoring and assessment efforts is provided to the Governing Board on an annually and on a five-year basis. Results from two five-year assessment of the SWUCA recovery strategy (SWFWMD 2013, 2018), indicate the District continues to make progress toward recovery, but challenges to achieving full recovery by 2025 remain. Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing water resource development projects designed to augment or preserve levels and flows.

1.0 Punta Gorda Water Supply Master Plan

The City of Punta Gorda prepared a Water Supply Master Plan in 2006 and a Master Plan Update in 2009 to address their water supply issues. The City is supplied by the Shell Creek surface water treatment facility which has faced numerous operational challenges including poor source water quality, permitting restrictions on its ASR system, and the potential need of a recovery strategy for the lower segment of Shell Creek that could affect available withdrawals. Following a recommendation of the 2009 Master Plan Update, the City pursued the development of a brackish wellfield and reverse osmosis (RO) system to provide a blending source for the Shell Creek plant. The new RO facility was cooperatively funded by the District and will be complete in 2020. The District, the PRMRWSA, and the City are also developing a regional interconnect to the treatment facility for supply-reliability, to allow supplies from the Shell Creek facility to be utilized regionally, and help maintain minimum flow levels in Shell Creek.

Part D. Reservations

Reservations of water are established by rule and authorized as follows: “The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety…” (Section 373.223(4), F. S.).

In accordance with Rule 62-40.474, F.A.C., as exemplified by Rule 40D-2.302, F.A.C. for the SWUCA, the District will consider establishing a reservation of water when a District water resource development project will produce water needed to achieve and adopted MFL. The rule-making process associated with reservation adoption, allows for public input to the Governing Board in its deliberations about establishing a reservation, including, among other matters, the amount of water to be reserved and the time of year the reservation would be effective. When a reservation is established and incorporated into Rule 40D-2.302, F.A.C., only those water use withdrawals that do not reduce the reserved quantity can be evaluated for permitting.

For example, within the Heartland Planning Region, the District is planning to reserve water to aid in the recovery of MFLs in the upper Peace River. To address identified recovery needs for the river, the District is implementing a project to raise water levels in Lake Hancock and use this stored water to provide a significant portion of the flows necessary for meeting the river's MFLs. Rulemaking to reserve from permitting the quantity of water stored in the lake to support the recovery effort is scheduled for completion in 2020. There are currently no plans to establish a reservation in the Southern Planning Region.

Part E. Climate Change

Section 1. Overview

Climate change has been a growing global concern for several decades. According to the Intergovernmental Panel on Climate Change (IPCC), the global mean average land and ocean temperatures have likely increased approximately 1.4 to 2.2°F from pre-industrial levels (IPCC, 2018). Such increases are driving a slow but persistent increase in sea levels and are altering precipitation regimes. These conditions will likely have local impacts including changes to natural habitats, encroachment of seawater into surface and groundwater resources, risk to public infrastructure, warmer temperatures that increase evaporation and impact agriculture, and changes to seasonal and annual rainfall patterns. Climate change is a global issue that requires international coordination and planning, although strategies for assessing vulnerabilities and developing adaptation plans are necessary on the local, regional, and statewide level.

In recent years, numerous agencies and organizations in Florida have developed initiatives to address climate change. Many of the state's Regional Planning Councils (RPCs) have pooled resources and are developing vulnerability assessments, climate adaptation plans, and post-disaster redevelopment plans for member communities. The FDEP's Community Resilience Initiative provides planning tools and promotes collaboration among RPCs and coastal communities. The WMDs and other agencies participate in focus groups organized by RPCs, Florid Sea Grant, and other entities to consolidate climate information, develop consistent approaches to planning, and provide technical expertise when appropriate. Other participants in these initiatives include the National Weather Service; regional water supply authorities; state universities; and Florida Fish and Wildlife Conservation Commission, Department of Transportation, Department of Health, FDEP, and the Division of Emergency Management.

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

Section 2. Possible Effects

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

1.0 Sea Level Rise

Data from the National Oceanic and Atmospheric Administration (NOAA) tide gauge in St. Petersburg shows that monthly mean water levels have already increased 7.8 inches from the gauge's first reliable records in 1946 to 2019 (CSAP, 2019). The latest NOAA projections over this report's 20-year horizon (2020 through 2040) estimate that local sea levels will rise by 3.5 inches based a linear extrapolation, 4.3 inches by factoring the likely acceleration, and over 12 inches if accounting for potential polar ice sheet instabilities. With a 50-year horizon (2020 through 2070), a common lifecycle for infrastructure design, the NOAA projections range from 9 inches to over 3 feet (Sweet et al, 2017).

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

One positive aspect is that SLR is projected to occur relatively slowly, although persistently, which allows time to thoroughly evaluate the impacts to natural resources and public infrastructure, plan and implement adaptation strategies, and continue to use most existing coastal infrastructure for several decades. The cost of initiating SLR planning or incorporating it into other existing efforts is relatively low compared to disaster recovery efforts.

2.0 Air Temperature Rise

The IPCC estimates that current green-house emission levels will cause mean global air temperatures to reach or stabilize at approximately 2.7°F above pre-industrial levels (1850 to 1900) by the end of this century, with greatest warming at inland and polar regions (IPCC, 2018). The impacts to southwest Florida will likely be more hot days and few cold days seasonally. Evaporation is likely to increase with a warmer climate, which could result in lower surface water levels and increased irrigation demand. Increased evaporation is likely to impact stormwater runoff, soil moisture, groundwater recharge, and reservoir storage losses (Bates et al., 2008). Additionally, higher air temperatures may exasperate algal blooms and declines in reservoir water quality that could raise treatment costs for potable water supply.

3.0 Precipitation Regimes and Storm Frequency

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

Warming temperatures in the Atlantic and Gulf of Mexico can increase the likelihood of intense tropical storms and hurricanes that can generate storm surge, strong winds, and heavily concentrated rainfall. Hurricane activity near Southwest Florida is statistically more common during AMO warm periods. Higher summer temperatures and humidity may also increase the frequency of local convective weather events, resulting in thunderstorms, higher peak surface water flows, and increased flooding in some areas (Groisman et al., 2005).

Section 3. Current Management Strategies

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

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

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

Section 4. Future Adaptive Management Strategies

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

- Armament. An armament strategy involves the erection of defensive barriers such as dykes and pumping systems to protect existing infrastructure from storm surges and SLR. Armament may be a preferred approach for dense urban and commercial areas, although they may limit transitional natural habitats and create an effective tipping point for inundation. The community's existing water supply infrastructure and demand centers would be maintained.
- Accommodation. An accommodation strategy utilizes improved infrastructure such as elevated roads and buildings and canal systems that allow coastal inundation to occur. Accommodation strategies may suit growing municipalities that can apply innovative community planning to assure longevity. The District's water supply planning efforts may involve the technological development of alternative water supplies including AR systems, direct and indirect reuse, and RO 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.

Chapter 3. Demand Estimates and Projections

This chapter is an analysis of the demand for water for all use categories in the Southern Planning Region for the 2015 to 2040 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 (SWFWMD) (District) projected water demand for the public supply (PS), agricultural (AG), industrial/commercial (I/C), mining/dewatering (M/D), power generation (PG) and landscape/recreation (L/R) water use sectors for each county in the planning region. An additional water use sector, environmental restoration (ER), comprises quantities of water that need to be developed and/or retired to meet established minimum flows and levels (MFLs). The environmental restoration demand could increase during the planning period based on the recovery requirements of MFLs established in future years. The methodologies used to project demand for each category are briefly summarized in this chapter and presented in greater detail in the Chapter 3 Appendix.

The demand projections represent those reasonable and beneficial uses of water that are anticipated to occur through the year 2040. The District determined 5-in-10 (average condition) and 1-in-10 (drought condition) demands for each five-year increment from 2015 to 2040 for each sector. The demand projections for Charlotte County, located partially in the District, reflect only the anticipated demands in the portion of the county located within the District's boundaries. Decreases in demand are reductions in the use of groundwater for the AG and I/C, M/D and PG 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 (FDEP), formed in 1997 as a means to reach consensus on the methods and parameters used in developing the RWSPs. Some of the key guidance parameters include:

- Establishment of a base year: The year 2015 was agreed upon as a base year for the purpose of developing and reporting water demand projections. 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 2015; whereas, data for the years 2020 through 2040 are projected demands.
- Water use reporting thresholds: Minimum thresholds of water use within each water use category were agreed upon as the basis for projection.
- 5-in-10 versus 1-in-10: For reporting demand in average versus drought conditions, specific parameters were prescribed for at least a portion of the demand related to all water supply categories except 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 2040. Total demand does not account for reductions that could be achieved by additional demand management measures. Water conservation and other sources are accounted for separately in Chapter 4 as a means by which demand can be met.

Part A. Water Demand Projections

Demand projections were developed for five sectors; (1) PS, (2) AG, (3) I/C, M/D and PG, (4) L/R and (5) 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 PS sector is composed 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 (DSS) (individual private homes or businesses that are not utility customers that receive their water from small wells that do not require a WUP), and (4) additional irrigation demand (water from domestic wells that do not require a WUP and used for irrigation by residences that rely on a utility for indoor and other non-irrigation water needs).

2.0 Population Projections

2.1 Base Year Population

All WMDs agreed that 2015 would be the base year from which projections would be determined. The District calculated the 2015 population by extrapolating from GIS Associates, Inc.'s 2016 population estimate. Utilities with permitted quantities less than 100,000 gallons per day are not required to report population or submit service area information. Subsequently, population was obtained from the last issued permit.

Potable water pumping station

2.2 Methodology for Projecting Population

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

3.0 2015 Base Year Water Use and Per Capita Rate

3.1 Base Year Water Use

The 2015 PS base year water use for each large utility is derived by multiplying the average 2011 to 2015 unadjusted gross per capita rate by the 2015 estimated population for each individual utility. For small utilities, per capita information is found in the last issued permit. If no per capita information is available, the per capita is assumed to equal the average county per capita. Base year water use for small utilities is obtained by multiplying the per capita from the current permit by the 2015 estimated population from the last issued permit. Domestic self-supply (DSS) base year is calculated by multiplying the 2015 DSS population for each county by the average 2011 to 2015 residential countywide per capita water use.

4.0 Water Demand Projection Methodology

4.1 Public Supply

Water demand is projected in five-year increments from 2020 to 2040. To develop the projections, the District used the 2011 to 2015 average per capita rate multiplied by the projected population for that increment. An additional component of PS demand is water derived from domestic wells for irrigation. These wells have a diameter of less than 6 inches, do not require a WUP and are used for irrigation at residences that receive potable water for indoor use from a utility. These wells are addressed in a separate report entitled Southwest Florida Water Management District Irrigation Well Inventory (D.L. Smith and Associates, 2004). This report provides the estimated number of domestic irrigation wells within the District and their associated water demand. The District estimates that approximately 300 gallons per day (gpd) are used for each well.

4.2 Domestic Self-Supply

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

5.0 Water Demand Projections

Table 3-1 presents the projected PS demand for the planning period. The table shows that demand will increase by 30.78 mgd for the 5-in-10 condition. These projections are lower than those in the District's 2015 RWSP. The differences can be attributed to slower than anticipated regional population growth and more accurate utility level population projections using a GIS model that accounts for growth and build-out at the parcel level.

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

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Charlotte	19.21	20.36	20.56	21.79	21.75	23.05	22.77	24.14	23.65	25.07	24.43	25.89	5.22	5.53	27.2%	27.2%
DeSoto	2.77	2.93	2.84	3.01	2.90	3.08	2.96	3.14	3.02	3.20	3.06	3.24	0.29	0.31	10.5%	10.6%
Manatee	39.48	41.85	43.46	46.06	47.36	50.20	50.84	53.89	53.92	57.16	56.54	59.94	17.06	18.09	43.2%	43.2%
Sarasota	40.25	42.67	42.56	45.11	44.58	47.25	46.17	48.94	47.46	50.31	48.46	51.36	8.21	8.69	20.4%	20.4%
Total	**101.71**	**107.81**	**109.42**	**115.97**	**116.59**	**123.58**	**122.74**	**130.11**	**128.05**	**135.74**	**132.49**	**140.43**	**30.78**	**32.62**	**30.26%**	**30.26%**

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

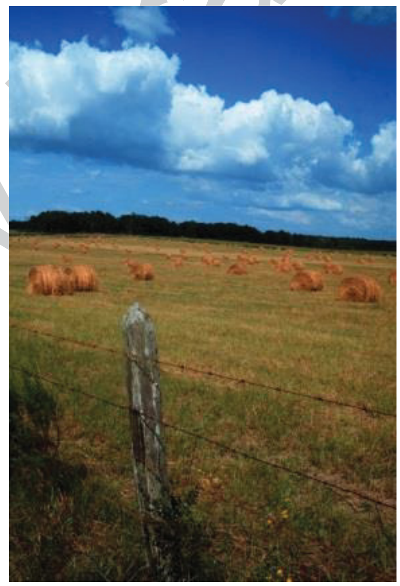
6.0 Stakeholder Review

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



Agriculture represents the second largest sector of water use in the District after public supply

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

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

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

3.0 Water Demand Projections

Trends indicate that agricultural activities are expected to slightly increase in the Southern Planning Region during the planning period. Irrigated acreage is expected to increase by about five percent, from 158,000 acreage in 2016 to nearly 167,000 acres in 2040. This projection indicates a stabilization for the region, which has experienced a dramatic decrease in water use from peak levels in the early 2000s. Total agricultural water use in this region has fallen from over 160 to 260 mgd annually in the late 1990s and early to 2000s to about 107 mgd from 2014 to 2016.

Current average year demands are estimated at 105 mgd for 2016 acreage levels. The District projects that in 2040 the increase in irrigated acreage will result in a four percent increase in water demands to approximately 110 mgd. Most of the increase in acreage will be in fresh market vegetables, with a small recovery in citrus acreage. FDACS forecasts that Charlotte, Desoto, and Manatee counties will gain about 10,000 acres of irrigated land, while Sarasota county is expected to have a slight decrease in irrigated acreage of about 1,900 acres. Citrus represents the largest or second largest crop by acreage in each of these counties, and the long-term response of the industry to citrus greening disease will likely drive water use trends in the Southern Planning Region. Table 3-2 displays projected combined agricultural irrigation and non-irrigation demands for the 5-in-10 (average) and 1-in-10 (drought) conditions for the planning period.

4.0 Stakeholder Review

District staff began presenting draft agricultural demand projections to the District's Agricultural and Green Industry Advisory Committee permit evaluation staff and FDACS staff in September 2018. The District additionally requested input from the Agricultural and Green Industry Advisory Committee on the FSAID5 water use projections and methodology as well as the adjusted FSAID5 method developed by the District. The Committee wished to take time to consider the proposed methods and adjourned to solicit feedback from industry groups and other stakeholders. In October 2018, the Committee reconvened, and District staff provided an additional presentation on the potential agricultural projections methods and draft results. Stakeholders present included representatives from the Florida Turfgrass Association, Florida Citrus Mutual, Florida Strawberry

Growers Association, Florida Nursery Growers and Landscape Association, and University of Florida Institute of Food and Agricultural Sciences (IFAS), among others. After discussion, the Agricultural and Green Industry Advisory Committee unanimously voted to support the District's updated Agricultural Water Demands Projections Methodology based on FSAID5 acreage projections and adjustments to the incorporated District metered water use data. Additionally, the District consulted with staff from the FDACS Office of Agricultural Water Policy on the proposed method, and FDACS assented to the Districts' method based on FSAID5 acreage projections and District metered water use data.

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

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Charlotte	8.12	11.39	8.31	11.65	8.75	12.26	9.20	12.86	9.89	13.76	10.30	14.29	2.18	2.90	26.8%	25.5%
DeSoto	44.09	64.75	44.29	65.03	44.45	65.24	44.63	65.5	44.7	65.61	45.09	66.15	1.00	1.40	2.3%	2.2%
Manatee	48.87	64.43	49.28	64.97	49.68	65.48	50.45	66.49	50.93	67.12	51.34	67.68	2.47	3.25	5.1%	5.0%
Sarasota	3.97	4.99	3.71	4.64	3.60	4.51	3.24	4.05	3.03	3.75	2.92	3.62	-1.05	-1.37	-26.4%	-27.5%
Total	**105.05**	**145.56**	**105.59**	**146.29**	**106.48**	**147.49**	**107.52**	**148.9**	**108.55**	**150.24**	**109.65**	**151.74**	**4.60**	**6.18**	**4.38%**	**4.25%**

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

Section 3. Industrial/Commercial and Mining/Dewatering

1.0 Description of the Industrial/Commercial and Mining/Dewatering Water Use Sectors

Industrial/Commercial (I/C) and Mining/Dewatering (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 2020 RWSP were developed by multiplying the 2015 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 I/C facility used 0.30 mgd in 2015 and the county calculated growth factor from 2015 to 2020 was 3 percent, the 2020 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 2015 is derived from the District's 2015 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 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 details.

3.0 Water Demand Projections

Table 3-3 shows the projected net change in I/C and M/D water demand for the planning period. Demand is projected to change from 6.09 mgd in 2015 to 10.65 mgd in 2040, a change of approximately 75 percent, due primarily to a projected increase in mining activities in Manatee County.

For several years, the permitted quantity in the I/C and M/D sectors has been declining. Much of this reduction is due to revisions in the way permitted quantities for M/D are allocated by the District's 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 2019 Format and Guidelines, the 5-in-10 and 1-in-10 demands are the same. The uses "are assumed to be reasonably the same in a 1-in-10-year drought event as in an average year (i.e., no significant demand variation)" (FDEP et al., June 2009).

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

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Charlotte	0.14	0.08	0.09	0.09	0.09	0.09	-0.05	-35.7%
DeSoto	0.59	0.60	0.62	0.63	0.64	0.66	0.06	11.9%
Manatee	4.99	6.15	6.17	9.55	9.56	9.57	4.58	91.8%
Sarasota	0.37	0.30	0.31	0.32	0.33	0.33	-0.04	-10.8%
Total	**6.09**	**7.13**	**7.19**	**10.59**	**10.62**	**10.65**	**4.56**	**74.9%**

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

4.0 Stakeholder Review

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

Section 4. Power Generation

1.0 Description of the PG Water Use Sector

The PG uses within the District include water for thermoelectric power generation used for cooling, boiler make-up water, or other purposes associated with the generation of electricity. The PG quantities have previously been grouped with I/C and M/D quantities but are provided separately in this section per the 2019 Format and Guidelines (FDEP et al., 2019).

2.0 Demand Projection Methodology

Demand projections for the 2020 RWSP were developed by multiplying the 2015 amount of water used for each PG facility by growth factors based on Woods & Poole Economics' GRP forecasts by county in five-year increments. For example, if a PG facility used 0.30 mgd in 2015 and the county calculated growth factor from 2015 to 2020 was 3 percent, the 2020 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 2015 is derived from the WUWPD. Please see Appendix 3-2 for more detail.

3.0 Water Demand Projections

Table 3-4 shows the projected increase in PG water demand for the planning period. Demand in 2015 was 3.60 mgd and is expected to be 4.64 mgd in 2040, an increase of approximately 29 percent. The demand projections do not include reclaimed, seawater, or non-consumptive use of freshwater.

In accordance with the 2019 Format and Guidelines, the 5-in-10 and 1-in-10 demands are the same. Power generation (PG) 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)" (FDEP et al., June 2009).

Table 3-4. *Projected PG demand in the Southern Planning Region (5-in-10 and 1-in-10)) (mgd)*

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Charlotte	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
DeSoto	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Manatee	3.60	3.69	3.92	4.17	4.40	4.64	1.04	28.9%
Sarasota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Total	**3.60**	**3.69**	**3.92**	**4.17**	**4.40**	**4.64**	**1.04**	**28.89%**

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

4.0 Stakeholder Review

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

Section 5. Landscape/Recreation

1.0 Description of the Landscape/Recreation Water Use Sector

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

2.0 Demand Projection Methodology

Landscape/Recreation (L/R) baseline use data is from the WUWPD (SWFWMD, 2017). 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 L/R demand. 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 2015 baseline pumpage. The projected percentage changes were based on projected socioeconomic factors such as household income and ethnicity, and golf play rates associated with those socioeconomic factors.

Landscape and other recreation demands are based on population growth within each county. Water use for this sector is assumed to grow at the projected county-level percent change in population. The five-year population percent changes were calculated for each five-year period 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 3.41 mgd for the 5-in-10 condition is projected between 2015 and 2040. This represents an increase in demand of 18.43 percent. Reclaimed water has made a definite impact on golf course water use and this should continue into the future. Most landscape/recreation water use occurs near major population centers in the coastal counties where large quantities of reclaimed water can be used to offset the use of potable water for this category.

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

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Charlotte	1.79	2.30	1.83	2.36	1.87	2.40	1.90	2.44	1.92	2.47	1.95	2.50	0.16	0.20	8.9%	8.7%
DeSoto	0.33	0.42	0.33	0.42	0.34	0.43	0.34	0.43	0.34	0.44	0.35	0.44	0.02	0.02	6.1%	4.8%
Manatee	9.85	12.48	10.28	13.02	10.87	13.77	11.39	14.42	11.86	15.01	12.26	15.52	2.41	3.04	24.5%	24.4%
Sarasota	6.53	8.36	6.77	8.66	6.96	8.91	7.12	9.11	7.25	9.27	7.35	9.40	0.82	1.04	12.6%	12.4%
Total	**18.50**	**23.56**	**19.21**	**24.46**	**20.04**	**25.51**	**20.75**	**26.40**	**21.37**	**27.19**	**21.91**	**27.86**	**3.41**	**4.30**	**18.4%**	**18.3%**

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

4.0 Stakeholder Review

The demand projection methodology, results and analyses were provided to the District's water use permitting staff and L/R use sector stakeholders for review and comment. The District's Agricultural and Green Industry Advisory Committee generally confirmed stable or decreasing water demands for golf as part of the L/R projections.

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Section 6. Summary of Projected Demands

Tables 3-6 summarizes the projected changes in demand for the 5-in-10 and 1-in-10 conditions for all use categories in the planning region. It shows that 44.39 mgd of additional water supply will need to be acquired from permitted reserves, developed, and/or existing use retired to meet demand in the planning region through 2040. Public supply (PS) water use will increase by 30.78 mgd over the planning period. Agricultural (AG) water uses will increase by 4.6 mgd over the planning period. The L/R water use will increase by 3.41 mgd. Table 3-7 summarizes the projected demands for each county in the planning region for the 5-in-10 condition.

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

Water Use Category	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
PS	101.71	107.81	109.42	115.97	116.59	123.58	122.74	130.11	128.05	135.74	132.49	140.43	30.78	32.62	30.3%	30.3%
AG	105.05	145.56	105.59	146.29	106.48	147.49	107.52	148.9	108.55	150.24	109.65	151.74	4.60	6.18	4.4%	4.2%
I/C & M/D	6.09	6.09	7.13	7.13	7.19	7.19	10.59	10.59	10.62	10.62	10.65	10.65	4.56	4.56	74.9%	74.9%
PG	3.60	3.60	3.69	3.69	3.92	3.92	4.17	4.17	4.40	4.40	4.64	4.64	1.04	1.04	28.9%	28.9%
L/R	18.5	23.56	19.21	24.46	20.04	25.51	20.75	26.4	21.37	27.19	21.91	27.86	3.41	4.30	18.4%	18.3%
Total	**234.95**	**286.62**	**245.04**	**297.54**	**254.22**	**307.69**	**265.77**	**320.17**	**272.99**	**328.19**	**279.34**	**335.32**	**44.39**	**48.7**	**18.9%**	**17.0%**

Notes: Summation and/or percentage calculation differences occur due to rounding.

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

Water Use Category	Planning Period						Change 2015-2040	
	2015	2020	2025	2030	2035	2040	mgd	%
Charlotte								
PS	19.21	20.56	21.75	22.77	23.65	24.43	5.22	27.2%
AG	8.12	8.31	8.75	9.20	9.89	10.30	2.18	26.9%
I/C & M/D	0.14	0.08	0.09	0.09	0.09	0.09	-0.04	-35.7%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	1.79	1.83	1.87	1.90	1.92	1.95	0.16	9.0%
Cumulative Total	**29.26**	**30.78**	**32.46**	**33.96**	**35.55**	**36.77**	**7.52**	**25.7%**
DeSoto								
PS	2.77	2.84	2.90	2.96	3.02	3.06	0.29	10.5%
AG	44.09	44.29	44.45	44.63	44.70	45.09	1.00	2.3%
I/C & M/D	0.59	0.60	0.62	0.63	0.64	0.66	0.06	11.9%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	0.33	0.33	0.34	0.34	0.34	0.35	0.02	6.0%
Cumulative Total	**47.78**	**48.06**	**48.31**	**48.56**	**48.70**	**49.16**	**1.37**	**2.9%**
Manatee								
PS	39.48	43.46	47.36	50.84	53.92	56.54	17.06	43.2%
AG	48.87	49.28	49.68	50.45	50.93	51.34	2.47	5.1%
I/C & M/D	4.99	6.15	6.17	9.55	9.56	9.57	4.58	92.0%
PG	3.60	3.69	3.92	4.17	4.40	4.64	1.04	29.0%
L/R	9.85	10.28	10.87	11.39	11.86	12.26	2.41	24.0%
Cumulative Total	**106.79**	**112.86**	**118.00**	**126.40**	**130.67**	**134.35**	**27.56**	**25.8%**
Sarasota								
PS	40.25	42.56	44.58	46.17	47.46	48.46	8.21	20.4%
AG	3.97	3.7	3.6	3.24	3.03	2.92	-1.05	-26.4%
I/C & M/D	0.37	0.3	0.31	0.32	0.33	0.33	-0.04	-10.8%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0	0.0%
L/R	6.53	6.77	6.96	7.12	7.25	7.35	0.82	12.6%
Cumulative Total	**51.12**	**53.33**	**55.45**	**56.85**	**58.07**	**59.06**	**7.94**	**15.5%**
Region Total	**234.95**	**245.03**	**254.22**	**265.77**	**272.99**	**279.34**	**44.39**	**18.9%**

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

Section 8. Comparison of Demands between the 2015 RWSP and the 2020 RWSP

There are several notable differences between the 2015 and 2020 RWSP demand projections. Th 2015 base numbers include a reduction in demands for the AG, I/C and M/D sectors from the 2015 projected numbers used in 2015 RWSP, whereas the PS and PG categories include slight increases in demands when compared with the 2015 RWSP. The differences for the PS category are largely attributable to methodology changes that include a parcel-based population projection approach. Regarding the PS category, the 2015 RWSP projected an increase of 28.68 mgd for the 2010 to 2035 planning period, while the 2020 RWSP projects an increase of 30.78 mgd from 2015 to 2040, only slightly higher than the 2015 RWSP.

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Chapter 4. Evaluation of Water Sources

This chapter presents the results of investigations by the Southwest Florida Water Management District (SWFWMD or District) to quantify the amount of water that is potentially available from all sources of water within the planning region to meet demands through 2040. Sources of water that 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. The amount of water that is potentially available from these sources is compared to the demand projections for the planning region presented in Chapter 3, and a determination is made as to the sufficiency of the sources to meet demand through 2040.

Part A. Evaluation of Water Sources

Fresh groundwater from the 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 the projected demands during the planning period will come from sources other than fresh groundwater. This assumption is based largely on the impacts of groundwater withdrawals on water resources in the SWUCA, 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 or ASR systems for storage. To facilitate the development of these projects, the District encourages partnerships between neighboring municipalities and counties for purposes of developing regionally coordinated water supplies.

The following discussion summarizes the status of the evaluation and development of various water supply sources and the potential for those sources to be used to meet the projected water demand in the planning region.

Section 1. Fresh Groundwater

Fresh groundwater from the UFA is the principal source of water supply for all use categories in the planning region. In 2017, approximately 76 percent (204 mgd) of the 269 mgd of water (including domestic self-supply [DSS]) used in the planning region was from groundwater sources. Approximately 18 percent (48 mgd) of the fresh groundwater used was for public supply (PS) (permitted and DSS). Fresh groundwater is also withdrawn from the surficial and intermediate aquifers for water supply, but in much smaller quantities. The following is an assessment of the availability of fresh groundwater in the surficial, intermediate and Upper Floridan aquifers in the planning region.

1.0 Surficial Aquifer

The surficial aquifer is mostly composed of fine-grained sand that is generally less than 50 feet thick. While small-diameter, low-yield wells can be constructed in the surficial aquifer almost anywhere, there clearly are more favorable areas for development. In general, the surficial aquifer is most productive in areas where it is greater than 100 feet thick or where it includes a significant shell bed, as is the case in the southwest portion of the planning region in Charlotte, southern DeSoto, and Sarasota counties.

Permitted surficial aquifer withdrawals are for PS and agricultural (AG) uses. The Gasparilla Island Water Association in Charlotte County has maintained a surficial aquifer wellfield near Placida for PS use for over 30 years. The average depth of each well is 25 feet. The Englewood Water District in southwest Sarasota County also withdraws from surficial aquifer wells for PS. Withdrawals from wells with WUPs in the surficial aquifer occur in Charlotte County and were 0.1 mgd in 2014. Small, unpermitted quantities are also withdrawn from domestic wells for lawn watering or household use. The quantity of water estimated for this use totaled 0.1 mgd for Charlotte, DeSoto, Manatee, and Sarasota counties in 2014.

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

Agriculture is also a significant user in Charlotte, southern DeSoto, and southern Sarasota counties, where significant shell beds have been identified in the surficial aquifer. In Charlotte County, a four-acre pit excavated into a shell bed is utilized for citrus irrigation. At least four other citrus operations in eastern Charlotte County are planning to irrigate with water from shell pits. In most cases, these withdrawals will supplement or replace withdrawals of poor-quality water from the UFA. It is possible that up to 5 mgd of water could be obtained from these shell beds in the southwest part of the planning region (Basso, 2009). Additional exploratory drilling and testing would greatly expand knowledge of the ultimate water-producing potential of these beds.

2.0 Intermediate Aquifer System

The intermediate aquifer system, or the Hawthorn aquifer system, lies between the surficial aquifer and the UFA. It exists over much of the planning region and is most productive in Charlotte, DeSoto, and Sarasota counties. Use of the aquifer increases in the southern portion of the region where the water-bearing zones increase in permeability and water quality of the UFA is poor.

The upper portion of the intermediate aquifer system is characterized by low permeability and is of limited extent. Water in this part of the aquifer is generally of sufficient quality and quantity for DSS indoor water use/outdoor irrigation and recreational uses. Annual average water use from permitted withdrawals within the intermediate aquifer system in 2006 was 34.8 mgd, with 44 percent (15.3 mgd) occurring in Sarasota County, 30 percent (10.6 mgd) in Charlotte County, 19 percent (6.6 mgd) in DeSoto County, and 7 percent (2.3 mgd) in Manatee County.

Small, unpermitted quantities are also withdrawn from the aquifer for lawn watering or individual household use. The quantity of water for these uses is estimated to be a total of 5.1 mgd in Sarasota, Charlotte, DeSoto, and Manatee counties in 2006. The estimated availability of water from the surficial and intermediate aquifers to meet demand in the planning region is 12.5 mgd (excluding 3 mgd that will replace existing UFA withdrawals), with 3.4 mgd allocated to recreational use, 5.1 mgd to DSS and household irrigation use, and 4.0 mgd to agricultural irrigation. 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	Agriculture[1]	Total
Charlotte	0.9	0.2	3[1]	4.1
DeSoto	0.2	0.0	1	1.2
Manatee	1.0	2.4	0	3.4
Sarasota	3.0	0.8	0	3.8
Total	**5.1**	**3.4**	**4.0**	**12.5**

[1] Replacement of existing UFA withdrawals.

3.0 Upper Floridan Aquifer

During development of the SWUCA Recovery Strategy (2006), it was anticipated that development of new water supplies from the UFA in the region would be limited due to existing impacts to minimum flows and levels (MFLs) water bodies. Requests for new groundwater supplies would not be allowed to cause further lowering of water levels in impacted MFLs water bodies.

The SWUCA Recovery Strategy emphasized the implementation of conservation measures and development of alternative water supplies (AWSs) as much as possible to meet future additional demands. Additionally, it was thought that changes in land use would result in the opportunity for some new demands to be met by accessing some portion of historically used groundwater withdrawals that were retired as a result of a change in land-use activities. However, based on demand projections prepared for this plan and work completed for the SWUCA Five-Year Assessment (SWFWMD, 2018), it appears that the ability to meet future water demands based on changes in land use activities is more limited than previously anticipated. Chapter 3, Table 3-7, indicates a net demand increase of 5.6 mgd for I/C, M/D, PG sectors and 4.6 mgd for agricultural irrigation by 2040, which is anticipated to be primarily met with groundwater.

It is also anticipated that some reductions in the use of groundwater can be achieved as a result of the District's comprehensive agricultural water conservation initiatives and the permanent retirement of WUPs on lands purchased for conservation. These reductions could be used to help meet the SWUCA Saltwater Intrusion Minimum Aquifer Level (SWIMAL) and lake MFLs, and/or to mitigate impacts from new groundwater withdrawals.

3.1 Intermediate and Upper Floridan Aquifer Permitted/Unused Quantities

A number of PS utilities in the planning region are not currently using their entire permitted allocation of groundwater. The District 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 PS WUPs in the planning region, approximately 25.9 mgd of additional groundwater quantities are available.

It is important to consider current impacts to MFL water bodies and other environmental features. Because of impacts that have occurred, it is possible that, in the future, some portion of currently permitted demands will need to be met using alternative water sources.

Section 2. Water Conservation

1.0 Non-Agricultural Water Conservation

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

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

Since the 1990s, the District has provided financial and technical assistance to water users and suppliers in the 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 Southern Planning Region through a combination of regulatory and economic measures, as well as incentive-based outreach and technical assistance for the development and promotion of the most recent technologies and conservation activities. Regulatory measures include WUP conditions, year-round water restrictions, and municipal codes and ordinances that require water-efficiency standards for new development and existing areas. For example, the National Energy Policy Act of 1992 requires all new construction built after 1994 to be equipped with low-flow plumbing fixtures. In Florida, Senate Bill 494, which took effect in July 2009, requires all automatic irrigation systems to use an automatic shutoff device. Senate Bill 2080 prohibits contractual and/or local government ordinance restrictions on the implementation of FFL. Periodically, water management districts (WMDs) in Florida issue water shortage orders that require short-term mandatory water conservation through situational BMPs and other practices.

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

The District's Utilities Services Group provides guidance and technical expertise to PS water utilities and helps identify and reduce water loss. The non-regulatory assistance and educational components of the program maximize water conservation throughout the PS water use sector and improve both local utility system efficiency and regional water resource benefits. Among the services provided upon request are comprehensive leak detection surveys, meter accuracy testing, and water audit guidance and evaluation. Since the program's inception, the leak detection team has conducted 154 comprehensive leak detection surveys throughout the District, locating 1,553 leaks of various sizes and totaling an estimated 5.9 mgd. In the Southern Planning Region, the District leak detection team has conducted 13 leak detection surveys, locating 75 leaks totaling an estimated 0.2 mgd.

For the past 10 years, the District has administered the statewide FWS voluntary water conservation certification program for new and existing homes and commercial developments. Residences, businesses, and communities can earn FWS certification through meeting efficiency standards in appliances, plumbing fixtures, irrigation systems, and landscapes.

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

Education is an important element of a successful conservation program. While the actual quantity of water saved as a result of customer education is not measurable, the effort greatly increases the success of all other facets of a conservation program by raising customer awareness and changing attitudes regarding water use. Educating the public is a necessary facet of every water conservation program, and conservation education programs accompanied with other effective conservation measures can be an effective supplement to a long-term water conservation strategy. On a Districtwide scale, water conservation efforts have contributed to declining unadjusted gross per capita use rates, from 115 gallons per day (gpd) per person in 2005 to 97 gpd per person in 2015. The per capita use rate for the District is the lowest of all five WMDs. The per capita trend for the Southern Planning Region is also decreasing as shown in Figure 4-1.

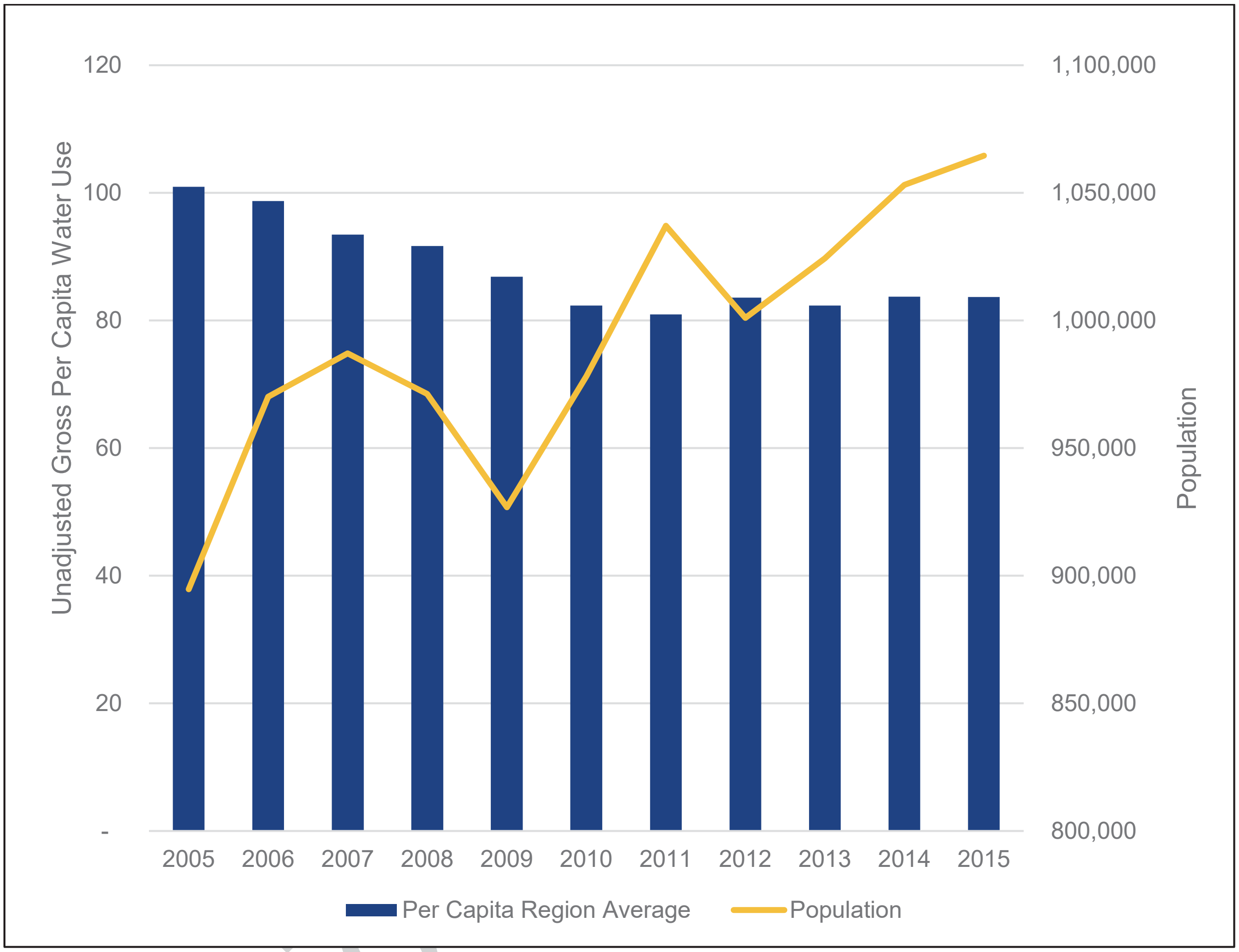

Figure 4-1. *Per capita water use rates in the Southern Planning Region, 2005-2015*

1.1 Public Supply

The PS sector includes all water users that receive water from public water systems and private water utilities. The PS sector may include non-residential customers such as hospitals and restaurants that are connected to a utility potable distribution system. Water conservation in the PS sector will continue to be the primary source of water savings in the District. Public supply (PS) systems lend themselves most easily to the administration of conservation programs since they measure each customer's water use and can focus, evaluate, and adjust the program to maximize savings potential. The success of the District's water conservation programs for PS systems to date is demonstrated by the 15.8 mgd in savings that has been achieved within the District since programs began in 1991. Within the region, it is estimated that savings for the PS category could be almost 7.67 mgd by 2040, if all water conservation programs presented below are implemented (See Table 4-3).

1.1.1 Water Conservation Potential in the Southern Planning Region

The Water Conservation Tracking Tool (AWE Tool) (Alliance for Water Efficiency, 2019) was used to estimate water conservation potential in the Southern Planning Region. This tool is built to assist utilities in determining the costs and benefits of passive and active conservation. It was chosen for use in measuring conservation in the Southern Planning Region due to its customizability and user friendliness given that it is based in Microsoft Excel.

1.1.2 Assessment Methodology

Water savings and costs were estimated using the AWE Tool on a utility-by-utility basis. Individualized water conservation projections were developed for the nine utilities that comprise approximately 90 percent of the total water use for the region and were separated into two categories: passive and active. The nine utilities included in the analysis are Manatee County, Sarasota County, Charlotte County, City of Sarasota, City of Bradenton, City of Punta Gorda, City of North Port, Englewood Water District, and City of Venice.

<u>Passive Conservation</u>

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

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

<u>Active Conservation</u>

Active water conservation encompasses a variety of measures, practices, and programs sponsored or encouraged by utilities and municipal governments which result in water use reductions. By their nature, active water conservation programs are typically funded and administered by PS utilities or other regional entities. Using the AWE Tool and other data from Public Supply Annual Reports, previously co-funded local conservation projects, "Determination of Landscape Irrigation Water Use in Southwest Florida" by Michael D. Dukes (2018), and the *Handbook of Water Use and Conservation* by Amy Vickers (2010), the conservation potential and costs for several conservation activities that utilities could implement were estimated. Conservation activities included in the analysis are:

1. High-efficiency Toilets (HET) (Residential)
2. Smart Irrigation Controllers
3. High-efficiency Toilets (HET) (Industrial/Commercial)
4. High-efficiency Showerheads
5. Landscape and Irrigation Evaluations/Audits
6. Rain Sensors
7. Soil Moisture Sensors

For indoor activities, the AWE Tool estimates the number of older, inefficient fixtures available for replacement in a given year after factoring in passive replacement. A participation rate is applied to this number, and the result is divided over the number of years in the planning horizon to calculate the estimated annual number of replacements. Subsequently, the annual savings and costs are determined. A similar approach is taken for outdoor conservation activities. Rather than basing the annual number of replacements on the number of inefficient fixtures, it is based on a subset of the number of dwelling units within a given service area. This subset is the number of high users that are likely over irrigating. The participation rate is then applied to the number of high users and divided by the number of years in the planning horizon to obtain the number of implementations for each outdoor activity. For additional input parameters used in the estimation, see Table 4-2.

Table 4-2. *Input parameters used in AWE Tool conservation estimation*

Conservation Activities	Participation Rates	Passive Replacement Rates
• High-efficiency Toilets (HET) (Residential) • Smart Irrigation Controllers • High-efficiency Toilets (HET) (Industrial/Commercial) • High-efficiency Showerheads • Landscape and Irrigation Evaluations/Audits • Rain Sensors • Soil Moisture Sensors	• 30 percent participation for all activities • For outdoor activities, participation rate is applied to a subset of users called "high users" [1] • High users considered to be 4 percent of residential customers, except for rain sensor activity[2] and the City of Punta Gorda[3]	• 4 percent per year for toilets (25-year life) • 12 percent per year for showerheads (8-year life) • 7.1 percent per year for clothes washers (14-year life) • 6.7 percent per year for dishwashers (15-year life)

[1] Participation rates for outdoor conservation activities were based in part on "Determination of Landscape Irrigation Water Use in Southwest Florida" by Michael D. Dukes (2018).
[2] Percentage of high users was kept higher at 15 percent for rain sensors to reflect the fact that rain sensors are a low-cost outdoor conservation activity that can be more readily implemented.
[3]Percentage of high users was set at 15 percent for all outdoor conservation activities in the City of Punta Gorda since the per capita water use in this service area is higher and more closely resembles that of the Tampa Bay region, where the aforementioned study (Dukes, 2018) was based.

1.1.3 Results

The conservation activities selected for analysis in this RWSP were chosen for their proven effectiveness in conserving water, overall cost effectiveness, and ease of implementation. It is estimated that approximately 7.67 mgd of combined active and passive PS savings could be achieved in the planning region by 2040 (Table 4-3). This equates to a 7.37 percent reduction in projected 2040 PS sector demand. This includes industrial and commercial entities that are connected to PS utilities.

The bulk of savings estimated by the AWE tool are attributable to passive conservation. This component represents approximately 67 percent of the PS savings available in the region. That's a 5 percent reduction in 2040 total demand, or nearly 5.2 mgd.

To achieve the projected savings, over 318,000 active program implementations would need to be completed during the planning horizon. The overall cost effectiveness for these programs is $0.90 per 1,000 gallons. Active programs account for approximately 32 percent of the savings available in the region. That's a 2 percent reduction in 2040 total demand or nearly 2.48 mgd. The total estimated cost for implemented programs is approximately $14.6 million. Figure 4-2 below depicts the change in demand over the planning horizon for the Southern Planning Region due to passive and active conservation.

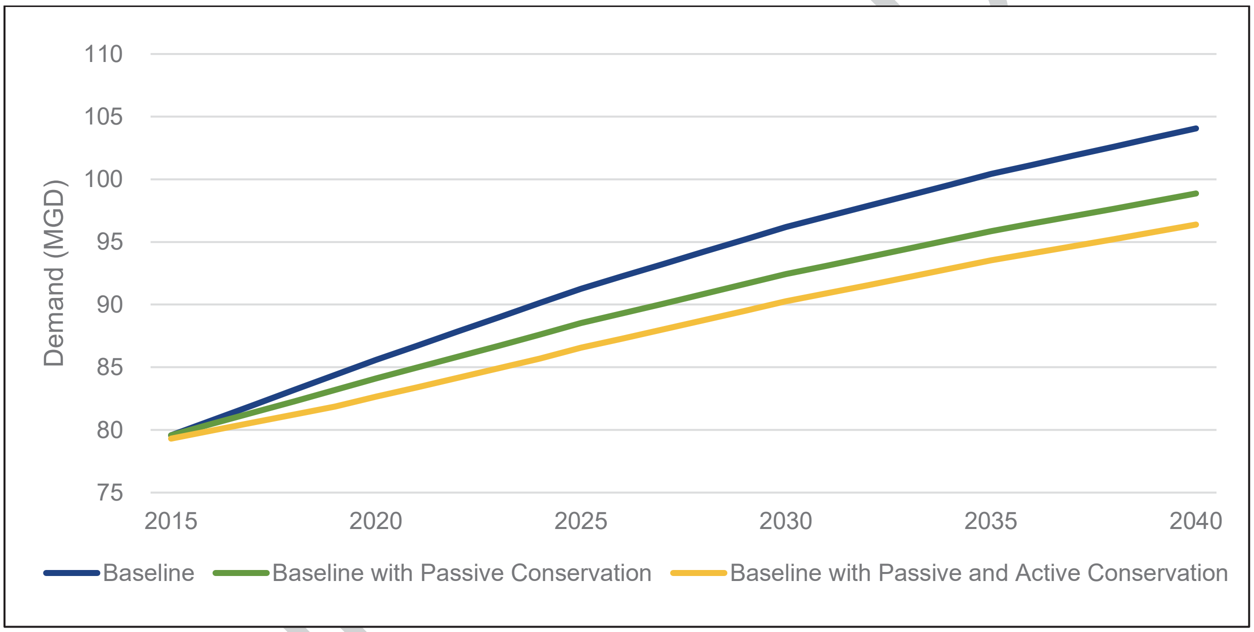

Figure 4-2. *Potential effects of conservation on projected PS demand*

1.1.4 Additional Considerations

Participation rates were kept low to provide conservative estimates and reflect the fact that per capita in the region is already relatively low. The active conservation analysis builds on the passive estimate as it considers only the inefficient stock not already replaced passively. However, it is not comprehensive as there are many other activities that could result in substantial water savings. These active estimates also factor in the effective life of various activities; therefore, for items that have a short-expected life (e.g., rain sensors), repetitive implementations and reoccurring costs are required just to maintain savings.

The 2017 gross per capita water use of the Southern Planning Region is lower than that of any other District planning region, and so it is to be expected that potential conservation savings is not as great as other areas of the District. Significantly more savings could be possible with the inclusion of ordinances adopting higher indoor efficiency standards and modifications to land development regulations that promote conservation. However, these regulatory mechanisms, while extremely effective, are politically unpalatable in many places and for that reason were left out of this estimate.

1.2 Domestic Self-Supply

The DSS sector includes individual private homes and businesses that are not utility customers and receive their domestic water supply from a well or from a surface supply for uses such as irrigation. DSS wells do not require a District WUP, as the well diameters do not meet the District's requirement for a permit. DSS systems are commonly not metered and, therefore, changes in water use patterns are less measurable than those that occur in the PS sector. Only passive conservation was estimated for DSS systems in this RWSP. Within the region, it is estimated that passive savings for the DSS sector could be 0.34 mgd by 2040 (Table 4-3).

1.2.1 Domestic Self-Supply Assessment Methodology

To calculate DSS passive savings, it was assumed that the DSS sector will experience the same percent savings as the PS sector over the planning horizon. The percent of PS passive savings calculated by the AWE Tool was therefore applied to the SWFWMD total DSS 2040 demand projection for the Southern Planning Region to obtain the passive savings specific to the DSS sector. In other words, the DSS 2040 demand (6.81 mgd) was multiplied by the PS passive savings rate (5 percent) to yield the DSS passive savings estimate (0.34 mgd).

1.3 Industrial/Commercial Self-Supply

This water use sector includes factories and other industrial enterprises that obtain water directly from surface water and/or groundwater sources through a WUP. Businesses try to minimize water use to reduce pumping, purchasing, treatment, and disposal costs. To date, the District has focused efforts on education, indoor and outdoor surveys, and commercial applications, such as spray valves and HET. 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 0.03 mgd by 2040 (Table 4-3).

1.3.1 Industrial/Commercial Assessment Methodology

The I/C savings estimate utilized the same methodology outlined in the 2020 Draft Central Florida Water Initiative (CFWI) RWSP. This methodology was based on a study by Dziegielewski et al. (2000) that examined the impact of water audits on improving water efficiency within this sector. The lower-bound savings determined in this study was 15 percent, and this number was used in lieu of the higher estimate to be more conservative. The 15 percent participation rate used in the 2020 Draft CFWI RWSP was also assumed. Therefore, the self-supplied I/C 2040 demand (1.31 mgd) multiplied by both the savings and participation rates (15 percent for both) yields the estimated water savings over the planning horizon for the self-supplied I/C sector within the Southern Planning Region (0.03 mgd).

1.4 Landscape/Recreation Self-Supply

The L/R water use sector includes golf courses and large landscapes (e.g. cemeteries, parks, and playgrounds) that obtain water directly from groundwater and surface water sources rather than from a PS system. It is acknowledged that some amount of water savings has been achieved in this category through the use of efficient irrigation practices and technology. Within the region, it is estimated that the savings for the L/R water use sector could be 1.25 mgd by 2040 (Table 4-3).

1.4.1 Landscape/Recreation Assessment Methodology

As with the self-supplied I/C sector, the estimate of the water conservation potential of the L/R sector was derived using the same methodology as the 2020 Draft CFWI RWSP. Conservation in this sector primarily comes from updating inefficient sprinkler heads and installing smart irrigation controllers, such as soil moisture sensors or weather-based controllers. Based on two studies by the University of Florida, it was determined that the lower-bound savings from retrofits and smart irrigation controllers are 10 percent and 20 percent, respectively. These values were used along with the 15 percent savings rate also assumed in the 2020 Draft CFWI RWSP to estimate self-supplied L/R water conservation. In other words, the 2040 L/R demand (27.85 mgd) was multiplied by the participation rate (15 percent), and this product was multiplied by each of the savings rates (10 percent and 20 percent). The sum of these final two numbers equates to the total L/R savings over the planning horizon (1.25 mgd). The 1-in-10 2040 demand projections were used instead of the 5-in-10 projections in an effort to be more conservative in our calculations.

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

Table 4-3 summarizes the potential non-agricultural water conservation savings in the Southern Planning Region. This table shows that, through the implementation of all conservation measures listed above for the PS, DSS, I/C, and L/R water use sectors, it is anticipated that approximately 9.29 mgd could be saved by 2040 at a total projected cost of $14.6 million. This is a 6.63 percent reduction in total demand.

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

Sector	2040 Demand (mgd)	Savings (mgd)	Potential Reduction in Demand (%)	Average Cost Effectiveness ($/kgal)
Public Supply (PS) Total	104.06	7.67	7.37%	-
PS Passive	-	*5.19*	*4.99%*	-
PS Active	-	*2.48*	*2.38%*	*$0.90*[1]
DSS	6.81	0.34	4.99%	-
I/C	1.31	0.03	2.25%	-
L/R	27.85	1.25	4.50%	-
Total	**140.03**	**9.29**	**6.63%**	**-**

[1]Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.

2.0 Agricultural Water Conservation

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

This RWSP uses the trend as a percent reduction (approximately 13 percent) in 2040 demand. The county-by-county savings percentages derived from FSAID5 data were applied to the 2040 agricultural demands shown in Table 3-2 which are District specific demand projections and lower than FSAID5 demands. Results are shown below in Table 4-4.

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

County	Projected 2040 demand (mgd)	Savings as a percentage (derived from FSAID5)	Agricultural Conservation Potential by 2040 (mgd)
Charlotte	10.30	13.11%	1.35
DeSoto	45.09	12.62%	5.69
Manatee	51.34	13.05%	6.70
Sarasota	2.92	10.96%	0.32
Total	**109.65**		**14.06**

These estimates should be considered potential conservation and should not be treated as "water supply" or directly removed from agricultural water demand estimates. Substantial investments will be necessary to realize these savings. District investment paired with other government assistance programs like FDACS and Natural Resources Conservation Service could accelerate the rate at which these savings occur. Water resource benefits from the Facilitating Agricultural Resource Management Systems (FARMS) Program are categorized as water resource development (WRD) or water conservation (gains in efficiency). Benefits associated with WRD (primarily tail water recovery) projects are estimated to be 13.58 mgd during the planning horizon. Additional information on the FARMS Program and its potential impact on water resources is located in Chapter 5 and 7.

Section 3. Reclaimed Water

Reclaimed water is defined by the Florida Department of Environmental Protection (FDEP) as water that is beneficially reused after being treated to at least secondary wastewater treatment standards by a 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 4-3 illustrates the reclaimed water infrastructure, utilization, and availability of reclaimed water within the District in 2015, as well as planned utilization that is anticipated to occur by 2025 as a result of funded projects. Existing and funded projects are expected to result in reclaimed water increases of more than 14 mgd, bringing utilization within the planning region to approximately to 50 mgd by 2025. Appendix 4-1 contains anticipated 2025 reclaimed water utilization.

The benefit that can be obtained from the use of reclaimed water is governed by the concepts of utilization and water resource benefit. Utilization is the percent of treated wastewater from a WWTP that is utilized in a reclaimed water system. The utilization rate of a reclaimed water system varies by utility. Typically, only 50 to 70 percent of treated wastewater flows go to reclaimed water customers. The highest utilization rates occur in utilities in urban areas where large industries and numerous residential customers can be supplied. Utilization is also limited by seasonal supply and storage. A utility cannot expand its reuse system beyond peak flow demand, which occurs during dry periods when demand is highest, without experiencing shortages. For example, a reclaimed water system with a 1.0 mgd average annual flow normally is limited to supplying 0.5 mgd (50 percent utilization) on an annual basis. This is because during the dry season, demand for reclaimed water for irrigation can more than double.

Reclaimed water can be used for agricultural, residential, golf course, and other public access irrigation use

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

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

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

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

Environmental enhancement and recharge involve using excess reclaimed water to enhance wetland habitat, meet 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 enables systems to serve a larger customer base.

Water resource benefit is the amount of potable-quality groundwater or surface water that is replaced by reclaimed water usage or the amount of reclaimed water used for environmental enhancement. Customers tend to use more reclaimed water than potable water because reclaimed water is generally less expensive and not as restricted as potable water. For example, a single-family residence with an inground irrigation system connected to potable water uses approximately 330 gpd for irrigation. However, if the same single-family residence converts to an unmetered, flat rate, reclaimed water irrigation supply without day-of-week restrictions, it will use approximately two and one-half times (804 gpd) that amount. In this example, the benefit rate would be 41 percent (330 gpd benefit for 804 gpd reclaimed water utilization). Different types of reclaimed water use have different benefit potentials. For example, a power plant or industry using 1.0 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 offset is approximately 65 percent. The District is actively cooperating with utilities to identify ways to increase reclaimed water utilization and benefit. For example, efficiency can be further enhanced with practices such as individual metering coupled with water-conserving rates, efficient irrigation design, and irrigation restrictions.

The District’s goal is to achieve a 75 percent utilization rate of all WWTP flows and benefit efficiency of all reclaimed water used of 75 percent by the year 2040. This goal is intended to reduce the overuse of reclaimed water and increase potable and groundwater benefits. Opportunities may exist for utilization and 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.

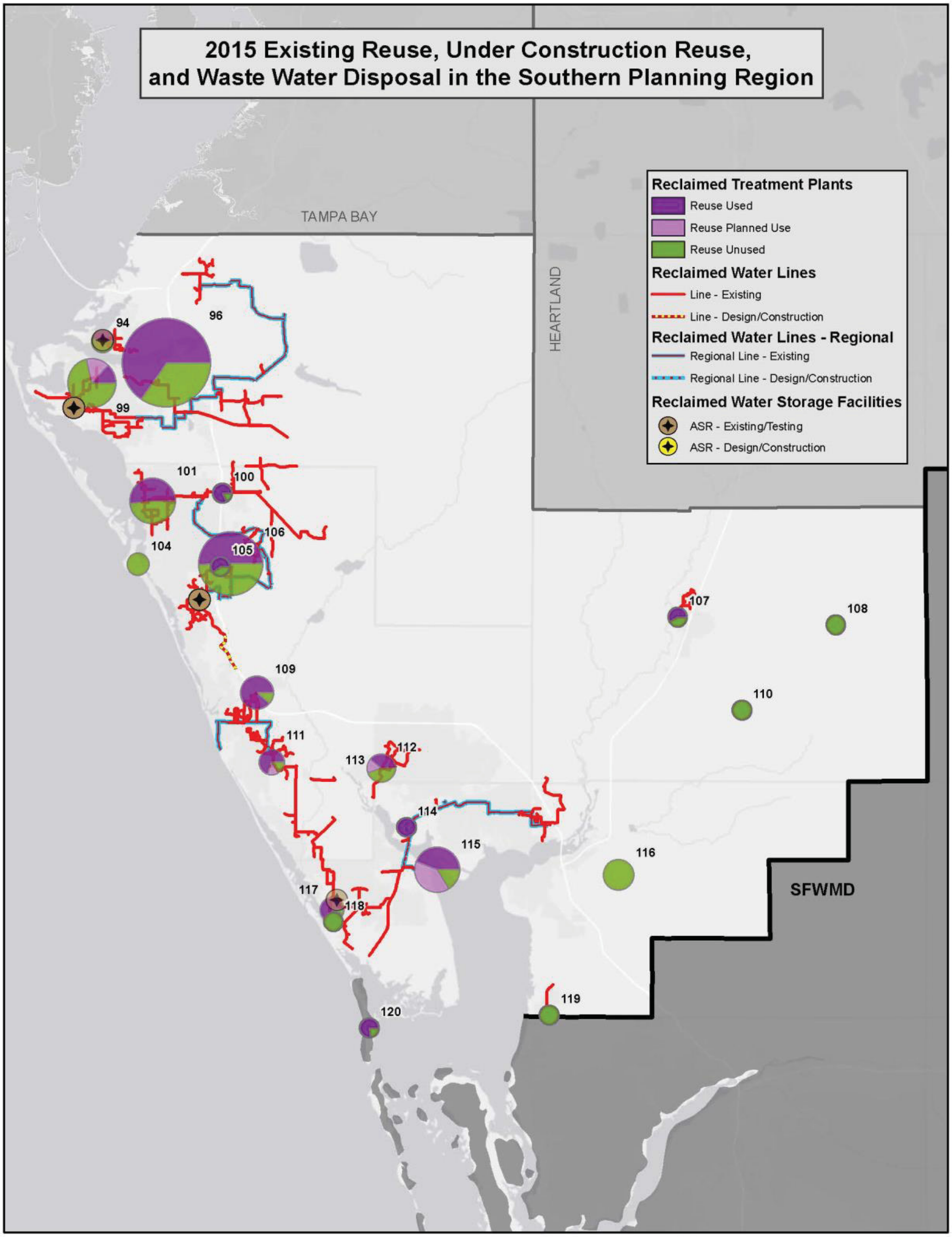

Figure 4-3. *Southern Planning Region reclaimed water map (information on numbered facilities is available at http://www.swfwmd.state.fl.us/conservation/reclaimed/)*

1.0 Potential for Water Supply from Reclaimed Water

Table 4-5 provides information on the current and future availability of reclaimed water in the planning region and the potential to achieve potable-quality water benefits through 2040. In 2015, there were 26 WWTPs in Manatee, Sarasota, Charlotte and DeSoto counties that collectively produced 68 mgd of treated wastewater. Of that quantity, 35 mgd was used, resulting in nearly 25 mgd (70 percent efficiency) of benefits to traditional water supplies. Therefore, only 52 percent of the available wastewater produced in the planning region was utilized for irrigation cooling, or other beneficial purposes. By 2040, it is expected that the anticipated 75 percent of reclaimed water utilization rate could be exceeded. Efficiency by the end user is anticipated to average more than 75 percent through a combination of measures such as customer selection, metering, volume-based rates and education. As a result, by 2040, it is estimated that 65 mgd of the 86 mgd of wastewater water that will be produced in the planning region will be beneficially used. This will result in more than 48 mgd of benefits, of which nearly 24 mgd are additional post-2015 benefits (75 percent efficiency).

Table 4-5. *2015 actual versus 2040 potential reclaimed water availability, utilization and offset (mgd) in the Southern Planning Region*

County	2015 Availability, Utilization and Benefit[1]				2015 to 2040 Potential Availability, Utilization and Benefit[2]			
	Number of WWTPs in 2015	WWTP Flow in 2015	Utilization in 2015 (52%)	Potable-Quality Water Benefit in 2015 (70%)	2040 Total WWTP Flow	2040 Utilization (75%)[3]	2040 Potable-Quality Water Benefit (75%)[3]	Post-2015 Benefit
Manatee	5	29.89	15.85	11.15	38.29	28.72	21.54	10.39
Sarasota	9	26.12	13.99	9.57	31.70	23.77	17.83	8.26
Charlotte	9	10.74	5.04	3.54	14.21	11.30	8.48	4.94
DeSoto	3	1.42	0.66	0.51	1.46	1.09	0.82	0.31
Total	**26**	**68.17**	**35.54**	**24.77**	**85.66**	**64.88**	**48.67**	**23.90**

[1]Estimated at 70 percent Regionwide average.
[2]See Table 4-1 in Appendix 4.
[3]Unless otherwise noted.

Section 4. Surface Water

The major river/creek systems in the planning region include the Braden, Manatee, Myakka and Peace rivers; Myakkahatchee, Shell, Prairie, and Joshua creeks; and Cow Pen Slough. Major PS utilities use the Braden, Manatee, and Peace rivers, and Myakkahatchee and Shell creeks. The Braden and Manatee rivers and Shell Creek have in-stream dams that form reservoirs for storage. The potential yield for all rivers will ultimately be constrained by their minimum flows once they are established; however, yields associated with rivers that have in-stream impoundments also depend on the degree of structural alteration that has occurred and the habitat that is supported by the flows. The City of Bradenton utilizes the Evers Reservoir on the Braden River for PS and diverted an average of 5.5 mgd per year for the period 2011 to 2018. Manatee County withdrew an average of 29.5 mgd from 2013 to 2018 from Lake Manatee, which is an in-stream impoundment on the Manatee River. The City of Punta Gorda's average withdrawal from the Shell Creek reservoir from 2011 to 2018 was 5.0 mgd.

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 a river was not yet established or a hydrodynamic model was not available, planning-level minimum flow criteria were 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 more detailed explanation of the methodology is included in the Chapter 4 Appendix 4-2.

2.0 Overview of River/Creek Systems

The Braden River is a major water source for the City of Bradenton

2.1 Manatee River

The Manatee River watershed is located almost completely within Manatee County and encompasses nearly 330 square miles, including 83 square miles of the Braden River system. The river originates in northeast Manatee County and flows 45 miles to its mouth at the southern end of Tampa Bay. A dam was constructed on the river in 1966, impounding approximately six miles of the river's middle reach, forming Lake Manatee. Withdrawals from the reservoir began soon after construction. Since tidal influences reach approximately 20 miles upstream from the mouth of the river nearly to the dam, no stream-gauging stations are in place downstream of the dam. Lake Manatee is operated as a public water supply reservoir by the Manatee County Utility Department. The adjusted annual average flow for the period from 1982 to 2018 is 107 mgd (166 cubic feet per second [cfs]). However, this value might not be completely reliable. The utility holds water in the reservoir during the dry season and releases large quantities during the wet season due to the limited storage capacity of the reservoir.

This skews the flow distribution and affects the calculated potential withdrawal amounts. A citrus grove is permitted to withdraw 0.06 mgd from the East Fork of the Manatee River. Total average annual diversions from 2011 to 2018 were 29 mgd. Based on existing withdrawals and the planning level minimum flow criteria, no additional water is potentially available from the river.

2.2 Braden River

The Braden River discharges to the tidal reaches of the Manatee River approximately eight miles south of Tampa Bay. From its confluence with the Manatee River, the river extends seven miles southeasterly and then approximately 12 miles easterly to its headwaters. The upper reaches consist of channelized tributaries in central Manatee County. A water supply reservoir, Ward Lake (38 acres), was created in 1938 by damming the river just south of State Road 70. The reservoir was enlarged in 1985 and renamed the Bill Evers Reservoir (230 acres). The river is tidally influenced below the dam. The adjusted average annual discharge from 1993 to 2018 at the Braden River was 57 mgd (88.2 cfs). Bradenton Utilities is permitted to withdraw an average of 6.95 mgd. Average annual withdrawals from 2011 to 2018 were 5.5 mgd. Based on existing withdrawals and planning level minimum flow criteria, an additional 0.6 mgd is potentially available from the river.

2.3 Cow Pen Slough

The Cow Pen Slough watershed encompasses approximately 63 square miles in Sarasota County and 9.5 square miles in Manatee County. Land use in the upper part of the watershed is primarily agricultural and primarily urban in the lower part. Runoff from the watershed is conveyed through 14 miles of improved channel and outfalls into Dona Bay. Historically, a large portion of the upper watershed discharged into the Myakka River. In the 1960s, the slough was channelized to improve conditions for agricultural development. This alteration resulted in the diversion of flows from the Myakka River and has contributed to excess freshwater flows entering Dona Bay, which has disrupted the natural freshwater/saltwater regime in the estuary. Two flood-control structures are located on Cow Pen Slough, one just north of Laurel Road and the other just south of State Road 72. Minimum flows have been adopted for Cow Pen Slough.

It is anticipated that future environmental restoration efforts in the watershed will focus on preventing the excess freshwater flows from entering Dona Bay. Through the diversion and capture of these excess flows, opportunities for water supply development will be created, which will help to advance environmental restoration efforts. There is limited flow data available on Cow Pen Slough. As part of the District's efforts to establish MFLs, flow measurements on the Slough were initiated in 2003. Flows from 1985 to 2018 were estimated to average 38.5 mgd (59.6 cfs) and were based on a model calibrated to the flows in the Myakka River. No permitted withdrawals exist on Cow Pen Slough. The peer review panel for the Cow Pen Slough MFL recommended against direct withdrawals from the Dona Bay/Shakett Creek System until such time that additional studies can be conducted in the small tributaries (Salt Creek and Fox Creek), which provide the majority of flow to the original 16-square-mile watershed below Cow Pen Slough Canal. Accordingly, the established minimum flow prohibits withdrawals from Dona Bay/Shakett Creek below the CPS-2 flood control structure; however, it allows for diversion of the channelized flows from Cow Pen Slough above CPS-2. Based on the established MFL, 38.5 mgd of water supply is potentially available; however, available quantities could be reduced if excess flows are redirected during future environmental restoration efforts.

2.4 Myakka River

The Myakka River extends 69 miles from its mouth at Charlotte Harbor, northeast to its origins in northeast Manatee County, and it has a watershed of approximately 598 square miles. Major tributaries are Myakkahatchee Creek (Big Slough Canal), Deer Prairie Slough/Creek, and Owen Creek. Two lakes of significant size, Upper and Lower Myakka lakes, are located along the Myakka River and have a combined surface area of 1,380 acres. A portion of the river has been designated an Outstanding Florida Water (OFW) and the segment through Sarasota County was designated a Florida Wild and Scenic River.

Lower Myakka Lake, one of two lakes along the Myakka River

The Myakka River watershed has undergone extensive hydrologic alteration. Over the past few decades, inflows from irrigation water applied to agricultural lands are believed to have contributed to excess water entering Flatford Swamp and other areas of the river. Along the middle portion of the river, small dams were constructed on the Upper and Lower Myakka lakes. Other flow alterations, including those at Tatum Sawgrass, Vanderipe Slough, Clay Gully, Cow Pen Slough, and the Blackburn Canal, have shifted the timing of flows, drastically reduced storage areas and diverted large quantities of water out of the watershed. Seventy-three percent of the river's annual flow occurs during the wet season, and the river has a broad, seasonally inundated floodplain. Historically, during the drier periods of the year, there was no flow in the upper Myakka River. However, in the last several decades, inflows from irrigated agricultural lands have significantly increased the dry-season flow of the river and it no longer ceases flowing in the dry season. The adjusted annual average flow from 1965 to 2018 at the Myakka River near Sarasota is 159.8 mgd (247.2 cfs). This includes up to an average of 32.4 mgd (50 cfs) of excess flow that has been estimated to occur during the year as a result of irrigation of agricultural lands and other land use changes.

As part of efforts to restore environmentally impacted areas in the upper Myakka River watershed, it will be necessary to prevent excess surface water flows from entering Flatford Swamp. The District is looking at the diversion and capture of these excess flows before the Myakka River enters Flatford Swamp and use it as recharge to help recover the SWIMAL in the SWUCA. There are currently no permitted withdrawals from the river. Based on the lower Myakka River minimum flow, an additional 32.4 mgd of water supply is potentially available from the river; however, implementation of a Flatford Swamp Hydrologic restoration project would reduce future surface water flows.

2.5 Myakkahatchee Creek (Big Slough Canal)

The Myakkahatchee Creek (Big Slough Canal) is a tributary to the lower Myakka River. The Myakkahatchee Creek watershed covers approximately 195 square miles, with the largest segments in Manatee and Sarasota counties. Smaller portions of the watershed are also located in DeSoto and Charlotte counties. A tributary of the Myakka River, Myakkahatchee Creek is a channelized drainageway for more than 20 miles, with the lower portion of the watershed situated in the City of North Port. In the upper reaches, land use is predominantly pasture. Near the outlet, land use is urban and residential and the many canals draining the urban areas are fitted with control structures.

The annual average flow in Myakkahatchee Creek from 1981 to 2018, which was derived and measured at the structure near the withdrawal point upstream of the US 41 crossing, is 31 mgd (47.9 cfs). The City of North Port is permitted to withdraw an annual average of 4.4 mgd from Myakkahatchee Creek based on intermediate wellfield use, and Charlotte Golf Partners, L.P., is permitted to withdraw an annual average of 0.08 mgd from the Cocoplum Waterway tributary. Within the last several years, Charlotte Golf Partners, L.P. has utilized reclaimed water. Total average annual withdrawals from 2010 to 2018 were 1.3 mgd.

2.6 Peace River

The Peace River originated in the Green Swamp and flows south to Charlotte Harbor. The Peace River watershed encompasses 1,800 square miles. There are two main tributaries in the upper watershed. Peace Creek drains approximately 225 square miles in the northeast part of the watershed, serving as an outlet for several lakes near Haines City and the City of Lake Alfred. Saddle Creek Canal drains 144 square miles in the northwest portion of the watershed in Polk County, where the dominant drainage feature is Lake Hancock. Numerous lakes are present in the area north of Bartow, ranging in size from a few to approximately 4,600 acres. In this area, surface water drainage is ill-defined. South of Bartow, to approximately Fort Meade, the land surface has been considerably altered by phosphate mining activities. Major tributaries south of Fort Meade include Horse, Joshua, and Charlie creeks.

Horse Creek near Arcadia, a major tributary of the Peace River

The major withdrawal from the Peace River is for PS by the PRMRWSA. The PRMRWSA operates a regional water supply facility in southwest DeSoto County. The facility has two off-stream reservoirs and 21 ASR wells that provide a combined 13 billion gallons of storage for seasonal and drought period reliability. Consistent with minimum flow methodology, annual flow was calculated by summing flow at the Peace River at Arcadia, Horse Creek near Arcadia, and Joshua Creek at Nocatee for the reference period 1975 through 2018. Adjusted annual flow was 762.7 mgd (1180.6 cfs). The PRMRWSA is permitted to withdraw 80 mgd annual average and 258 mgd max daily from the river, subject to minimum flows availability as follows; the PRMRWSA is permitted to withdraw 10 percent of the total flow of the river up to a maximum of 90 mgd when the flow, as measured the previous day at the Arcadia stream gauge, is above 84 mgd (130 cfs). Average annual withdrawals by the PRMRWSA during the period 2007 to 2011 were 20.3 mgd. In addition to the permitted PRMRWSA withdrawals, three additional permittees withdraw an annual average of 0.2 mgd of surface water. Total average annual withdrawals from approximately 2011 to 2018 were 28 mgd. Surface water availability in Table 4-6 was calculated using revised flow criteria that were eventually adopted by the District's Governing Board in 2010.

Projects are being developed and implemented to divert and store water from the upper Peace River during high-flow periods for release to meet minimum flows during low-flow periods. These projects include the completion and implementation of the Lake Hancock Lake Level Modification Project, and the planned 2020 development of a reservation for water stored in the lake to help achieve minimum flows in the river. Flow assumptions used for the reservation and minimum flow recovery may be adjusted in the future.

All available surface water in the Peace River is allocated to the Southern Planning Region in Table 4-6, because more water is physically present and available downstream; however, future withdrawals from the river in the Heartland Planning Region are possible and likely. To maximize development of additional water supplies from the river, future withdrawals will need to be closely coordinated with the PRMRWSA and other users. Based on the minimum flow criteria, an additional 2.2 mgd of water supply is potentially available from the river.

2.7 Shell Creek

The Shell Creek/Prairie Creek watershed encompasses 400 square miles and empties into the lower Peace River near where the river enters Charlotte Harbor. It is the largest sub-basin in the Peace River watershed. In 1964, a dam was constructed on Shell Creek which created an 835-acre in-stream reservoir used for municipal supply by the City of Punta Gorda. The adjusted annual average discharge from 1974 to 2013 at the reservoir is 228.8 mgd (354.1 cfs). Punta Gorda Utilities is permitted for average annual withdrawals of approximately 8.1 mgd. Several withdrawals for agricultural irrigation are permitted on Shell Creek for a total annual average withdrawal of 0.50 mgd. Average annual diversions from 2007 to 2018 were 3.75 mgd. Minimum flows are scheduled for completion in 2020. Based on existing withdrawals and planning level minimum flow criteria, an additional 14.4 mgd of water is potentially available from the river.

Prairie Creek

3.0 Potential for Water Supply from Surface Water

Table 4-6 summarizes the potential availability of water from rivers in the planning region. The estimated additional surface water that could potentially be obtained from rivers in the planning region ranges from approximately 108.2 mgd to 196.3 mgd. The lower end of the range is the amount of surface water that has been permitted, but is currently unused (156.1 mgd minus 47.9 mgd), and the upper end includes permitted but unused quantities (108.2 mgd) plus the estimated remaining unpermitted available surface water (88.1 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. Although Table 4-6 depicts available water quantities at the more downstream gauges, it is possible and likely that some of the water will be developed in upstream portions of the watersheds.

Table 4-6. *Summary of current withdrawals and potential availability of water from rivers/creeks in the Southern 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		
							Avg	Min	Max
Manatee River @ Dam	Yes	107	10.7	35.0	26.3	0.0			
Braden River @ Dam	Yes	57	7.6	7.0	5.5	0.6	365	365	365
Cow Pen Slough @ I-75[7]	Yes	38.5	38.5	0.0	0.0	38.5	355	280	366
Myakka River @ Sarasota[8]	No	159.8	32.4	0.0	0.0	32.4	342	271	366
Myakkahatchee Creek upstream of Diversion	Yes	31	3.1	4.5	1.3	0.0			
Peace River @ Treatment Plant[9]	No	762.1	102.9	101.1	11.0	2.2	365	365	366
Shell Creek @ Dam	Yes	228.8	22.9	8.5	3.8	14.4	340	255	366
TOTAL				**156.1**	**47.9**	**88.1**			

[1] Mean flow based on recorded U.S. Geological Survey (USGS) flow plus reported WUP withdrawals added back in when applicable. Maximum period of record used for rivers is 1965 to 2018. Flow records for Manatee River (1982 to 2018), Braden River (1993 to 2018), and Myakkahatchee Creek (1981 to 2018), and Peace River (1985to 2018), and Shell Creek (1974 to 2018) are shorter. Cow Pen Slough was estimated based on flow data for watersheds of similar areas (1985 to 2018).

[2] Based on 10 percent of mean flow for all water bodies with the following exceptions: minimum flow criteria were used to calculate potentially available quantities for Cow Pen Slough, Peace River and Myakka River.

[3] Based on individual WUP permit conditions, which may or may not follow current 10 percent diversion limitation guidelines.

[4] Based on average reported withdrawals during 2007 to 2018. Myakkahatchee Creek 2007 to 2018 data is taken from USGS gauge Big Slough at West Price Blvd near North Port.

[5] Equal to remainder of 10 percent of total flow after permitted uses allocated, with minimum flow cutoff for new withdrawals of P85 and maximum system diversion capacity of twice median flow (P50) with these exceptions: Peace River, Myakka River and Cow Pen Slough estimated by subtracting permitted withdrawal limits from estimated available flow prior to withdrawal. Early estimates on the proposed MFL for the lower Manatee River predict no potentially available flow will be available.

[6] Based on estimated number of days that any additional withdrawal is available considering current permitted quantities and withdrawal restrictions. The minimum and maximum are the estimated range of days that additional withdrawals would have been available in any particular year.

[7] Dona Bay/Shakett Creek flows have been increased significantly through channelization (Cow Pen Slough Canal) of upland wetlands that used to flow to the Myakka into the headwaters of Shakett Creek. Adjusted average annual flow is for the channelized portion of Cow Pen Slough above the CPS-2 structure. Potentially available flow quantities allow for withdrawal of all flows above CPS-2, which would reduce unnatural discharges to the Dona Bay/Shakett Creek system. Excess flows may be redirected as part of environmental restoration efforts, which could reduce surface water flows.

[8] Myakka River flows have increased over time due to augmentation resulting from agricultural irrigation and watershed alterations. Potentially available flow prior to withdrawal equals the sum of the daily excess flows (capped at 130 cfs) and 10 percent of the remaining daily flows at the Myakka River near Sarasota gauge from June 21 to the end of February. From March 1 through June 20, withdrawals from the river are limited to the excess flows capped at 130 cfs. Implementation of Flatford Swamp Hydrologic Restoration project could reduce future surface water flows.

[9] All available surface water is shown in Southern Planning Region, because calculation was based on flows at furthest downstream gauge; however, future withdrawals in the Heartland Planning Region are possible and likely.

Section 5. Brackish Groundwater Desalination

Brackish groundwater suitable for water supply is available from two general sources within the District; in the UFA and intermediate aquifer system along coastal areas, and inland at greater depths within the Lower Floridan aquifer (LFA) below MCU II. The coastal brackish groundwater is found as a depth-variable transition between fresh and saline waters. Figure 4-4 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.

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

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

While RO is the most common brackish water treatment technology, electrodialysis reversal (EDR) systems may also be viable and are in use within the District at the T. Mabry Carlton facility in Sarasota County. The EDR method uses an electrical current to pull ionic minerals outward from water flowing through a gel membrane, and the electrical current is frequently reversed to prevent buildup in the membrane. It is recommended that both RO and EDR systems be considered in brackish water supply project conceptualization and feasibility studies.

Both RO and EDR treatment systems generate a concentrate byproduct that must be disposed of through methods that may include surface water discharge, deep-well injection, or dilution at a WWTP. Surface water discharges require a National Pollutant Discharge Elimination System (NPDES) permit and may be restrained by TMDL limitations. In some cases, brackish water treatment facilities have been required to run below their potential efficiencies to reduce the strength of the concentrate. Because of these environmental considerations, deep-well injection is becoming more prevalent. Deep-well injection may not be permittable in some areas with unsuitable geologic conditions. An additional but costly disposal option is zero liquid discharge (ZLD). ZLD is the treatment of concentrate for a second round of high-recovery desalination, then crystallization or dehydration of the remaining brine. The resulting solids might have economic value for various industrial processes.

The Florida Legislature declared brackish groundwater an 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 hydrologic properties and water quality of the aquifer, rates of groundwater withdrawal, and well configurations.

The District revised its Cooperative Funding Initiative policy in December 2007, recognizing brackish groundwater as an AWS and allowing for assistance with construction projects. Since then, the District has assisted constructing five brackish groundwater treatment projects in the cities of North Port, Oldsmar, Tarpon Springs, Clearwater, and Punta Gorda. Each City has a regionally interconnected water supply system. The District is also co-funding two additional brackish groundwater projects for the Polk Regional Water Cooperative (PRWC) that are under design. The funding is intended to incentivize the development of integrated, robust, multijurisdictional systems that are reliable, sustainable, and utilize diverse water sources. While the District's regional water supply development processes have traditionally been based on meeting increasing demand projections, several brackish groundwater projects have been pursued for other needs: to blend permeate with treated surface water in order to meet finished water quality standards, to maintain viability of existing wellfields with deteriorating water quality, and to provide seasonal source substitution to meet an MFL. Future projects might also incorporate indirect potable reuse. The District recognizes the importance of maintaining the viability of existing supplies, but also encourages the consideration of alternate options based on economics and long-term regional benefit. A phased approach to brackish groundwater development is recommended that includes hydrogeologic evaluations to determine project viability, design phases that help refine the economic and permitting feasibility, and construction procured through a competitive bidding process.

1.0 Potential for Water Supply from Brackish Groundwater

Because brackish groundwater withdrawals from the UFA in the SWUCA have the potential to exacerbate saltwater intrusion, requests for brackish groundwater will be evaluated similarly to requests for fresh groundwater withdrawals. Proposed withdrawals, either fresh or brackish, cannot impact UFA water levels in the most impacted area (MIA) of the SWUCA. 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. As discussed in the SWUCA recovery strategy, if a proposed withdrawal impacts groundwater levels in the MIA or impacts other MFL water bodies, it may be possible to receive a permit for the requested quantity if a net benefit can be achieved. A net benefit is an action an applicant can take to offset the projected effects of the withdrawal by an amount equal to the effect plus a 10 percent improvement. A net benefit can be achieved through means such as retiring existing groundwater withdrawals. Until recovery is achieved and any need for additional recovery is determined, entities seeking additional water in coastal areas should consider brackish groundwater from the UFA as an option only after other sources of water, including conservation, have been fully explored and implemented.

One of the benefits of using brackish groundwater in the planning region, especially as part of a regional system, is the potential to use it conjunctively with existing surface water sources. During normal or excess rainfall years, the region would make use of its abundance of surface water sources. Production from brackish groundwater wellfields would be reduced during these periods to minimize environmental impacts. During drought periods when river flows are below minimums, and storage within reservoir and ASR storage facilities are reduced, production from brackish groundwater wellfields would be maximized to meet demands of the region.

There are 14 brackish groundwater desalination facilities operated by utilities in the planning region that report water use to the District. In 2018, the combined withdrawal of the reporting facilities was approximately 19 mgd. The withdrawals occur from the lower permeable zone of the intermediate aquifer system and the upper portion of the UFA. The largest brackish groundwater facility is at the T. Mabry Carlton facility in Sarasota County, which is an EDR system and has a 12 mgd treatment capacity. The facility began a renovation in 2019 which should be completed in 2021, so capacity is temporarily reduced. The PRMRWSA has an emergency permit allocation to use 4 mgd from the Carlton Wellfield facility. The raw water from Sarasota County's University Wellfield has brackish quality but is treated by dilution with imported water sources. In 2013, The City of North Port commenced operation of a 1.5 mgd brackish facility collocated at the Myakkahatchee Creek facility. This facility is used for blending with treated surface water to improve finished water quality. The facility has been withdrawing surface and brackish groundwater at a relatively constant 50/50 rate. The City of Punta Gorda is constructing a 4.0 mgd RO facility co-located at the Shell Creek facility, due online in 2020. The facility will also be used for blending with seasonally variable surface water and may also assist with meeting future MFLs on the creek.

Concentrate disposal challenges have limited brackish groundwater production at some locations. The RO facility at the City of Venice is limited to 50 percent treatment efficiency due to the allowable discharge concentrations into the Intracoastal Waterway. The City is applying for modifications to its discharge permit that will allow improvements to the facility's efficiency.

The location of these facilities and other existing and proposed brackish groundwater desalination facilities in the region and District are shown in Figure 4-5.

The ultimate availability of brackish groundwater in the planning region 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 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 values of each facility are shown in Table 4-7.

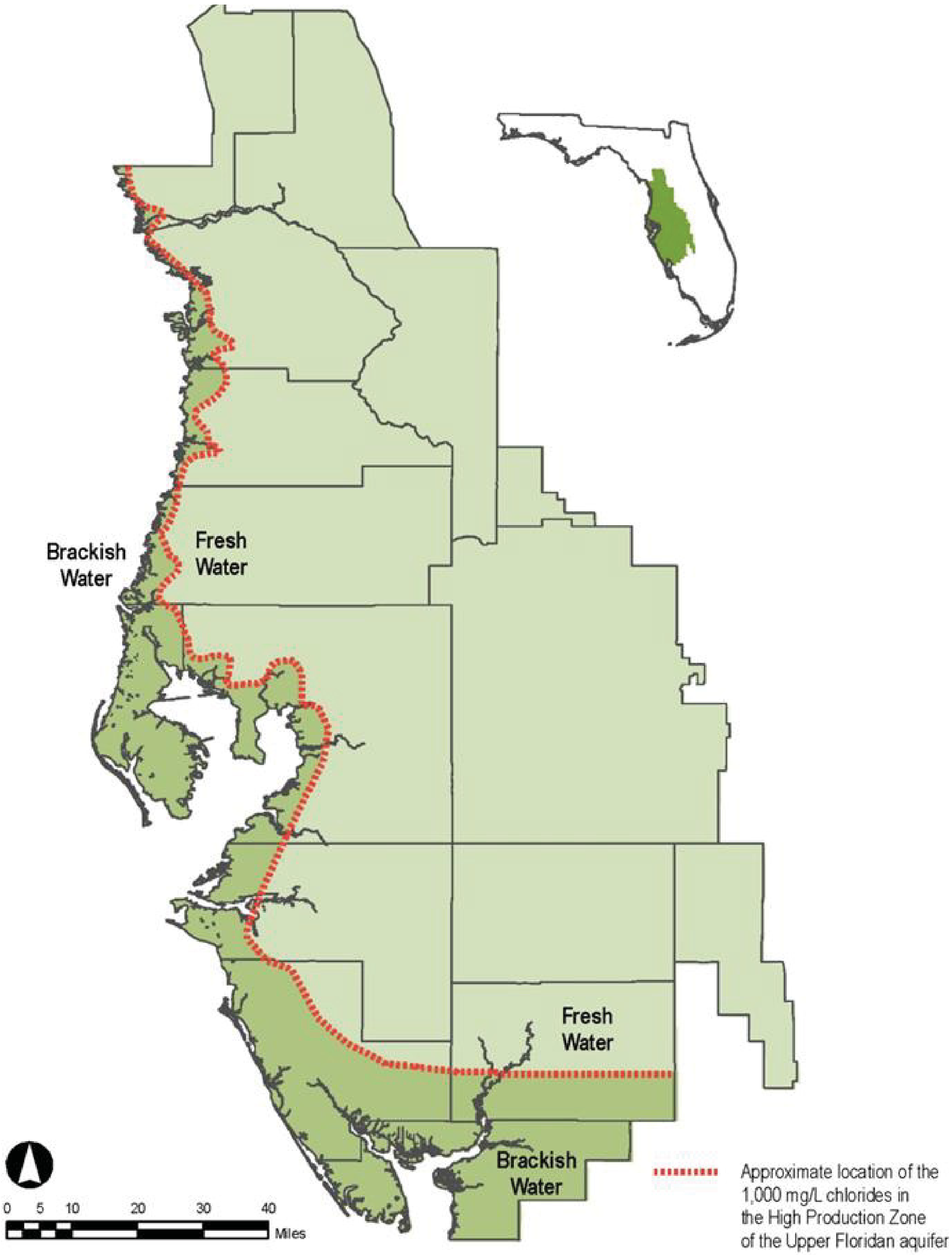

Figure 4-4. *Generalized location of the freshwater/saltwater interface*

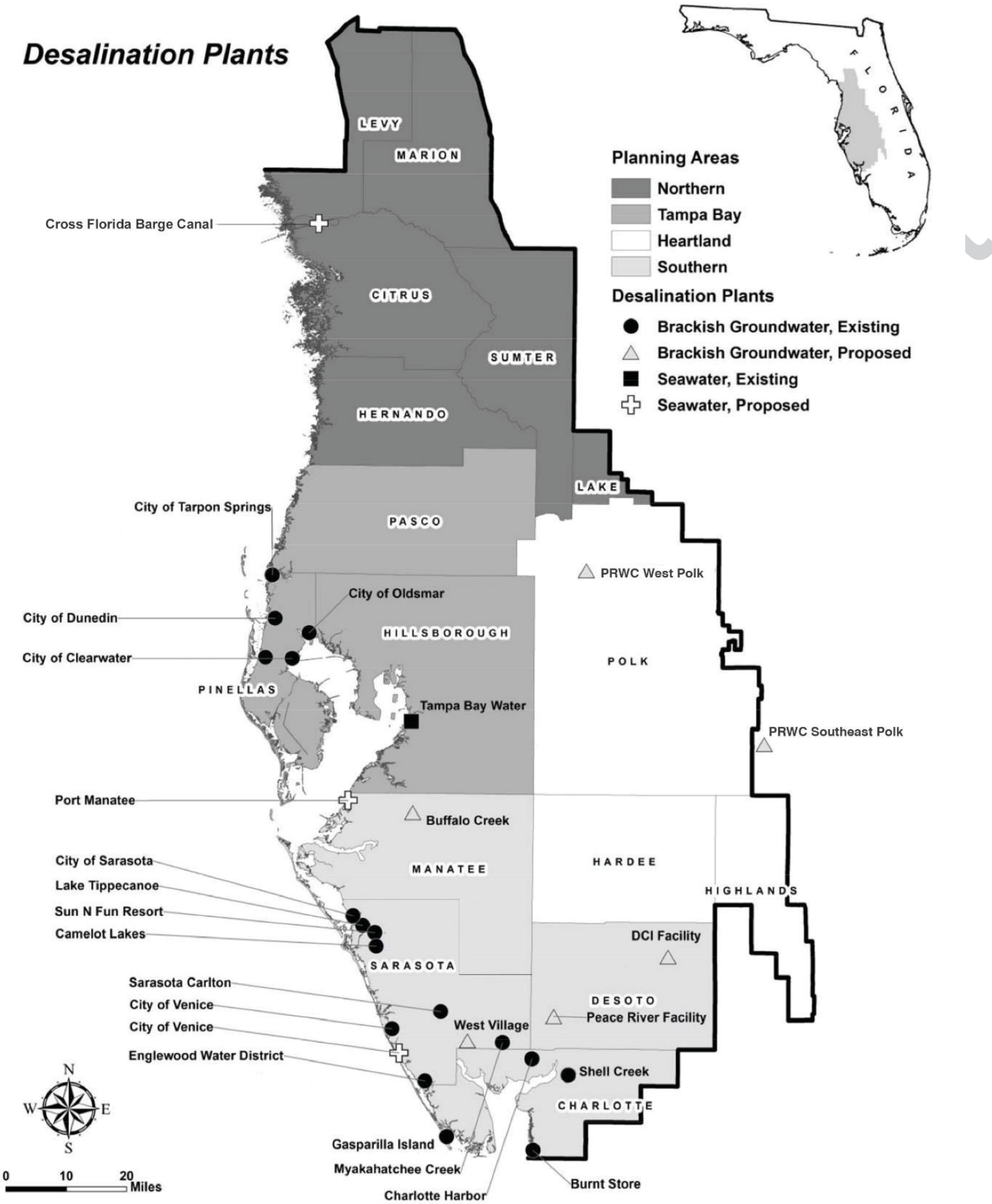

Figure 4-5. *Location of existing and potential seawater and brackish groundwater desalination facilities in the District*

Table 4-7. *Brackish groundwater desalination facilities that are existing or under development in the Southern Planning Region*

Name of Utility	County	Brackish GW Treatment Capacity (mgd)	Annual Average Permitted Withdrawal (mgd) [1]	2018 Total Withdrawals (mgd)	2018 Finished Supply (mgd)	Estimated Available Supply [2] (mgd)	Source Aquifer	Raw Water Quality TDS (mg/L)	Concentrate Discharge Type [3]
Existing Facilities									
Sarasota County (Carlton and Venice Gardens WTPs) [4]	Sarasota	14.75	13.74	3.676	2.926	8.011	Int./UFA	600 - 5,300	Deep Well
City of Venice	Sarasota	4.50	6.864	4.465	2.717	0.021	Int.	960 - 4,700	Surface
City of Sarasota (Verna and Downtown RO WTPs) [5]	Sarasota	12.50	12.043	8.061	6.313	3.119	Int./UFA	700 - 3,500	Surface
City of Punta Gorda (Online 2020)	Charlotte	4.00	8.088	NA	NA	TBD	UFA	500 - 2,100	Deep Well
Buffalo Creek Wellfield (permitted, not developed)	Manatee	TBD	3.95	NA	NA	3.00	Int./UFA	TBD	WWTP
Englewood Water District	Sarasota	3.00	5.36	3.869	2.892	0.000	Int.	3,100 - 11,000	Deep Well
City of North Port [5]	Sarasota	1.50	4.40	2.035	1.941	0.000	Int	1,000 - 2,000	WWTP/ Deep Well
CCU/Burnt Store	Charlotte	1.10	3.17	0.536	0.427	0.449	Int.	1,700 - 3,900	Surface
Gasparilla Island	Charlotte	1.10	1.538	1.497	1.153	0.000	Int.	400 - 9,000	Deep Well
Charlotte Harbor	Charlotte	0.75	0.712	0.452	0.343	0.197	Int.	1,400 - 1,700	Surface
Camelot Communities	Sarasota	0.20	0.362	0.324	0.324	0.000	Int.	760 - 950	SWP
Sun-N-Fun RV	Sarasota	0.165	0.186	0.065	0.054	0.108	Int.	100 - 600	Surface
Lake Tippecanoe	Sarasota	0.06	0.05	0.02	0.02	0.03	Int.	< 2,000	SWP

[1] The WUP annual average quantity is the total permit quantity and may include additional sources from fresh groundwater wells under the permit.
[2] Estimated Available Supply is calculated subtracting the 2018 withdrawals from either the Brackish Treatment Capacity or Permit Capacity (whichever is less), then deducting the treatment efficiency (Finished Supply/Withdrawal)
[3] WWTP: wastewater treatment plant, SWP: surface/stormwater pond. The utilities shown have WUPs with the District. Other small RO systems exist for self-supplied users.
[4] The Sarasota County Consolidated Permit #8836 allows a combined total annual average withdrawal of 13.7374 from three wellfields; Carlton, Venice Gardens, and University Parkway. The University Parkway wellfield has brackish quality water but uses blending from other sources rather than desalination to meet potable standards.
[5] The City of Sarasota utilizes the Verna RO Wellfield, Downtown RO Wellfield, and the Bobby Jones Wellfield. The 2018 uses are combined
[6] The City of North Port permit #2923 allows a total annual average withdrawal of 7.1 mgd, divided as 4.4 mgd from the Myakkahatchee Creek facility and 2.7 mgd from a future planned brackish wellfield. The desalination facility at Myakkahatchee Creek treats groundwater for blending with surface water from the creek and Cocoplum Waterway, and the permit allows up to 50 percent of the raw water to be sourced from groundwater.

Section 6. Aquifer Storage and Recovery

Aquifers are reservoirs and conveyance systems that can provide tremendous storage capabilities, enabling rapid storage or recharge of captured excess wet season flows. Aquifer Storage and Recovery (ASR) and recharge projects enable the District to smooth out the wet and dry cycles and better manage droughts, which are already challenging. As the impacts from climate change become more pronounced and population increases, droughts could become even more difficult to manage. Utilization of the aquifer system's reservoir potential is accomplished through an ASR system, 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.

Aquifer Storage and Recovery (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 4-6. Aquifer Storage and Recover (ASR) may be used for potable, reclaimed, groundwater, or partially treated surface water. If water stored in the aquifer is for potable supply, when it is withdrawn from storage it is disinfected, retreated if necessary, and pumped into the distribution system. District projects include storage projects that use the same well to inject and withdraw water and aquifer recharge and recovery projects that use one location for injection and another for withdrawal.

Aquifer Storage and Recovery (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 five 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.

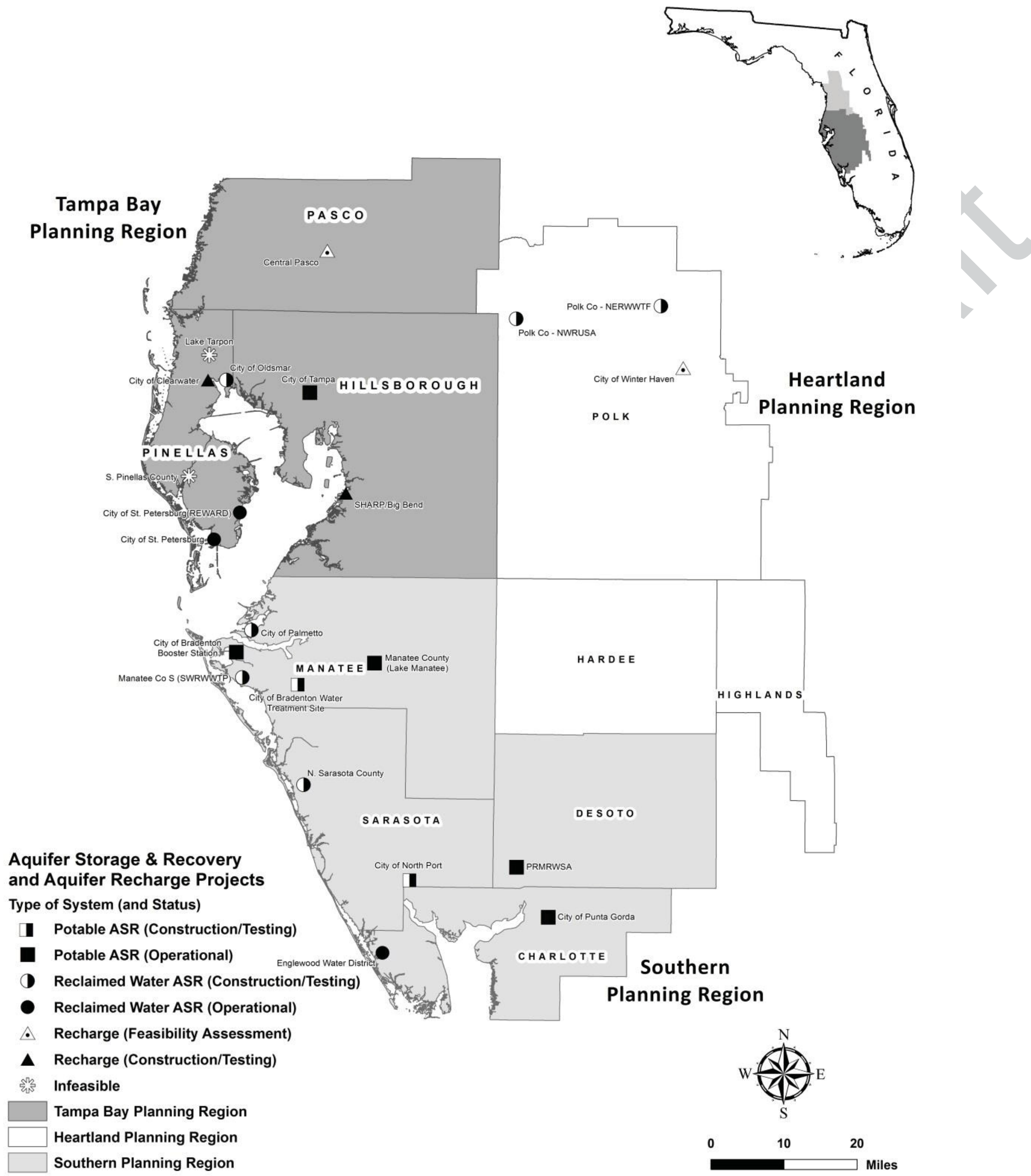

Figure 4-6. *Location of aquifer storage and recovery and aquifer recharge projects in the District that are operational or under development.*

Projects under development are those the District is co-funding and are either (1) actively in the planning, design, or construction phase, or (2) not yet in the planning phase but have been at least partially funded through fiscal year (FY) 2019, or (3) been completed since the year 2015 and are included to report on the status of implementation since the previous RWSP.

1.0 Aquifer Storage and Recovery Hydrologic and Geochemical Considerations

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

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

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

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

2.0 Aquifer Storage and Recovery Permitting

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

Significant clarifications of ASR regulations, as they apply to public water supply systems storing treated drinking water underground were issued by the EPA in 2013. The 2013 guidance allows the FDEP to evaluate ASR systems on a case by case basis to determine if mobilization of arsenic and subsequent recovery and treatment of the water can be done in a manner that 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.

3.0 Aquifer Storage and Recovery and Arsenic

When the last RWSP was under development in 2015, permitting of potable water ASR facilities in Florida, although hindered by the mobilization of naturally occurring arsenic in the aquifer, was possible on a case by case basis under a zone of discharge approach. Reclaimed water ASR projects, however, cannot have a zone of discharge for any primary drinking water standards; therefore, the issue of using a similar zone of discharge for arsenic mobilization is still unanswered by FDEP. Since the last RWSP, effective solutions to the arsenic mobilization issue continue to be developed. The City of Palmetto successfully managed arsenic mobilization using a chemical oxygen scavenger. Bradenton is presently running a pilot project that removed DO from the injection water via a vacuum degasification tower. DO control offers one method of achieving an operation permit for ASR and recharge facilities. DO control can be achieved through physical removal, chemical scavenging or direct use of groundwater as a source for injection. Projects are currently testing chemical scavenging as a method for arsenic control.

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

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

Section 7. Aquifer Recharge

1.0 Aquifer Recharge

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

Successful AR projects will improve groundwater levels. Water level improvement may result in (1) improving local groundwater quality, (2) mitigating or offsetting existing drawdown impacts due to withdrawals, (3) providing storage of seasonally-available waters and thereby augmenting water supplies, and (4) potentially allowing additional new permitted groundwater withdrawals in areas of limited water supply. AR project success criteria can include demonstration of the level to which aquifers have been restored and 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. A total volume of 738 mgd of reclaimed water was used Statewide in 2015 (FDEP, 2015), for water uses including residential, industrial, recreational (golf courses), water treatment plants, rapid infiltration basins, and spray field applications.

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

1.1 Direct Aquifer Recharge

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

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

Recent experience with operational ASR projects incorporating oxygen degasification systems and post treatment stabilization have proven that metals mobilization can be minimized and controlled by reducing the DO content in the injection source water, in addition to maintaining a negative oxygen reduction potential. 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.

1.2 Indirect Aquifer Recharge

Indirect AR is when water is applied to land surfaces where it can infiltrate and recharge the aquifer. Indirect AR can be accomplished by using a variety of techniques, including spray fields, recharge wetlands, large-scale drain fields, and RIBs. This recharge approach is used in areas where there is a good connection between the surface and source aquifer for water supply. Water applied to the surface must meet minimum water quality standards approved by the FDEP. Infiltration capacity and permeability of the soil, presence of drainage features, depth to the water table, local hydrogeology, locations of nearby drinking water wells, as well as locations of nearby wetlands and lakes are all important to identify, test and characterize to determine the feasibility of indirect AR. In favorable regions, indirect AR can provide additional natural water quality treatment to the water as it percolates through sediments during infiltration, in addition to subsequently increasing aquifers levels. It is estimated by the District that 20 mgd of available reclaimed water (Districtwide) was being applied through RIBs for indirect AR as of 2015 (FDEP, Reuse Inventory of 2015).

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 OFW or aquatic preserves. Ecological concerns include the risk of impingement and entrainment of aquatic life at the intake, entrainment of sediments and oils, and perturbation to seagrasses and hard-bottom communities.

The pretreatment of source water is imperative to protect the sensitive RO membranes from fouling prematurely from organic carbon and particulates, and this may be the most critical design element. A pretreatment system may require coagulation and/or microfiltration technology similar to the treatment of fresh surface water. A robust pretreatment may seem duplicative, but lessons learned from Tampa Bay Water and other facilities have demonstrated the importance of pretreatment to the long-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 (FDEP, 2010). Most large-capacity seawater facilities have energy recovery systems that use turbines driven by high-pressure flow exiting the RO membranes to boost pressure to the pumps feeding the source water. Energy recovery systems reduce electrical demands, alleviate redundant pumping capacities, lower operational costs, and reduce the facility's carbon footprint.

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

RO systems use high pressure and semi-permeable membranes to desalinate seawater

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

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

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

1.0 Potential for Water Supply from Seawater Desalination

Two options for large-scale seawater desalination facilities in the planning region have been identified as part of the planning efforts of the District and the PRMRWSA. The options would be located at Port Manatee in Manatee County, on lower Tampa Bay, and on an industrial site by the Venice Airport in Sarasota County. Both options are conceptualized as having capacities of 20 mgd, based on economies of scale, and would circulate over 400 mgd of water in order to dilute discharge concentrate at a 20 to 1 ratio.

The Port Manatee site is advantageous because of its proximity to existing potable water transmission systems and a shipping channel where the intake and discharge structures would be located. The tidal flushing present in this portion of Tampa Bay may also benefit the permissibility of the discharge. The Venice Airport site is also located near existing potable distribution systems and would be close to high water demand areas. The seawater intake would be located on the C-1 Canal, a five-mile section of the Intracoastal Waterway, and the discharge would be through a dispersed outlet system into the Gulf of Mexico. The dilution pumping and discharge may provide a net environmental benefit by increasing circulation through the C-1 Canal, which was excavated in the 1960s and has exhibited poor water quality. The conceptual costs for the two options were included in the PRMRWSA Master Plan Update and are presented in Chapter 5. The total potential quantity of water supply from seawater desalination in the planning region is 40 mgd.

Section 9. Stormwater

The FDEP and the WMDs define stormwater as the flow of water which results from, and which occurs immediately following, a rainfall event and which is normally captured in ponds, swales, or similar areas for water quality treatment or flood control. Development of the natural landscape can result in significant changes to the characteristics of stormwater flows. Stormwater runoff can provide considerable volumes of water that can be captured and beneficially used, resulting in water supply, AR, water quality, and natural system benefits. Rule 62-40, Florida Administrative Code (F.A.C.), defines "stormwater recycling" as the capture of stormwater for irrigation or other beneficial use. The reliability of stormwater can vary considerably depending upon climatic conditions and storage capability. Therefore, the feasibility of effectively utilizing stormwater as an AWS source often relies on the ability to use it in conjunction with another source (or sources) in order to decrease operational vulnerability to climatic variability (i.e., "conjunctive use"). Stormwater represents a potentially viable AWS at the local level, particularly for reclaimed water supplementation and irrigation water uses.

In the SWUCA, the District FARMS Program has had much historical success in developing tailwater recovery systems for agricultural operations to utilize stormwater supplies to reduce demands for fresh groundwater. A major future opportunity for stormwater development is the ability for local governments and utilities to partner with the Florida Department of Transportation (FDOT) on stormwater capture and harvesting projects. Presently, FDOT's Efficient Transportation Decision Making Process (ETDM) gives the WMDs and other agencies an opportunity to provide comments during the Planning Screen phase of a project. When FDOT projects advance to the Project Development and Environment (PD&E) phase, FDOT uses Environmental Look Arounds (ELAs) to proactively look for cooperative and regional stormwater management opportunities. ELAs can assist the districts, other agencies, and local utilities with identifying sources of stormwater for activities such as reclaimed water augmentation and MFL recovery.

Section 10. Summary of Potentially Available Water Supply

Table 4-8 is a summary of the additional quantity of water that will potentially be available from all sources of water in each county in the planning region from 2015 through 2040. The table shows that the total quantity available could be as high as 315.42 mgd.

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 2040 and demands calculated for the 2015 base year (Table 3-7). The projected additional water demand in the planning region for the 2015 to 2040 planning period is approximately 49.39 mgd. It is possible that the demand for environmental restoration will be higher because preliminary studies undertaken in support of the minimum flow for Shell Creek indicate that actual flows in the creek are below proposed minimums. Therefore, a recovery strategy will be required. The quantity of water needed for restoration will be determined once minimum flow studies for Shell Creek have been completed.

As shown in Table 4-8, up to an additional 315.42 mgd is potentially available from water sources in the planning region to meet the overall additional projected demand of 49.39 mgd. 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 2040.

Table 4-8. *Potential additional water availability in the Southern Planning Region through 2040 (mgd)*

County	Surface Water[1]		Reclaimed Water	Desalination		Fresh Groundwater		Water Conservation		Total
	Permitted Unused	Available Unpermitted	Benefits	Seawater	Brackish Groundwater (Permitted Unused)	Surficial and Intermediate	Upper Floridan[2] Permitted Unused	Public Supply	Agricultural	
Charlotte	4.70	14.40	4.94	-	0.65	4.10	3.22	2.28	1.35	35.64
DeSoto	90.00	2.20	0.31	-	0.0	1.20	0.34	0.0	5.69	99.74
Sarasota	3.16	70.90	8.26	20.00	11.26	3.80	3.30	2.59	0.32	123.59
Manatee	8.70	0.60	10.39	20.00	3.00	3.40	0.86	2.80	6.70	56.45
Total	**106.56**	**88.10**	**23.90**	**40.00**	**14.91**	**12.50**	**7.72**	**7.67**	**14.06**	**315.42**

[1] All available surface water from the Peace River is shown in DeSoto County, because the calculation was based on flows in DeSoto County; however, future withdrawals from the Peace River in Hardee and Polk counties are possible.
[2] Groundwater that is permitted but unused for public supply. Based on 2018 Estimated Water Use (SWFWMD, 2019).

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Chapter 5. Overview of Water Supply Development Options

The water supply development (WSD) component of the Regional Water Supply Plan (RWSP) requires the Southwest Florida Water Management District (SWFWMD) (District) to identify water supply options from which water users can choose to meet their individual needs. In addition, the District is to determine the associated costs of developing these options. As discussed in Chapter 4, sources of water potentially available to meet projected demands in the planning region include fresh groundwater, water conservation, reclaimed water, surface and stormwater, brackish groundwater desalination, Aquifer Storage and Recovery (ASR) and Aquifer Recharge (AR), 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 2015 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.

Where applicable, water supply options developed through the work of additional regional planning efforts are incorporated into this chapter, such as technical memorandums related to the 2020 update of the (PRMRWSA Integrated Regional Water Supply Master Plan. 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 the PRMRWSA 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 Options

The development of additional fresh groundwater from the Upper Floridan aquifer (UFA) in the planning region will be limited as a result of environmental impacts from excessive withdrawals and planned reductions in withdrawals that are part of the SWUCA recovery strategy. In particular, groundwater withdrawals cannot impact water levels in the SWUCA Most Impacted Area (MIA).

Priority will be given to reducing groundwater withdrawals, when possible, in order to contribute to water level recovery in the area.

Future requests for groundwater from the UFA and the intermediate aquifers will be evaluated based on the projected impacts of the withdrawals on existing legal users and water resources, including those with established minimum flows and levels (MFLs). Requests for withdrawals of groundwater from the UFA for new uses will be considered only if the requested use is reasonable and beneficial, incorporates maximum use of conservation, and there are no available alternative sources of water. If all these conditions are met and the withdrawals are projected to impact water levels in the MIA, it will be necessary for those impacts to be offset prior to issuance of a WUP.

Section 2. Water Conservation Options

1.0 Non-Agricultural Conservation

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

Some readily applicable conservation activities are not addressed due to the wide variance in implementation costs and the site-specific nature of their implementation. Two such measures are water-conserving rate structures and local codes/ordinances, which have savings potential, but are not addressed as part of the 2020 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 WUP application or renewal period. Below is a description of each non-agricultural water conservation option. Savings and costs for each conservation activity evaluated in the 2020 RWSP are also summarized in Table 5-1 below. These savings and costs are also depicted in Figure 5-1 and Figure 5-2, respectively.

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

Conservation Activity	2040 PS Savings (mgd)	Average Cost Effectiveness ($/k gal)	Total Cost
Residential			
High-efficiency Toilets (HET)	0.40	$2.27	$3,269,134
High-efficiency Showerheads	0.30	$0.65	$1,359,792
Landscape and Irrigation Evaluations/Audits	0.48	$0.71	$2,356,883
Smart Irrigation Controllers	0.43	$0.89	$2,287,402
Rain Sensors	0.17	$1.26	$1,485,042
Soil Moisture Sensors	0.43	$0.89	$2,287,402
Non-residential			
High-efficiency Toilets (HET)	0.26	$1.74	$1,600,547
Total Public Supply	**2.47**	**$0.90[1]**	**$14,646,202**

[1]Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.

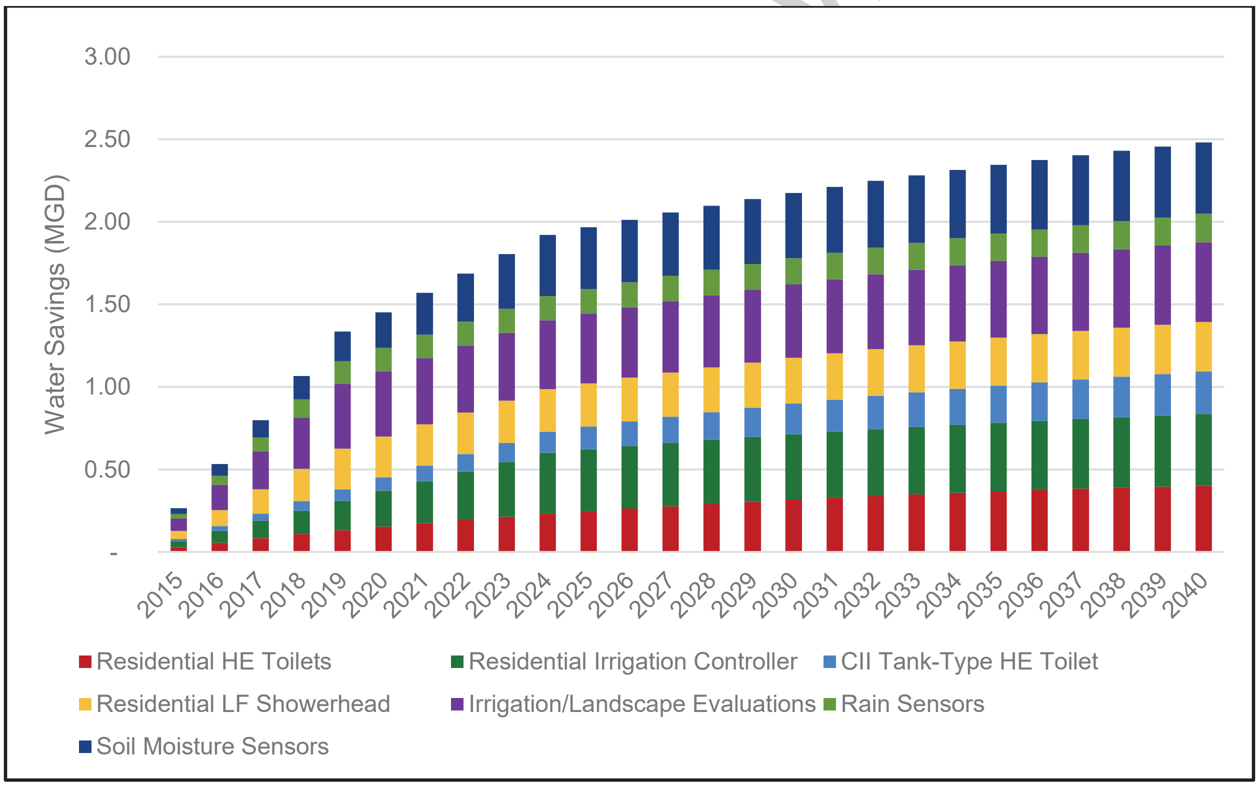

Figure 5-1. *Total active water savings in the Southern Planning Region by conservation* type

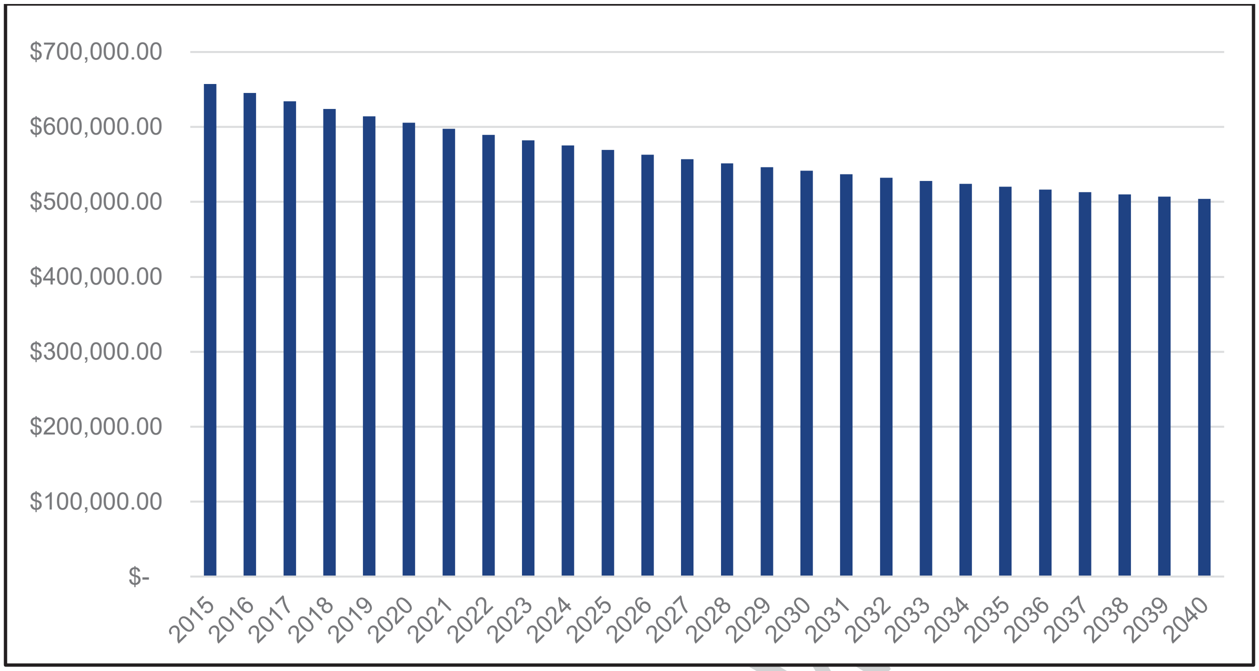

Figure 5-2. *Total cost of active conservation in the Southern Planning Region*

1.1 Description of Non-Agricultural Water Conservation Options

1.1.1 High-Efficiency Showerheads

This practice involves installing U.S. Environmental Protection Agency (EPA) WaterSense®-labeled, high-efficiency showerheads. This is a low-cost conservation option that is easy to implement for both residential and I/C users. Savings figures shown in this chapter reflect upgrading 2.5 gallons per minute (gpm) showerheads to a 2.0 gpm WaterSense®-labeled version.

Toilet replacements were identified as a major source of conservation potential.

1.1.2 High-Efficiency Toilets Rebates (Residential)

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

1.1.3 High-Efficiency Toilets (Industrial/Commercial)

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

1.1.4 Landscape and Irrigation Evaluations/Audits

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

Residential irrigation evaluations were identified as a major potential source of water conservation.

1.1.5 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. As with showerheads, rain sensors are an easily implemented, low-cost conservation option. They are often paired with a landscape and irrigation evaluation/audit but can also be given away to homeowners with irrigation systems.

1.1.6 Smart Irrigation Controllers

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

1.1.7 Soil Moisture Sensors

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

2.0 Agricultural Water Conservation Options

Nearly 40 percent of irrigated agricultural acreage and 30 percent of agricultural water use in the District occurs in the planning region. As the largest consumer of water in the region, there is great potential to increase the efficiency of agricultural water use. The District has a comprehensive strategy to reduce agricultural groundwater 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 200 projects that have helped farmers increase the efficiency of their water use and improve water quality. Water conservation options for which the District will provide assistance as part of Facilitating Agricultural Resource Management Systems (FARMS) and other programs are described below.

2.1 Facilitating Agricultural Resource Management Systems

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 best management practices (BMPs) that involve both water quantity and water quality aspects. It is intended to expedite the implementation of production-scale agricultural BMPs that will help farmers become more efficient in their water use, improve water quality, and restore and augment natural systems. The FARMS Program is a public/private partnership among the District, FDACS, and private agriculturalists. Reimbursement cost-share rates for agriculturalists are based on the degree to which they implement both water quantity and water quality BMPs. The FARMS Program achieves resource benefits through two main types of projects: alternative water supply and conservation through precision irrigation. These types of projects will be discussed below. The goal for the FARMS Program is to offset 40 mgd of groundwater use for agriculture within the SWUCA.

2.2 Facilitating Agricultural Resource Management Systems Conservation Potential

Districtwide, as of September 2019, FARMS has funded more than 200 projects with agricultural cooperators, for a total estimated reduction in groundwater use of more than 28 mgd. In the Southern planning region, there are 104 projects with an estimated reduction in groundwater use of more than 21.7 mgd. While the rate of FARMS participation has varied over time, difficulties within the citrus industry has resulted in a decreasing participation trend. This historical funded project information (2004 to 2019) was used to develop a long-term trend line as a means of estimating potential future program activity. Even with the decreasing participation trend, during the current planning horizon from fiscal year (FY) 2015 through FY2040, if the current trends in agriculture and District cooperation continue, the FARMS program has the potential to reduce groundwater use by nearly 24 mgd through development of alternative water supplies and more than 1.6 mgd through precision irrigation or other groundwater conservation BMPs. Within the Southern Planning Region, the District projects that alternative water supplies could save more than 13.5 mgd and conservation BMPs could save nearly 0.5 mgd over the same planning horizon of FY 2015 through FY 2040.

Table 5-2. *FARMS Conservation Potential within the Southern Planning Region*

Project type	Potential resource benefit (mgd)	Estimated costs	Cost Benefit (cost per 1,000 gallons saved)
Alternative water supply (tailwater recovery)	13.5	$35,000,000	$1.51
Conservation	0.5	$790,000	$0.94

Typical FARMS Project #1. Tailwater Recovery

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

An example of a tailwater recovery project is the DeSoto Land Investment project in DeSoto County. The farm is permitted to withdraw up to 0.498 mgd of groundwater to irrigate citrus. The goal of the project is to reduce groundwater withdrawals through the use of a tailwater recovery/surface water collection reservoir. The project includes two surface water pump stations, filtration and infrastructure necessary to operate and connect the reservoir to an existing irrigation system. The projected reduction in groundwater withdrawals is 37 percent, or 0.185 mgd of its permitted quantities.

Typical FARMS Project #2. Precision Irrigation Systems

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

An example of precision irrigation in the Southern Planning Region is A&A Blueberries. The farm is a 50-acre blueberry farm just north of Arcadia. It is permitted for 0.204 mgd for supplemental irrigation. The FARMS Program funded a precision irrigation project that included automated pump control, weather stations with soil moisture sensors, and automated valve control. It is estimated that the project will reduce groundwater use by approximately 10 percent or about 0.02 mgd.

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

2.3 Mobile Irrigation Laboratory

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

2.4 Best Management Practices

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

Section 3. Reclaimed Water Options

The planning region encompasses a diverse mix of rural and urban land uses that provide opportunities for urban, industrial and agricultural reclaimed water use. In addition, opportunities for storage of excess reclaimed water in brackish aquifers in coastal areas and in old mine pits in the wet season for use during dry periods are abundant in the region. 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 (ASR):** injection of reclaimed water into an aquifer during times of excess supply and the recovery of that same water for use during high demand
- **Distribution:** expansion of a reclaimed water system to serve more customers
- **Efficiency/Research:** the study of how utilities can maximize efficiency and offset potential of reclaimed water systems to conserve water (rate structures, telemetry control, watering restrictions, metering and others) and research (water quality, future uses)
- **Interconnect:** interconnection of systems to enhance supply and allow for better utilization of the resource or to enable agricultural or other WUP exchanges
- **Natural System Enhancement/Recharge:** introduction of reclaimed water to create/restore natural systems and enhance aquifer levels (indirect potable reuse)

- **Saltwater Intrusion Barrier:** injection of reclaimed water into an aquifer in coastal areas to create a salinity barrier
- **Storage:** reclaimed water storage in ground storage tanks and ponds
- **Streamflow Augmentation:** introduction of reclaimed water downstream of water withdrawal points as replacement flow to enable additional utilization of the surface water supply
- **System Expansion:** construction of multiple components (transmission, distribution, storage) necessary to deliver reclaimed water to more customers
- **Transmission:** construction of large mains to serve more customers
- **Potable reuse:** purification of reclaimed water to meet drinking water standards prior to introduction into a potable raw water source.

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

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

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

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

The District developed four reclaimed water options (Table 5-3) 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 2040 at a utilization rate of 75 percent or greater (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 5-3.

Flow and capital cost data for 39 funded reclaimed water construction projects identified as being under development (FY2015 to FY2020) within the District were used to develop a representative cost per 1,000 gallons supplied and capital cost for each option. The data show that for the 39 new reclaimed water supply projects anticipated to come online between 2015 and 2025, the average capital cost is approximately $10.27 million for each 1 mgd supplied. This figure was used in cost calculations for individual reclaimed water options, unless specific cost data were available.

Reclaimed water tank in Englewood

Table 5-3. *List of reclaimed water options for the Southern Planning Region*

Option Name and Entity	County	Type	Supply (mgd)	Benefit (mgd)	Capital Cost (Millions)
Manatee Co. to FPL Power Plant Reuse	Manatee	System Expansion	4.00	4.00	$30.20
Sarasota Co. to Braden River MFL & IPR Reuse	Sarasota, Manatee	Potable Reuse, Streamflow Augmentation	3.00	3.00	$23.50
Manatee Co.-FPL and Gilley Creek MFL and IPR Reuse	Manatee	Potable Reuse, Streamflow Augmentation, System Expansion	7.00	7.00	$37.00
Punta Gorda IPR & Shell Creek MFL Reuse	Charlotte	Potable Reuse, Streamflow Augmentation	2.75	2.50	$34.40
Total			**16.75**	**16.50**	**$ 125.10**

The use of italics denotes SWFWMD estimations.
Offset = (if estimated) Annualized Supply: 1. x 75% for Ag, & R/A/C, 2. x 100% for I/C, NSR, & PG. 3. x 75% for Variety and 4. for RES is number of customers x 300 gallons per day (gpd).

Section 4. Surface Water/Stormwater Options

As shown in Chapter 4, Table 4-6, capturing and storing water from river/creek systems during times of high flow has the potential to meet the 2040 demand. Based on planning level criteria, approximately 181.8 mgd could be developed for water supply if all the rivers/creeks in the planning region described in Chapter 4 were developed to their full potential. A number of rivers of significant size, including the Peace, Braden, Manatee, Myakka, and Shell Creek, are located partially or completely within the planning region. Except for the Myakka River, all of these rivers are currently used for water supply. The Peace River is the most prominent drainage feature in the region, draining portions of Polk, Hardee, DeSoto and Charlotte counties. It has the highest flow of all the rivers in the region with a mean annual flow of 763 mgd (1,181 cubic feet per second [cfs]). Although portions of the Myakka River have been designated an Outstanding Florida Water (OFW) and a Wild and Scenic River, the watershed has experienced numerous alterations that have affected flows. These alterations include agricultural activities, drainage projects, and flood control projects. It is possible that water supply projects could be developed on the Myakka River that would help to restore the river and surrounding natural systems. Table 5-4 is a list of surface water/stormwater options developed in earlier RWSPs by the District and costs have been updated.

A number of surface water/stormwater options with the potential to meet the PRMRWSA's demands in the future were identified and evaluated in the update of its Integrated Regional Water Supply Plan update completed in 2019. That update provided costs for the various options. The following are several of those options.

1.0 Surface Water/Stormwater Options

Surface Water/Stormwater Option #1. New Flatford Swamp Net Benefit Groundwater Recovery Concept

- Entities Responsible for Implementation: PRMRWSA, District

The District has progressed in planning a concept to passively recharge excess flows within the upper Myakka River watershed at Flatford Swamp, which is estimated to be approximately 10 mgd annual average daily flow (AADF) from the upper Myakka system at buildout. Excess flows from Coker/Ogelby Creek, Myakka River at Taylor Road, and Maple Creek will be diverted from Flatford Swamp to the UFA's Avon Park High-Permeability Zone. Once the pilot study is completed by the District, groundwater modeling should be completed to confirm the percent of recharge water achievable for groundwater credits. Discussions with the District would be required to fully understand the methodology to be developed for quantifying the Net Benefit that could be realized from this AR project coupled with public water supply. To justify the Authority's partial use of the Net Benefit derived from operating the Flatford Swamp AR program, it may be necessary for the Authority to operate the Flatford Swamp AR system on behalf of the District. Assuming a 5 mgd AADF freshwater supply can be obtained, a 10 mgd UFA wellfield near Myakka City could be constructed that is operated to produce a 5 mgd AADF water supply for the region. This is anticipated to require up to 10 production wells averaging 1 mgd each and conventional water treatment facilities capable of treating up to 10 mgd of fresh groundwater. This report is assuming the fresh groundwater will need to be treated for sulfur through aeration and disinfected prior to distribution. For conveyance, approximately 20 miles of 24-inch transmission main could tie into the Authority's Phase IIIC transmission main. See Table 5-4 for a summary of this option's potential costs.

Table 5-4. *Flatford Swamp Net Benefit option costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
5	$21,439,000	$4,287,800	$TBD	$TBD

<u>Surface Water/Stormwater Option #2. Cow Pen Slough</u>

- Entities Responsible for Implementation: PRMRWSA, Sarasota County

This option consists of capturing excess flow from Cow Pen Slough for storage in an off-stream reservoir and would also provide an environmental benefit by restoring the natural freshwater/saltwater regime in the Dona Bay estuary. Sarasota County has begun to implement this diversion in two phases. Phase 1, termed the Dona Bay Conveyance Improvements, encompasses the Cow Pen Slough flow diversion system to the wetland detention areas and Pinelands wetland area. Sarasota County is currently designing Phase 2, which is a storage facility planned to restore the former Venice Minerals borrow pit area. Phase 2 will create an approximate 370-acre wet detention area with water level control structures that will receive flows downstream of the Pinelands wetland area via a 72-inch pipeline to the Venice Minerals reservoir site. Beyond the currently planned projects by Sarasota County, creation of a 5 mgd water supply could be achieved as stated in the 2015 RWSP by adding a Venice Minerals Reservoir Pump Station with surface water main to the T. Mabry Carlton Reserve site for treatment. The surface water quality is seasonally variable in salinity, likely requiring a high-pressure membrane treatment process. Management of the concentrate produced from the membrane treatment process would need to be considered. Expansion of the Venice Minerals Reservoir capacity and expanding the water treatment capacity could allow for up to 5 mgd each of additional finished water, totaling an approximate 15 mgd of finished water. See Table 5-5 for a summary of this option's potential costs.

Table 5-5. *Cow Pen Slough option costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
5	$65,700,000	$13,140,000	$2.32	$1.21

Issues:

- As Sarasota County restoration work and studies continue, more information will be available to better quantify excess flows within Cow Pen Slough. Ultimately, the quantity of water supply available from Cow Pen Slough will be determined through the permitting process.

<u>**Surface Water/Stormwater Option #3. Peace River Facility Surface Water System Expansion**</u>

- Entities Responsible for Implementation: PRMRWSA

With this option, reliability modeling conducted by the Authority has reflected a 15 mgd additional yield in finished water capacity by constructing 138 mgd of additional Peace River diversion pumping for a total of 258 mgd, conveyance to a new 6 billion gallon (bg) Reservoir for additional raw water storage for a total of 12.5 bg in the reservoir system, and a Peace River Facility (PRF) treatment capacity expansion of 26 mgd. These expansion quantities rely on the implementation of the Phase 2 Capacity and ASR Wellfield Expansion Project and the partially treated water ASR Project. This project provides maximum utilization of the additional harvesting opportunity of freshwater flows now allowed by the Authority's recently issued 50-year WUP. The study analyzed three potential sites for a new 6 bg Reservoir on the R.V. Griffin Reserve and concluded that the primary constraint of siting the new reservoir is mitigation for impacts to existing wetland habitats and floodplain compensation. See Table 5-6 for a summary of this option's potential costs.

Table 5-6. *Peace River Facility Surface Water System Expansion option costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
15	$332,200,000-339,500,000	$22,146,667-22,633,333	$4.94-5.03	$0.99-1.00

<u>**Surface Water/Stormwater Option #4. Peace River Facility Treatment Plant Capacity Expansion Phase II**</u>

- Entities Responsible for Implementation: PRMRWSA

The Authority is planning to increase their current PRF rated treatment capacity of 51 mgd by 4.5 mgd to 55.5 mgd and add 12 new ASR wells to create additional wellfield recovery capacity to the reservoir system. Additional plant improvements are expected to include adding additional alum storage capacity, adding an additional high service pump, and adding a third sludge press; however, other minor improvements as needed will be determined when this project begins in 2024. If the partially treated water ASR project, as explained above, is successfully permitted, expansion of the Authority's ASR wellfield becomes an economically sensible option to increase this water storage resource. See Table 5-7 for a summary of this option's potential costs.

Table 5-7. *Peace River Facility Treatment Plant Capacity Expansion Phase II option costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual O&M/1,000 gal
4.5	$32,300,000	$7,177,778	$2.09	$0.81

2.0 System Interconnect/Improvement Options

The system interconnect/improvement options are critical components of water supply distribution systems that involve the construction of pipelines and booster pumping stations. Development of these options will facilitate the regionalization of potable water supply systems by providing transmission of water from areas of supply to areas of demand. The options will also increase rotational and reserve capacity and provide redundancy of water supplies during emergency conditions.

The PRMRWSA is developing the Regional Integrated Loop System as a series of transmission pipelines to regionally transfer water from existing and future alternative supplies to demand centers within the PRMRWSA's service area. Five of the Loop System phases are complete or under construction as of 2020 (Phases 1, 1A, 2, 3A, 3B). The PRMRWSA revisited their loop system in the Integrated Water Supply Master Plan Update (2019). The phasing is updated to develop segments over the current or future planning horizons to transfer regional water supplies within the four-county service area. The future phases are listed in no particular order of implementation in Table 5-8.

Table 5-8. *Regional Integrated Loop System estimated costs by future phase*

Regional Integrated Loop System Phase	Project Description	Estimated Capital Cost
Phase 2B	Approximately 4.3 miles from the Phase 2A terminus westward along the Charlotte/Sarasota border, and 1.7-mile branch southward to the Walenda Pump Station.	$20,750,000
Phase 2 Bachman Pumping Facility	Regional pumping and Storage Facility to support Phase 2 water transmission pressures in western Charlotte and Sarasota Counties.	$12,000,000
Phase 2C	Approximately 19-mile extension from Phase 2B westward towards Venice and the Carlton WTP in Sarasota County, completing the southern regional loop.	$53,000,000
Phase 2D	Approximately 12.5-mile branch from Phase 2C west of Myakka River southward to interconnect with Englewood WTP.	$34,600,000
Phase 3C	Approximately 6.5 miles from Clark Road (SR 72) in Sarasota County to a storage and repump facility on Fruitville Road (SR 780), and continuing 3.5 miles to University Parkway and Manatee County	$51,383,000
Phase 4	Approximately 15 miles from Burnt Store WTP in southern Charlotte county, north along Burnt Store road and Grove Blvd., to connection point with the Phase 1A pipeline near Ridge Road and Highway 17.	$27,505,000

Section 5. Brackish Groundwater Desalination Options

Options proposing to withdraw brackish groundwater from the UFA may not be permittable in many areas of the planning region due to their potential to exacerbate existing resource problems that have resulted from historical groundwater withdrawals. 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 stressed water resources, including the SWUCA Saltwater Intrusion Minimum Aquifer Level. Brackish groundwater obtained from the intermediate aquifer system may be a more viable source of water supply. Additionally, some UFA quantities may result from "net benefit" activities that improve recharge to water resources or retire groundwater withdrawals from other uses.

The PRMRWSA and PS utilities have identified numerous brackish groundwater project options, in spite of issues with source availability, because the projects typically allow a phased expandability and can work conjunctively with more seasonal alternative water sources. The options identified include the following:

Brackish Groundwater Option #1. Peace River Facility Brackish Wellfield

- Entity Responsible for Implementation: PRMRWSA

The PRF, located in the RV Griffin Reserve in DeSoto County, is a large-scale surface water treatment facility that includes an off-stream reservoir and ASR system. Evaluations of test and monitor well data near the facility indicate that water quality and production of groundwater may be sufficient for the development of a supply wellfield. In 2010, the PRMRWSA commenced a detailed feasibility analysis for developing brackish groundwater sources at the facility. The investigation evaluated three groundwater production zones, and found the Avon Park (1,300 to 1,500 feet below surface at the locality) to be the most viable production zone with productivity rates of 3 to 5 mgd and total dissolved solids concentrations between 5,000 and 6,000 mg/l. The intermediate aquifer system was less productive but contained better quality water that could provide a secondary source for raw water blending. A Reverse Osmosis (RO) system and an injection well would be constructed at the PRF and used conjunctively with the existing surface water treatment and regional transmission systems. The project cost includes a clear well for blending control. See Table 5-9 for a summary of this option's potential costs.

Table 5-9. *Peace River Facility Brackish Wellfield option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 gallons	O&M Cost/1,000 gallons
5.5	$40,800,000	$7,418,000	$3.48	$1.64

Brackish Groundwater Option #2. City of Venice Reverse Osmosis Facility Expansion

- Entity Responsible for Implementation: City of Venice

The City of Venice operates a RO facility that was originally designed to produce 4.5 mgd of finished water. Many of the City's wells are located close to the Intracoastal Waterway and withdrawal water from the Hawthorne aquifer. The facility and wellfields are located in the MIA, and additional withdrawals would require appropriate mitigation. The existing RO system operates at 50 percent recovery by design, due to concentrate water quality limits regulated for their surface water discharge permit issued in 1997. The City has worked with the Florida Department of Environmental Protection to expand the water quality limits based on historic facility operations and monitoring, which would allow the City to improve the treatment efficiency. Improving the system recovery would increase capacity and/or reduce withdrawals needed for current demand.

In 2018 the City completed a process efficiency study that was required as a special condition of their WUP. The study identified a feasible option to increase efficiency to 75 percent. The option would install a second-pass RO component for half of the existing membranes. The upgraded half would meet current demands and the other half of the RO system would stand by for peak demands. The total treatment capacity would be increased by 1.46 mgd, and without additional wells or increased WUP capacity.

The facility improvement option shown in Table 5-10, below. It includes the inter-stage booster pumps and second-pass RO membranes for half the existing facility. The system would use the current disposal method of surface water discharge.

Table 5-10. *City of Venice RO Facility Expansion option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 gallons	O&M Cost/1,000 gallons
1.2	$3,300,000	$2,750,000	$0.55	$0.24

Brackish Groundwater Option #3. DeSoto County Brackish Wellfield at the DeSoto Correctional Institute

- Entity Responsible for Implementation: PRMRWSA, DeSoto County

DeSoto County currently owns and operates a wellfield located at the DeSoto Correctional Institute (DCI) permitted for 0.8 mgd. The location offers the potential to develop additional supply to serve local and regional needs. The planning-level costs shown in Table 5-11 were developed for the draft PRMRWSA Integrated Regional Water Supply Plan 2020 update. The conceptual design includes additional production wells situated in the intermediate aquifer system and the upper zones of the UFA, a RO facility, a deep well injection system, 10 miles of 16-inch transmission main, and booster pumping. The Authority anticipates the transmission man may be connected to the portion of Desoto County's system that is currently supplied by the Authority by 2024. Approximately $6.3M of the cost shown will be offset if DeSoto County proceeds to add this pipeline in advance.

Table 5-11. *DeSoto Brackish Wellfield option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 gallons	O&M Cost/1,000 gallons
5.0	$40,100,000	$8,020,000	$2.31	$0.89

Brackish Groundwater Option #4. Manatee County Buffalo Creek Brackish Wellfield

- Entity Responsible for Implementation: Manatee County

Manatee County is planning to develop a 3 mgd RO facility and wellfield located adjacent to the Buffalo Creek golf course. Approximately eight wells would withdraw water from the intermediate aquifer system and the upper zones of the UFA. The facility would dispose of RO concentrate by diluting with reclaimed water and beneficially reusing the water for irrigation at the golf course. Since 2015, Manatee County has installed two Class I Deep Injection Wells at their North Regional Water Reclamation Facility for excess reclaimed water disposal. One of those deep injection wells was completed to Class I industrial injection well standards, which will allow disposal of RO concentrate. The conceptual costs shown in Table 5-12, below.

Table 5-12. *Manatee County Buffalo Creek Brackish Wellfield option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 gallons	O&M Cost/1,000 gallons
3.0	$36,000,000	$12,000,000	$3.77	$1.17

Section 6. Seawater Desalination Options

Seawater desalination options for the planning region were evaluated for locations compatible with adjacent land uses and coastal environments, proximity to existing potable water transmission infrastructure, and permissibility of concentrate discharges. There are two project options that were initially identified in the 2015 RWSP.

Seawater Desalination Option #1. Port Manatee

- Entity Responsible for Implementation: PRMRWSA, Manatee County

This option is for the development of a desalination facility at Port Manatee in northwestern Manatee County, on Tampa Bay. The site was chosen because of its industrial nature, proximity to a deep-water channel that could accommodate intake and discharge facilities, and potential to obtain a permit to discharge concentrate. An additional advantage of the site is that it is located approximately 0.5 miles from a point of connection to two potable water lines that are part of Manatee County's water system. The facility would be designed to withdraw up to 440 mgd of seawater, of which 40 mgd would be feed water for the desalination process. The facility would produce 20 mgd of finished water and 20 mgd of concentrate would be diluted with up to 400 mgd of seawater (20 to 1 ratio) and discharged to the gulf. Because the concentrate would be discharged in Class III waters outside aquatic preserves or areas designated as OFWs, the potential for obtaining a permit for the discharge would be improved. The proximity of this site to the mouth of Tampa Bay may be advantageous with respect to concentrate disposal, because the large volumes of water entering and leaving the bay during a normal tidal cycle would provide the volume of water necessary for dispersion. See Table 5-13 for a summary of this option's potential costs.

Table 5-13. *Port Manatee Desalination Facility option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	O&M/1,000 Gallons
20	$271,800,000	$13,550,000	$5.58	$3.16

Seawater Desalination Option #2. Venice

- Entity Responsible for Implementation: PRMRWSA, City of Venice

This option is for a desalination facility located in the general vicinity of the Venice airport. The site was chosen because it is in close proximity to areas of high water demand, has access to a potential intake in the Intracoastal Waterway, and is near a permitted surface water discharge site to the Gulf of Mexico. The site is also located near a water treatment plant that is interconnected to the Sarasota County water system, which could serve as the point of regional distribution for the product water. The water intake would be located within the C-1 Canal, a five-mile section of the Intracoastal Waterway that was excavated in the 1960s and has experienced poor water quality. The withdrawals would theoretically increase circulation in the waterway for a net environmental benefit. The concentrate would be sent through a pipeline with discharge into the Gulf of Mexico. To properly manage the disposal of concentrate from the desalination facility, the intake would be designed to withdraw up to 440 mgd from the Intracoastal Waterway, of which 40 mgd would be feed water for the desalination process. A treatment efficiency of 50 percent would result in 20 mgd of concentrate that would be diluted with up to 400 mgd of seawater (20 to 1 ratio) and discharged to the gulf. See Table 5-14 for a summary of this option's potential costs.

Table 5-14. *Venice Desalination Facility option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	O&M/ 1,000 Gallons
20	$287,400,000	$14,370,000	$5.73	$3.17

Chapter 6. Water Supply Projects Under Development

This chapter is an overview of water supply projects that are under development in the Southern 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 fiscal year (FY) 2019, or (3) have been completed since the year 2015 and are included to report on the status of implementation since the previous Regional Water Supply Plan (RWSP).

The demand projections presented in Chapter 3 show that approximately 49.4 mgd of new water supply will need to be developed during the 2020 to 2040 planning period to meet demand for all use sectors in the planning region. As of 2019, it is estimated that approximately 36 percent of that demand (17.6 mgd) has either been met or will be met by projects that meet the above definition of being "under development." In addition to these projects under development, it is probable that additional water supplies are being developed by various entities in the planning region outside of the District's funding programs.

Section 1. Water Conservation

1.0 Non-Agricultural Water Conservation Projects

1.1 Indoor Water Conservation Projects

Since 2015, the District has cooperatively funded the distribution of approximately 8,746 ultra low-flow or high-efficiency fixtures within the Southern Planning Region. These programs have cost the District and cooperating local governments a combined $1,354,904 and have yielded a potable water savings of approximately 214,778 gallons per day (gpd). Table 6-1 provides information on indoor water conservation projects that are under development in the planning region.

1.2 Outdoor/Other Water Conservation Projects

Since 2015, the District has cooperatively funded three projects in the Southern Planning Region that reduce potable water line flushing. These line looping projects reduce potable water flushing by eliminating distribution system dead-ends and rerouting water to higher demand areas. In addition, one soil moisture sensor rebate program has been funded. These programs have cost the District and cooperating local governments a combined $1,744,484 and have yielded a potable water savings of approximately 146,611 gpd. Table 6-1 also provides information on outdoor water conservation projects that are under development.

Table 6-1. *Water conservation projects under development in the Southern Planning Region*

Cooperator	Project Number	General Description	Savings (gpd)	Devices Rebates	Total Cost[1]	District Cost	$/1,000 gal Saved
Indoor Projects							
Manatee County	N623	Toilet Rebate	29,093	1,524	$225,755	$112,860	$2.17
City of Venice	N625	Toilet Rebate	4,569	318	$48,099	$24,050	$2.94
Manatee County	N725	Toilet Rebate	24,816	1,323	$198,625	$99,312	$2.23
Manatee County	N806	Toilet Rebate	23,945	1,228	$184,421	$92,211	$2.15
City of Venice	N808	Toilet Rebate	4,028	302	$53,217	$26,609	$3.69
Manatee County	N877	Toilet Rebate	23,760	1,228	$184,987	$92,493	$2.17
Manatee County	N982	Toilet Rebate	26,380	1,000	$151,000	$75,500	$1.60
City of Venice	N992	Toilet Rebate	4,990	249	$58,900	$29,450	$3.29
City of Palmetto	Q073	Toilet Rebate	41,827	325	$40,000	$20,000	$0.27
Manatee County	Q111	Toilet Rebate	26,380	1,000	$151,000	$75,500	$1.60
City of Venice	Q126	Toilet Rebate	4,990	249	$58,900	$29,450	$3.29
Indoor Total			*214,778*	*8,746*	*$1,354,904*	*$677,435*	*$1.76*[2]
Outdoor/Other Projects							
City of North Port	N680	Line-Looping	26,851	NA[3]	$419,093	$163,579	$3.80
City of Arcadia	N815	Line-Looping	28,267	NA[3]	$313,391	$235,044	$2.70
Braden River Utilities	Q020	Soil Moisture Sensor Rebate	55,000	600	$308,000	$154,000	$2.29
City of North Port	N979	Line-Looping	36,493	NA[3]	$704,000	$352,000	$4.69
Outdoor/Other Total			*146,611*	*600*	*$1,744,484*	*$904,623*	*$3.24*[2]
Total			**361,389**	**9,346**	**$3,099,389**	**$1,582,057**	**$2.36**[2]

[1] The total project cost may include variable project specific costs including marketing, education and administration.
[2] Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.
[3] This is a construction project that includes the removal of auto flushers and installation of a new pipeline.

2.0 Agricultural Water Conservation Projects

The District's largest agricultural water conservation initiative, the Facilitating Agricultural Resource Management Systems (FARMS) Program is not included in this section because the District classifies the program 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 Research and Education Projects

The District provides funding for Institute of Food and Agricultural Sciences (IFAS) to investigate a variety of agriculture/ urban issues that involve water conservation. These include, but are not limited to, development of tailwater recovery technology, determination of crop water use requirements, evaluation of alternative irrigation methods, field irrigation scheduling, frost/freeze protection, residential irrigation, and urban water use. IFAS conducts the research, then provides the results to the agricultural community. The District has funded research on strawberries, citrus, tomatoes, potatoes, peaches, biofuel grasses, turf grass, peppers, blueberries, and various landscape and nursery ornamental plants and trees. Of the 58 research projects, 48 have been completed. Completed projects include 10 projects dealing with urban landscape issues and 38 involving various agricultural commodities. While the research projects are not specific to each planning region, they are specific to a commodity group that has a strong presence in each region. The research will help develop best management practices that will conserve water Districtwide. Specific benefits to the planning region are dependent on the commodities dominant in that planning region. The 10 ongoing projects are described in Table 6-2.

Research on agricultural frost/freeze protection is one of many projects conducted by IFAS to improve water conservation measures

Table 6-2. *List of water conservation research projects*

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

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

Section 2. Reclaimed Water

1.0 Reclaimed Water Projects: Research, Monitoring and Education

In addition to funding reclaimed water projects, the District also supports reclaimed water research and monitoring which is central to maximizing reclaimed water use and increasing benefits. The District assists utilities in exploring opportunities for increased utilization of reclaimed water and supports applied research projects, which not only include innovative treatment and novel uses of reclaimed water, but also nutrient and constituent monitoring. Table 6-3 is a list, description, and summary of the benefits and costs that have been or will be realized by the five reclaimed water projects currently under development and another two estimated to experience additional future supply growth. It is anticipated that these seven projects will be online by 2025. Table 6-4 includes general descriptions and a summary of 10 research projects for which the District has provided more than $1,026,000 in funding. The District has also committed to developing a comprehensive reclaimed water education strategy. All reclaimed water construction projects funded by the District require education programs that stress the value and benefits of efficient and effective water use regardless of the water source. To provide reclaimed water information to a broader audience, the District has developed a webpage that is one of the top Internet sources of reuse information including Geographic Information System (GIS) and other data. The District also produces reclaimed water publications that are offered to residents, utilities, engineering firms, environmental agencies and other parties interested in developing and expanding reclaimed water systems.

Reclaimed water pipes

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

Cooperator	General Project Description	Reuse (mgd)			Customer (#)		Costs	
		Produced	Benefit	Storage	Type	Total	Total	District[1]
Charlotte County								
Charlotte County	Trans/Pump N556	2.23	1.34	NA	Res, Rec, Com, GC	TBD	$9,430,000	$4,715,000
Riverwood	Growth of Flows	0.03	0.02	NA	Res, GC	TBD	Prior	Prior
Manatee County								
City of Bradenton	Growth of Flows to Lakewood Ranch	4.26	4.26	NA	Res	TBD	Prior	Prior
City of Bradenton, BRU	Trans, N711	1.00	1.00	11.4	Res, Rec, Com, GC	TBD	$4,600,000	$2,300,000
DeSoto								
City of Arcadia	Trans, Store N881	0.10	0.09	0.60	GC	1	$300,000	$225,000
Sarasota County								
West Villages Improvement District	Trans N920	0.25	0.19	NA	Res	620	$712,000	$356,000
City of North Port	Trans N667	0.36	0.22	NA	Res, Com, Rec, GC	TBD	$1,320,000	$660,000
Total	**7 Projects**	**8.23**	**7.12**	**12.00**		**621**	**$16,362,000**	**$8,256,000**

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

Table 6-4. *Descriptions and summary of reclaimed water research projects co-funded in the District*

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

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

Section 3. Surface Water/Stormwater

1.0 System Interconnect/Improvement Projects

The regional integrated loop system projects are a series of transmission pipelines and associated storage and pumping stations being developed to regionally transfer and deliver water from existing and future alternative supplies to demand centers within the PRMRWSA four-county service area. The system also provides reserve capacity for emergency transfers and maximizes the use of surface water in the SWUCA. Three phases of the loop system were completed prior to 2015, and two are under construction and scheduled for completion by 2022 or sooner. The two ongoing phases are described in Table 6-5. The layout, timing, and conceptual costs of other future phases were recently updated for the PRMRWSA's Water Supply Master Plan Update and are discussed in Chapter 5, Water Supply Development Options.

System Interconnect/Improvement Project #1. Regional Loop System Phase 1

The Phase 1 project consists of approximately 6 miles of 24-inch transmission pipeline to interconnect a distribution station in southern DeSoto County on US 17 with Punta Gorda's Shell Creek water treatment facility in Charlotte County. The project includes 3,500 linear feet of subaqueous crossing of Shell Creek installed by directional drilling. With the concurrent construction of the City's new Reverse Osmosis (RO) facility, the project will provide DeSoto County with a reliable back-up water supply. The project will also allow the City to meet demands when Shell Creek withdrawals are limited by expected minimum flows. The project was initially designed in 2007 but then postponed, and a design update commenced in 2014. Construction began in 2018 and the project is scheduled for completion by December 2021.

System Interconnect/Improvement Project #2. Regional Loop System Phase 3B

The Phase 3B project will extend from the Phase 3A northern terminus at a meter station along Cow Pen Slough that serves Sarasota County's Preymore neighborhood, approximately five miles northward to Clark Road (SR 72) in Sarasota County, where a new transmission connection will send up to 7 mgd to the County's pump station #5. A future Phase 3C expansion and booster station would extend the Loop System into Manatee County. The Phase 3B pipeline is 48-inch in diameter and will be capable of sending an additional 17 mgd through the future connection. The project design work commenced in 2016, construction began in 2019, and completion is scheduled for 2021.

Table 6-5. *Regional Loop System project cost/share by phase*

Interconnect Project Name	Total Capital Cost	District Share	Description
PRMRWSA Regional Loop System Phase 1 Interconnect	$12,000,000	$6,000,000	24-inch interconnect from the US-17 booster station in DeSoto County to Punta Gorda's Shell Creek Water Treatment Facility (WTF) in Charlotte County.
PRMRWSA Regional Loop System Phase 3B Interconnect	$16,700,000	$8,1,00,000	48-inch interconnect to extend the current Loop System northern terminus from the Preymore meter station along Cow Pen Slough, northward approximately 5 miles to Clark Road (SR 72) in central Sarasota County.

Section 4. Brackish Groundwater Desalination

Brackish Groundwater Desalination Project #1. City of Punta Gorda Brackish Groundwater Project

The City of Punta Gorda's Brackish Groundwater project consists of the design, wellfield testing study, third-party reviews, permitting, and construction of a 4 mgd brackish groundwater RO facility collocated at the City's existing 10 mgd Shell Creek surface water treatment facility. The facility components include a water blending station, 2 mg storage tank, raw water supply wellfield, and a concentrate disposal well. The City's primary purpose for the new facility is to create a high-quality blending source for treated surface water from Shell Creek, which at times exceeds drinking water standards for TDS. Additional benefits include creating a reliable backup regional water supply to DeSoto County through the PRMRWSA's Loop System Phase 1 Interconnect, meeting demands while allowing for flow reductions on Shell Creek to meet expected minimum flows, and mediation of arsenic issues with the City's ASR wells by converting them to brackish supply wells. The project commenced in 2014 and is scheduled for completion in 2021. See Table 6-6 for a summary of this project's potential costs.

Table 6-6. *City of Punta Gorda Brackish Groundwater project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
4.0	$39,400,000	$15,650,000	$9,850,000	$3.89

Brackish Groundwater Project #2. City of North Port West Village Brackish Wellfield

- Entity Responsible for Implementation: City of North Port

The City of North Port is utilizing a previously constructed and capped brackish groundwater wellfield to create a Southwest Water Treatment Plant which will serve the West Villages Improvement District that is rapidly growing. The groundwater wellfield is permitted for an average and peak withdrawal rate of 2.7 mgd. Assuming 25 percent RO treatment losses, the finished water capacity is anticipated to be 2.03 mgd. The City has stipulated in their Capital Improvement Plan (CIP) that the developer for the West Villages Improvement District is required to design, permit, and construct the water treatment plant and dedicate to the City. Construction is expected to be complete in 2022. The construction costs shown in Table 6-7 are a budgetary estimate provided by the developer.

Table 6-7. *City of North Port West Village Brackish Wellfield option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 gallons	O&M Cost/1,000 gallons
2.03	$26,000,000	$12,800,000	$TBD	$1.12

Section 5. Aquifer Storage and Recovery Projects

There are two potable and two reclaimed water ASR projects under development in the Southern Planning Region. Figure 4-6 shows ASR project locations in the District.

PRMRWSA Partially Treated Surface Water Aquifer Storage and Recovery Project #1. Peace River Manasota Regional Water Supply Authority (N854)

The PRMRWSA partially treated surface water project consists of design, permitting and construction of full-scale surface appurtenances to supply existing ASR wells at the facility. The system originally utilizes fully treated surface water. By converting to partially treated surface water ASR systems, recovery efficiency is anticipated to increase by 3 mgd on an annual average basis. See Table 6-8 for a summary of this project's potential costs.

Table 6-8. *PRMRWSA Partially Treated Surface Water ASR (N854) project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
3	$7,755,000	$3,265,000	$	$

Reclaimed Water Aquifer Storage and Recovery Project #2. Braden River Utilities ASR Feasibility (N912)

The Braden River Utilities Reclaimed Water ASR Feasibility study is for construction and cycle testing of two sites each including an ASR well, two storage zone monitoring wells, and one upper zone monitoring well; partial infrastructure consisting of simplified control system; and temporary piping, pumps, and other associated infrastructure. The benefit of this project is the optimization of reclaimed water supplies through increasing wet-weather storage, reducing reliance on groundwater, and contributing to the recovery of the most impacted area (MIA) of the SWUCA. The two sites would provide approximately a combined 3 to 4 mgd injection and recovery capacity. Feasibility at these two sites could also result in the development of four additional sites in the future with peak injection capacity of 19 mgd. The ASR wells will be located within the Braden Utilities service area. The project is currently working through Florida Department of Environmental Protection (FDEP) Underground Injection Control permitting issues associated with reclaimed water ASR projects. See Table 6-9 for a summary of this project's potential costs.

Table 6-9. *Braden River Utilities ASR (N912) project cost/share*

Quantity Produced (mgd)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
TBD	$5,995,000	$2,997,500	TBD	TBD

Potable Water Aquifer Storage and Recovery Project #4. City of Bradenton Surface Water ASR-2 (N435)

The City of Bradenton ASR project consists of design, third party review, permitting, construction and testing of one potable water ASR well, associated monitoring wells and surface facilities. The project includes a vacuum degasification tower to remove dissolve oxygen as an arsenic management technique. The project is currently undergoing cycle testing with fully treated surface water. Results from the first cycle tests are pending. The project is located at the Bill Evers Reservoir site. See Table 6-10 for a summary of this project's potential costs.

Table 6-10. *City of Bradenton Surface Water ASR-2 (N435) project cost/share*

Quantity Produced (mgy)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons
NA	$4,700,000	$2,350,000	TBD	TBD

Reclaimed Water Aquifer Storage and Recovery Project #4. City of Venice Reclaimed Water ASR (Q050)

The City of Venice ASR project consists of 30 percent design and third-party review of a system to store and recover at least 25 million gallons per year (mg/yr) of reclaimed water at the City's Eastside Advanced Waste Water Reclamation Facility. At a planning level, two production wells (1 mgd capacity each) will be constructed. See Table 6-11 for a summary of this project's potential costs.

Table 6-11. *City of Venice Reclaimed Water ASR (Q050) project cost/share*

Quantity Produced (mgy)	Capital Cost	Capital Cost (District's Share)	Cost/mgd	Cost/1,000 gallons

NA	$165,000	$82,500	TBD	TBD

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Chapter 7. Water Resource Development Component

This chapter addresses the legislatively required water resource development (WRD) activities and projects that are conducted primarily by the District. The intent of WRD projects is to enhance the amount of water available for regional-beneficial uses and for natural systems. Chapter 373.019, Florida Statutes (F.S.), defines WRD 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 WRD; however, additional funding and technical support may come from state, federal, and local entities.

Part A. Overview of Water Resource Development Efforts

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

Section 1. Data Collection and Analysis Activities

The District budgets significant funds annually to implement the WRD data collection and analysis activities, which support the health of natural systems and water supply development. Table 7-1 displays the fiscal year (FY) 2020 budget and anticipated five-year funding levels for Districtwide data collection and analysis activities. Approximately $40.8 million will be allocated toward these activities annually for a five-year total of approximately $204 million. Because budgets for the years beyond FY2020 have not yet been developed, but are projected to be fairly constant, future funding estimates for activities are set equal to FY2020 funding. Funding for these activities is primarily from the Governing Board's allocation of ad valorem revenue collected within the District. In some cases, additional funding is provided by water supply authorities, local governments, and the U.S. Geological Survey (USGS). The activities listed in Table 7-1 are described in subsections 1.0 through 5.0, below.

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

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

1.0 Hydrologic Data Collection

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

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

1.1 Surface Water Flows and Levels. This includes data collection at the District's 808 surface water level gauging sites, and cooperative funding with the USGS for discharge and water-level data collection at 129 river, stream and canal sites. The data is available to the public through the District's Water Management Information System (WMIS), and through the USGS Florida Water Science Center Web Portal.

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

1.3 Meteorologic Data. The meteorologic data monitoring program consists of measuring rainfall totals at 171 rain gauges, most of which provide near real-time data. Annual funding is for costs associated with measurement of rainfall, including sensors, maintenance, repair and replacement of equipment. Funding allows for the operation of one District evapotranspiration (ET) station for reference near Lake Hancock, and for District participation in a cooperative effort between the USGS and all five Florida water management districts to map statewide potential and reference ET using data measured from the Geostationary Operational Environmental Satellites (GOES). The program also includes a collaborative effort between the five WMDs to provide high-resolution radar rainfall data for modeling purposes.

1.4 Water Quality Data. The District's Water Quality Monitoring Program (WQMP) collects data from water quality monitoring networks for springs, streams, lakes, and coastal and inland rivers. Many monitoring sites are sampled on a routine basis, with data analysis and reporting conducted on an annual basis. The WQMP develops and maintains the Coastal Groundwater Quality Monitoring Network, which involves sample collection and analysis from approximately 380 wells across the District to monitor saltwater intrusion and/or the upwelling of mineralized waters into potable aquifers.

1.5 Groundwater Levels. The District maintains 1,618 monitor wells in the data collection network, including 856 wells that are instrumented with data loggers that record water levels once per hour, and 762 that are measured manually by field technicians once or twice per month.

1.6 Biologic Data. The District monitors ecological conditions as they relate to both potential water use impacts and changes in hydrologic conditions. Funding for biologic data collection includes support for routine monitoring of approximately 150 wetlands and a five-year assessment of over 400 wetlands to document changes in wetland health and assess level of recovery in impacted wetlands. Funding also supports an effort to map the estuarine hard bottom of Tampa Bay, as well as Surface Water Improvement and Management (SWIM) program efforts for mapping of seagrasses in priority water bodies including Tampa Bay, Sarasota Bay, Charlotte Harbor, and the Springs Coast area.

1.7 Data Support. This item provides administrative and management support for the WQMP, hydrologic and geohydrologic staff support, the District's chemistry laboratory, and the District's LoggerNet data acquisition system.

2.0 Minimum Flows and Levels Program

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

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

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

As of August 2019, the District has preliminarily planned to monitor and assess the status of 210 adopted MFLs, including MFLs for 23 river segments, 10 springs or spring groups, 127 lakes, 41 wetlands, seven wells in the Northern Tampa Bay Water Use Caution Area, and the Upper Floridan aquifer (UFA) in the Most Impacted Area (MIA) of the SWUCA and in the Dover/Plant City Water Use Caution Area (DPCWUCA). The District is scheduling the establishment or reevaluation of 96 additional MFLs and one reservation through FY2029. The District's annual MFL Priority List and Schedule and Reservations List and Schedule is approved by the Governing Board in October, submitted to FDEP for review in November, and subsequently published in the Consolidated Annual Report. The approved and proposed priority lists and schedules are also posted on the District's Minimum Flows and Levels Documents and Reports webpage at: https://www.swfwmd.state.fl.us/projects/mfl/documents-and-reports

3.0 Watershed Management Planning

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

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

4.0 Quality of Water Improvement Program

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

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

5.0 Stormwater Improvements: Implementation of Storage and Conveyance Best Management Practices

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

Section 2. Water Resource Development Projects

As of FY2020, the District has 20 ongoing projects that meet the definition of water resource development "projects." The projects are listed in Table 7-2, below, along with their funding to date, total costs, participating cooperators, the estimated water quantity to be become available, and the planning region benefitted by the project. The total cost of these projects is approximately $150 million and a minimum of 78 mgd of additional water supply will be produced or conserved.

These projects include feasibility and research projects for new alternative water supply (AWS), Facilitating Agricultural Resource Management Systems (FARMS) projects to improve agricultural water use efficiency, and environmental restoration projects that assist MFLs recovery. District funding for a number of these projects is matched to varying degrees by local cooperators, including local governments, regional water supply authorities, and others; 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 FY2019	Total Project Cost (District + Cooperator)	Funding Source	Water to Become Available	Planning Region of Benefit
1) Alternative Water Supply Feasibility Research and Pilot Projects						
1.1	South Hillsborough Aquifer Recharge Program (SHARP) (N287)	$1,382,500	$2,765,000	SWFWMD, Hillsborough County	2 mgd	TBPR
1.2	Bradenton Aquifer Protection Recharge Well (N842)	$1,500,000	$5,050,000	District, City of Bradenton	5 mgd	TBPR
1.3	PRMRWSA Partially Treated Water ASR (N854)	$495,500	$7,755,000	District, PRMRWSA	3 mgd	SPR
1.4	Southern Hillsborough Aquifer Recharge Expansion (SHARE) Phase 1 (N855)	$4,500,000	$9,700,000	District, Hillsborough County	4 mgd	TBPR
1.5	Braden River Utilities ASR Feasibility (N912)	$2,736,250	$5,995,000	District, Braden River Utilities	TBD	SPR
1.6	Hydrogeologic Investigation of Lower Floridan Aquifer in Polk County (P280)	$11,375,000	$12,000,000	SWFWMD	TBD	HPR
1.7	Optical Borehole Imaging Data Collection from LFA Wells (P925)	$100,200	$167,000	District, USGS	NA	HPR
1.8	Sources/Ages of Groundwater in LFA Wells (P926)	$368,300	$555,800	District, USGS	NA	HPR

Water Resource Development Projects		Prior District Funding through FY2019	Total Project Cost (District + Cooperator)	Funding Source	Water to Become Available	Planning Region of Benefit
1.9	City of Venice Reclaimed Water Aquifer Storage Recovery (Q050)	$0	$5,065,000	District, City of Venice	0.17 mgd	SPR
1.10	Direct Aquifer Recharge-North Hillsborough Aquifer Recharge Program Phase 2 (Q064)	$0	$1,500,000	District, Hillsborough County	TBD	TBPR
1.11	Direct Aquifer Recharge-South Hillsborough Aquifer Recharge Program Phase 3 (Q088)	$0	$13,000,000	District, Hillsborough County	6 mgd	TBPR
2) Facilitating Agricultural Resource Management Systems (FARMS)						
2.1	FARMS Projects	$40,780,456	$71,791,225	SWFWMD, FDACS, State of FL, private farms	29 mgd	All
2.2	Mini-FARMS Program	$616,237	$150,000 (annual)	SWFWMD	2 mgd	All
3) Environmental Restoration and Minimum Flows and Levels (MFL) Recovery						
3.1	Lower Hillsborough River Recovery Strategy (H400)	$5,464,712	$10,857,462	SWFWMD, City of Tampa	3.1 mgd	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 (H04)	$3,668,040	$700,000	SWFWMD	3.9 mgd	TBPR
3.4	Haines City Reclaimed Water MFL Recharge & Advanced Treatment Feasibility Study (N888)	$225,000	$357,710	SWFWMD, Haines City	0.7 mgd	HPR
3.5	Lake Hancock Lake Level Modification (H008)	$9,989,166	$10,428,490	SWFWMD, State of FL, Federal	TBD	HPR, SPR
3.6	Lake Jackson Watershed Hydrology Investigation (N554)	$260,000	$400,000	SWFWMD, City or Sebring, Highlands County	NA	HPR
3.7	Upper Myakka / Flatford Swamp Hydrologic Restoration and Implementation (H089)	$5,044,012	$31,000,000	SWFWMD	6.0 mgd	SPR, HPR

Note: Tampa Bay Planning Region (TBPR); Southern Planning Region (SPR); Heartland Planning Region (HPR)

1.0 Alternative Water Supply Research, Restoration, and Pilot Projects

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

1.1 South Hillsborough Aquifer Recharge Program (SHARP) (N287).

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

1.2 Bradenton Aquifer Protection Recharge Well (N842).

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

1.3 PRMRWSA Partially Treated Water ASR (N854).

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

1.4 Southern Hillsborough Aquifer Recharge Expansion (SHARE) Phase 1 (N855).

This project is for a third-party review of the County's 30 percent design, completion of design and permitting, and the initiation of construction for Phase 1 of the South Hillsborough Aquifer Recharge Expansion (SHARE) project. Pending third-party review and approval, project will construct 9,500 feet of transmission mains, two reclaimed water recharge wells (2 mgd each), eight monitoring wells, and associated appurtenances. The SHARE project expands upon the county's current recharge project (N287).

1.5 Braden River Utilities ASR Feasibility (N912).

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

1.6 Hydrogeologic Investigation of LFA in Polk County (P280).

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

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

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

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

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

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

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

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

This project includes completion of a direct aquifer recharge feasibility study, which includes the construction and testing of three exploratory wells necessary to evaluate recharge locations for the North Hillsborough Aquifer Recharge Program (NHARP). If approved, the study will aid in the determination of the hydrogeological characteristics and water quality of the targeted Avon Park Formation of the UFA and the approximate depth of the base of the underground source of drinking water in the general vicinity of NHARP.

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

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

2.0 Facilitating Agricultural Resource Management Systems Projects

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

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

Shell Creek watershed

2.1 FARMS Cost-Share Projects.

Facilitating Agricultural Resource Management Systems (FARMS) Projects employ many of the agricultural water conservation strategies described in the RWSP to reduce groundwater withdrawals by increasing the WUE 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 WUE 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 also 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 from FY 2015 through FY 2019 is provided in Table 7-3.

As of September 2019, there were 208 approved FARMS projects including 104 in the Southern Planning Region. These 104 projects are projected to have a cumulative groundwater offset of 21.7 mgd.

2.2 Mini-FARMS Program.

Mini-FARMS is a scaled down version of the District's FARMS cost-share reimbursement program to implement agricultural BMPs on agricultural operations of 100 irrigated acres or less to conserve water and protect water quality within the District. Mini-FARMS is intended to assist in the implementation of the SWUCA Recovery Strategy, DPCWUCA Recovery Strategy, the Shell and Prairie Creek WMP, and the District's Strategic Plan. Much like the FARMS projects, the Mini-FARMS Program implements BMPs on agricultural operations to reduce UFA groundwater use and/or improve water quality conditions throughout the District. The maximum cost-share amount available from Mini-FARMS projects is $8,000 per agricultural operation per year, and the maximum cost-share rate is 75 percent of project costs.

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

2.3 FARMS Irrigation Well Back-Plugging Program.

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

A total of 85 wells have been back plugged in the SWUCA through FY2018, with 63 of these wells located in the SPJC priority watersheds. Analytical results for all back-plugged wells indicated conductivity, total dissolved solids, 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.

Table 7-3. *Specific FARMS cost-share projects within the Southern Planning Region funded, FY2015 to FY2019*

Project Description	District Budget FY2015-2019	Benefit (mgd)	Priority Area
4F LLC Gator Farm	$83,153	0.040	SPJC

Project Description	District Budget FY2015-2019	Benefit (mgd)	Priority Area
734 LMC Groves, LLC (ALICO) - Lily Grove	$74,184	0.027	SPJC
A&A Blueberries, LLC	$34,754	0.020	SWUCA
ALICO Bermont Grove - Phase 2	$232,170	0.208	SPJC
Bethel Farms - Hog Bay - Phase 2	$337,952	0.150	SPJC
Bethel Farms, LLLP - Phase 3	$448,500	0.130	SWUCA
Bethel Farms, LLLP - Hog Bay	$163,921	0.060	SPJC
BH Griffin - C & S Grove - Phase 2	$480,152	0.350	SPJC
Chapman Family Partnership, LLLP - Phase 2	$113,250	0.040	SPJC
Crossing Grove	$84,600	0.026	SPJC
Desoto Excavating	$200,000	0.036	SPJC
Dixie Groves and Cattle Company	$249,367	0.120	SPJC
Doe Hill Citrus - Phase 2	$262,000	0.085	SPJC
Family Dynamics, Inc.	$189,525	0.059	SWUCA
FLM - Blossom Grove - Phase 4 - Amend	$523,635	0.198	MIA
Hancock Groves - Phase 5	$21,450	0.035	SPJC
Hi Hat Ranch	$111,151	0.110	MIA
Jack Paul Properties	$503,208	0.144	SPJC
Jack Paul Properties - Phase 2	$295,500	0.112	SPJC
M & V, LLC - Avant Grove	$436,445	0.099	SPJC
Orange Co. JWCD Pump Automation	$178,769	0.070	SPJC
Premier Citrus - Bay Grove	$293,079	0.078	SPJC
Premier Citrus - County Line Grove	$384,435	0.140	SPJC
Premier Citrus - Southeast Groves - Phase 2	$5,744	0.012	SPJC
Premier Citrus - Sun Pure Groves	$712,353	0.164	SPJC
Premier Citrus - West Vero Farms	$34,500	0.043	SPJC
QC Desoto Grove Ventures PRR PH 4	$426,323	0.100	SPJC
QC Pelican Grove, LLC	$560,000	0.160	SPJC
Schwartz Farms	$76,376	0.066	MIA
Varner Groves	$158,384	0.108	SPJC
Wauchula Road Duette	$49,823	0.060	SWUCA
Total	**$7,724,703**	**3.049**	

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

3.0 Environmental Restoration and Minimum Flows and Levels Recovery Projects

As of FY2020, the District has five ongoing environmental restoration and MFL recovery projects that benefit water resources. The Lower Hillsborough River Recovery Strategy and Lower Hillsborough River Pumping Facilities projects are in the Tampa Bay Region. The Lake Hancock Lake Level Modification, the Lake Jackson Watershed Hydrology Investigation, and the Haines City Reclaimed Water MFL Recharge and Advanced Treatment Feasibility Study Projects are in the Heartland region. The Upper Myakka/Flatford Swamp Hydrologic Restoration and Implementation project is in the Southern Planning Region.

3.1 MFL Recovery Lake Hancock Design, Permit, Mitigation to Raise Lake (H008).

The Lake Hancock Lake Level Modification Project is part of the recovery strategy to restore minimum flows the upper Peace River, which is one of the four goals defined in the SWUCA Recovery Strategy. The project involved raising the control elevation of the existing outflow structure on Lake Hancock in order to slowly release water during the dry season to help meet the minimum flow requirements in the upper Peace River between Bartow and Zolfo Springs. Increasing the operating level will also help restore wetland function for several hundred acres of contiguous lands to Lake Hancock and provide recharge to the UFA through exposed sinks along the upper Peace River. Construction is complete and the project is currently in the monitoring phase.

3.2 MIA Recharge SWIMAL Recovery at Flatford Swamp (H089).

Hydrologic alterations and excess runoff have adversely impacted the Flatford Swamp in the upper Myakka watershed, and quantities of water should be removed from the swamp and surrounding areas to restore hydroperiods close to historic levels. The District has conducted evaluations to explore potential beneficial uses of water. In 2016, evaluations began on an injection recharge option that would use excess flow affecting the swamp to recharge the UFA in the vicinity of the MIA of the SWUCA to slow saltwater intrusion. The recharge system would assist with the SWUCA Recovery Strategy's goal of meeting the SWIMAL to help recover and protect groundwater resources in/near the MIA. The ongoing evaluation includes construction of test recharge wells in the Flatford Swamp and the design and permitting of diversion infrastructure for source water.

3.3 Lower Hillsborough River Recovery Strategy (H400).

The District established revised MFLs for the Lower Hillsborough River in 2007. Because the MFLs were not being met, the District incorporated a recovery strategy for the river into Rule 40D-80.073(8), F.A.C. As part of the recovery strategy, the District entered into a joint funding agreement and additional project-specific agreements with the City of Tampa to assess and implement projects associated with diversion of water from various sources to meet minimum flow requirements in the river.

In accordance with the recovery strategy, the City has diverted water from Sulphur Springs to the base of the Hillsborough River Reservoir Dam, as necessary to support river recovery. In addition, the District and more recently the City have diverted water from the Tampa Bypass Canal to the Hillsborough River Reservoir for subsequent diversion to the lower river. The City assumed responsibility for these diversions from the canal through the reservoir in 2018, with transfers of water from the reservoir to the lower river made using a newly constructed sluice gate in the dam that was cooperatively funded by the District and the City. In 2017, the City, with support from the District, completed the Blue Sink Project, which facilitates diversion of water from Blue Sink to the base of the dam for minimum flow recovery, and use of the sink as a recovery source was initiated in 2018. A project between the District and City associated with investigation of storage or additional supply options was completed in 2018 and identified the proposed Tampa Augmentation Project as a potential source for additional water that may be needed for recovery of the lower river. Permitting, design and permit-required monitoring associated with a project involving potential diversion of water from Morris Bridge Sink for river recovery have also been completed, although project implementation is contingent upon future recovery need assessments.

3.4 Lake Jackson Watershed Hydrology Investigations (N554).

Lake Jackson is a 3,412-acre lake located in the City of Sebring and is one of nine lakes in Highlands County with an established MFL. 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 project is a hydrologic investigation, including data collection, to identify the causes of low water level in Lake Jackson and Little Lake Jackson over the last decade and develop cost-effective recovery strategies.

3.5 Haines City Reclaimed Water MFL Recharge and Advanced Treatment Feasibility Study (N888).

This project is for the evaluation of reclaimed water recharge sites, components, and advanced treatment necessary to assist in meeting MFLs on Lake Eva in the "Ridge Lakes" area of the CFWI.

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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 2040 and restore minimum flows and levels (MFLs) to impacted natural systems.

Table 8-1 shows the projected increase in demand for each planning region for the planning period, as described in Chapter 3 of each volume of the Regional Water Supply Plan (RWSP). The table shows that approximately 209.8 mgd of new water supply is needed to meet user demands and to restore natural systems.

Table 8-1. *Summary of total projected increases in demand (5-in-10) (mgd) by each planning region from base year 2015 to 2040*

Planning Region	Projected Demand Increase
Heartland	38.9
Northern	50.4
Southern	44.4
Tampa Bay	76.1
Total	**209.8**

Note: Summation differences occur due to decimal rounding.

A portion of the total demand shown above will be met by existing permitted quantities; however, new regional infrastructure may be required to deliver permitted quantities to end users, and additional water supply development is necessary to maintain adequate capacity for peak demand periods and continuing growth.

To prepare an estimate of the capital cost for projects needed to meet the portion of demand not yet under development, the District has compiled a list of large-scale water supply development (WSD) projects (Table 8-2). The District anticipates that a large portion of the remaining demand will be met through projects that users will select from the water supply options listed in Chapter 5 of this RWSP.

The amount of funding that will likely be generated through 2040 by the various utility, District, state and federal funding mechanisms is compared to the capital cost of the potential large-scale projects. This comparison allows an evaluation of funding adequacy for support of projects necessary to meet water demands.

Part A. Statutory Responsibility for Funding

Section 373.705, Florida Statutes (F.S.), describes the responsibilities of the Water Management Districts (WMDs) in regard to funding water supply development and water resource development 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 Water Resource Development (WRD) projects. As discussed in Chapter 7, the District considers its WRD activities to include resource data collection and analysis as well as projects. In terms of WSD, the District has typically funded the development, storage and transmission of non-traditional sources of water, including reclaimed water and conservation. Potential sources of funding for WSD and WRD projects are addressed below.

Part B. Funding Mechanisms

Section 1. Water Utilities

Water supply development funding has been, and will remain, the primary responsibility of water utilities. Increased demand generally results from new customers that help to finance source development through impact fees and utility bills. Water utilities draw from a variety of revenue sources such as connection fees, tap fees, impact fees (system development charges), base and minimum charges, and volume charges. Connection and tap fees generally do not contribute to WSD or treatment capital costs. Impact fees are generally devoted to the construction of source development, treatment and transmission facilities. Base charges generally contribute to fixed customer costs, such as billing and meter replacement. However, a high base charge, or a minimum charge, which covers the cost of the number of gallons of water use, may also contribute to source development, treatment, and transmission construction cost debt service. Volume charges contribute to both source development/treatment/transmission debt service and operation and maintenance (O&M).

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 the PRMRWSA, are also special water supply districts, but do not have retail customers. Facilities are funded through fixed and variable charges to the utilities they supply which are, in the end, paid by the retail customers of the utilities. All the above-mentioned types of utilities and regional water supply authorities have the ability to issue secure construction bonds backed by revenues from fees, rates and charges.

While some utility revenues will go to pay existing facility debt service, most of that service will be retired in various stages over the next 20 years and debt service for new projects will be added. Projects built late in the 20-year planning period will continue to generate revenues for debt service for many years after the planning period.

Financing through volume-related charges is the most economically efficient means to finance new WSD. Volume charge financing provides consumers and businesses the greatest degree of direct control over water-related costs and a direct incentive to conserve. Such financing increases utility revenue stream variability, but such variability may be reduced through the development of rate stabilization or reserve funds.

If volume charges are utilized to fund higher cost alternative water sources (AWS), the impact on ratepayers can be mitigated through existing and innovative rate structures and charges. High-usage rate blocks can be set to reflect the full marginal cost of the next source of supply. Usage by conserving customers can be set at the existing average embedded cost, as they are not driving the need for additional supply development (or below existing cost if a lifeline rate is necessary). If the rate change to implement this pricing is designed to exceed current revenue requirements, the additional revenue can be dedicated to new source development. Such pricing both encourages conservation and reduces the need for steeper increases in future rates.

Conservation incentivized by block rate structures, in combination with collecting project revenues in advance of construction, can distribute price increases more evenly over time and buffer price fluctuations inherent in common water-pricing practices. This allows customers to adjust water use practices and technology over time. Indexing of prices is another means of distributing price increases over time. If changes to water rates are revenue-neutral, additional conservation can still occur, as the difference between average and marginal price blocks for larger water users increases. There are a number of additional means available to mitigate the impact of higher cost sources to customers. Many of these are addressed in the American Water Works Association's publications Avoiding Rate Shock: Making the Case for Water Rates (AWWA, 2004) and Thinking Outside the Bill: A Utility Manager's Guide to Assisting Low-Income Water Customers (AWWA, 2014).

Section 2. Water Management District

The District's Governing Board provides significant financial assistance for conservation, planning, and alternative water supply (AWS) 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 Facilitating Agricultural Resource Management Systems (FARMS) Program, and the Florida Department of Environmental Protection (FDEP) funding for the Springs Initiative.

1.0 Cooperative Funding Initiative

The primary funding mechanism is the District's CFI, which includes funding for major regional water supply and 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, this highly successful program has resulted in a combined investment (District and cooperators) of approximately $3.3 billion for a variety of water projects addressing the District's four areas of responsibility: water supply, natural systems, flood protection and water quality. From fiscal year (FY) 2016 through FY2020, the District's adopted budget included an average of $56.8 million in ad valorem tax dollars for the CFI program, of which $30 million (53 percent) was for WRD and water supply development assistance.

2.0 District Initiatives

Projects funded through the District Initiatives program are of great importance or a regional priority. The District can increase its percentage match and, in some cases, provide total funding for the project. Examples of these initiatives include: (1) the Quality of Water Improvement Program to plug deteriorated, free-flowing wells that waste water and cause inter-aquifer contamination, (2) the Utilities Services Group to conserve water by assisting utilities in controlling their water loss, (3) data collection and analysis to support major District initiatives such as the MFL program, and (4) the FARMS Program and other various agricultural research projects designed to increase the water-use efficiency of agricultural operations, (5) WRD investigations and MFL Recovery projects which may not have local cooperators, and (6) the Water Incentives Supporting Efficiency (WISE) program launched in 2019 offers cost-share funding for a wide variety of water conservation projects (maximum of $20,000 per project) to a wide variety of non-agricultural entities. From FY2016 through FY2020, the District's adopted budget included an average of $24.5 million in ad valorem tax dollars for District Initiatives, of which $9 million (37 percent) was for WRD and water supply development assistance.

The average total commitment from FY2016 through FY2020 for CFI and District Initiatives was approximately $81.3 million. The continued level of investment for these programs depends on various economic conditions, resource demands, and the District's financial resources. However, the District believes its resources are sufficient to ensure the long-term sustainability of the region's water resources moving forward.

Section 3. State Funding

1.0 The Springs Initiative

The FDEP Springs Initiative is a special legislative appropriation that has provided revenue for protection and restoration of major springs systems. The District has allocated Springs Initiative funding to implement projects to restore aquatic habitats, to reduce groundwater withdrawals and nutrient loading within first-magnitude springsheds, and to improve the water quality and quantity of spring discharges. Projects include the reestablishment of aquatic and shoreline vegetation near spring vents, construction of infrastructure necessary to convey wastewater currently treated in septic systems or package plants to a centralized wastewater treatment facility and may increase reclaimed water production and implementation of other Best Management Practices (BMPs) within springshed basins.

The first year of the appropriation was FY2014, when the District received $1.35 million from FDEP to allocate for springs restoration. To date, the District has been allocated over $55.2 million in Springs Restoration funding from FDEP, including $19.25 million for FY2020, of which $7 million will be budgeted in future years. This funding has provided for reclaimed water projects that will provide approximately 4 mgd in additional reuse flows and 5 mg in reclaimed water storage. The projects receiving Springs Initiative funding have primarily been in the Northern Planning Region, where the majority of first and second magnitude springs within the District are located.

2.0 Water Protection and Sustainability Program

Large areas of Florida do not have sufficient traditional water resources to meet the future needs of the state's growing population and the needs of the environment, agriculture and industry. The state's Water Protection and Sustainability Program Trust Fund (WPSPTF) was created in the 2005 legislative session through Senate Bill 444 to accelerate the development of AWS and later recreated in Chapter 373, F.S., as part of the 2009 legislative session. Legislation focused on encouraging cooperation in the development of alternative water supplies and improving the linkage between local governments' land use plans and the WMDs' RWSPs. The program provides matching funds to the District for AWS development assistance. From FY2006 through FY2009, the District received a total of $53.75 million in legislative allocations through the program for water supply development projects. Annual WPSPTF funding resumed in FY2020 with $250,000 allocated to the District.

Program funds are applied toward a maximum of 20 percent of eligible project construction costs. In addition, the Legislature established a goal for each WMD to annually contribute funding equal to 100 percent of the state funding for AWS development assistance, which the District has exceeded annually. The legislation also requires that a minimum of 80 percent of the WPSPTF funding must be related to projects identified in a district water supply plan. The District's RWSP is utilized in the identification of the majority of WPSPTF-eligible projects.

Projects are evaluated for funding based on consideration of the 12 factors described in Subsections 373.707(8)(f) and (g), F.S., and additional District evaluation factors as appropriate. If the Legislature continues to fund the state's WPSPTF, it could serve as a significant source of matching funds to assist in the development of alternative water supplies and regional supply infrastructure in the region.

3.0 The Florida Forever Program

The Florida Forever Act, as originally passed by the Florida Legislature in 1999, established the 10-year $3 billion statewide Florida Forever Program. The Program was extended by the Legislature during the 2008 legislative session, allowing the Program to continue for 10 more years at $300 million annually

Since 1999, the District has allocated $95 million ($81.6 million for land acquisition and $13.4 million for water body restoration) of Florida Forever funding Districtwide in support of WRD. A "water resource development project" eligible for funding is defined in Section 259.105, F.S. (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 Program

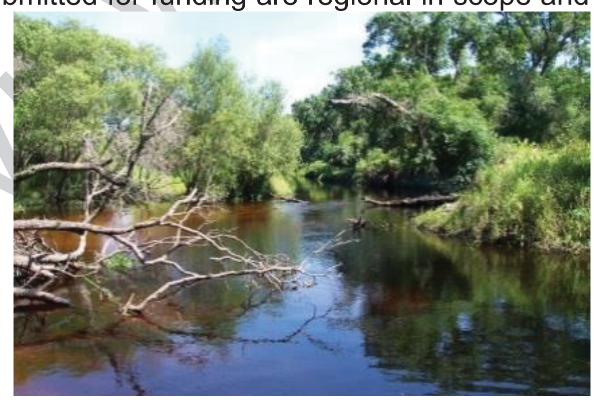
Operating under Chapter 40D-26, Florida Administrative Code (F.A.C.), the FARMS Program, through the District, utilizes additional state funding when available. Since the inception of the program, the District has received $6.4 million in state appropriations and $1.3 million from the Florida Department of Agriculture and Consumer Services (FDACS). No funding was provided by the state from FY2015 through FY2020.

5.0 West-Central Florida Water Restoration Action Plan

The West-Central Florida Water Restoration Action Plan (WRAP) is an implementation plan for components of the SWUCA recovery strategy adopted by the District. The document outlines the District's strategy for ensuring that adequate water supplies are available to meet growing demands, while at the same time protecting and restoring the water and related natural resources of the SWUCA. The WRAP prescribes measures to implement the recovery strategy and quantifies the funds necessary, making it easier for the District to seek funding for the initiative from state and federal sources. In 2009, the Legislature officially recognized the WRAP through Senate Bill 2080, creating Section 373.0363, F.S., as the District's regional environmental restoration and water resource sustainability program for the SWUCA. In FY2009 the District received $15 million in funding for the WRAP; however, no new funding has been provided via state appropriation since that time.

Section 4. Federal Funding

In 1994 the District began an initiative to seek federal matching funds for water projects. Since that time, the Office of the Governor, the FDEP, other WMDs, and local government and regional water supply authority sponsors have joined with the District to secure federal funding. Through a cooperative effort with members of Florida's Congressional Delegation, the federal initiative has grown substantially. In 1999 the effort was expanded to seek funding for the development of alternative source projects and, in 2001, the state of Florida and the WMDs expanded a list of projects in order to seek all available resources to develop an environmentally sustainable water supply strategy that would meet the demands of growth throughout the state. The projects include the use of AWS technologies, as well as stormwater retention and filtering and wastewater treatment. Each WMD certifies that the projects submitted for funding are regional in scope and that matching funds are available either from the District's budget or from a local government sponsor.



Myakka River watershed

Within the District, Federal matching funds from this initiative helped fund the construction of the 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 Development Act aids in the efforts to secure funding for the Peace River and Myakka River watersheds restoration initiative. District staff considers funding for water supply projects to be a top priority and continues to work with the Office of the Governor, the FDEP, the U.S. Army Corps of Engineers, and the members of the Florida Congressional Delegation to secure federal funding.

1.0 U.S. Department of Agriculture Natural Resources Conservation Service Programs

The National Resources Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP) provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands. The program provides assistance to farmers and ranchers to comply with federal, state, and tribal environmental laws that encourage environmental enhancement. The program is achieved through the implementation of a conservation plan that includes structural, vegetative, and land management practices. The program is carried out primarily in priority areas where significant resource concerns exist. Agricultural water supply and nutrient management through detention/retention or tailwater recovery ponds can be pursued through this program.

In addition to EQIP, the FARMS Program has partnered with NRCS through the Agriculture Water Enhancement Program (AWEP) and the Florida West Coast Resource Conservation and Development Council (RC&D) to bring additional NRCS cost-share funding to the SWUCA. The AWEP was created by the 2008 Farm Bill with similar goals as the EQIP program, including conserving and/or improving the quality of ground and surface water. The RC&D is a nonprofit organization that promotes sustainable agriculture and local community food systems in Hillsborough, Manatee, Pinellas, and Sarasota counties.

The District's FARMS Program works cooperatively with the NRCS EQIP, AWEP, and RC&D programs on both financial and technical levels, and dual cost-share projects have been coordinated whenever possible. By an agreement between the District, FDACS, and the NRCS, the maximum funding for using both FARMS and EQIP is 75 percent of total project cost. As of FY2018, 41 FARMS projects Districtwide have involved some level of dual cost-share with EQIP, AWEP, and/or the RC&D, with several additional cooperative projects expected in the near future. On a technical level, agency interaction includes using the NRCS mobile irrigation lab to investigate using FARMS cost-share for improvements to overall irrigation system efficiency, using NRCS engineering designs for regulatory agricultural exemptions whenever possible, and coordinating cost-share on specific project related infrastructure. For example, FARMS may assist with an alternative source of irrigation water and EQIP assists with an upgrade to an irrigation delivery system. The relationship is mutually beneficial, extends cost-share dollars, and provides more technical assistance to participants in both programs.

Section 5. Public-Private Partnerships and Private Investment

As traditional water sources reach their capacity, alternative sources must be developed that involve specialized technical expertise and risky financial investments. The development of such technologies may be beyond the ability and level of tolerance of many water utilities. A range of public/private partnership options are available to provide this expertise and shift the financial risk. These options range from all-public to all-private ownership, design, construction, and facility operation. Investment and competition among private firms desiring to fund, build, or operate WSD projects could reduce project costs, potentially resulting in lower customer charges.

In addition to investor-owned public supply utilities, private risk sharing could be undertaken by three distinct forms of water supply entities: (1) public-private partnerships consisting of public utilities or regional water supply authorities contracting with private entities to design, build, or operate facilities (2) cooperative institutions such as irrigation districts contracting with private entities and (3) private entities, which could identify a customer base and become a water supplier to one or more water use types.

1.0 Public-Private Utility Partnerships

Two advantages of public-private partnerships are 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 O&M. The cost savings over the life cycle of the contract is expected to be significant.

Public-private partnerships are becoming more common as water technology and regulation becomes increasingly complex. Increasing numbers of regulated pollutants and new higher-risk technologies drive privatization of some public water supply responsibilities. Partnerships work best where risks are beyond public sector tolerance, a project is new and standalone, construction and long-term operation are combined, there are clearly defined performance specifications, and there are clearly defined payment obligations (Kulakowski, 2005). Small utilities may not have the resources or project sizes sufficient to attract private interest but may participate through multi-utility agreements or through a regional water supply entity. A significant benefit of cooperation in larger projects is the economies of scale common in the water supply industry.

2.0 Cooperatives

Cooperatives are arrangements where multiple self-supplied water users pool their resources to construct water facilities that they could not technically or economically undertake on their own. They also share the risks. Such private or public/private cooperative institutions are more common where lengthy transmission systems are required, such as in the western U.S. where surface water is distributed to water districts and for irrigation. Water is usually obtained from a supplier at a cost and then distributed among members by the water district. Members cooperatively fund the construction of transmission and distribution facilities. As groundwater resources become increasingly limited and reclaimed water systems expand, the same type of economic forces that created irrigation and water districts in the west could develop in portions of Florida. Cooperatives may also shift financial risk by entering into design, build, and operate arrangements with contractors. One example of this structure is the Polk Regional Water Cooperative, formed in 2016 to address the development and provision of AWS to its member local governments. Other forms of cooperative institutions in Florida, such as drainage districts and grower cooperatives, have effectively reduced competition and litigation over resources (OPPAGA, 1999).

3.0 Private Supply Investment (Aside from Investor-Owned Public Supply)

Private Supply Investment is where investors identify an unserved customer base and develop water facilities to meet those needs. This type of investment may facilitate the development of alternative water supplies. Such private financial investment occurs where firm regulatory limits are in place to protect water resources and related environmental features, and further development of traditional sources are not allowable. Although the purpose of the regulatory measures is resource protection, they indirectly create a customer base for alternative source developers.

Part C. Amount of Funding Anticipated to Be Generated or Made Available Through District and State Funding Programs and Cooperators

Section 1. Projection of Potentially Available Funding

- Below is a summary of projected resources that could be generated by the District and state funding programs for WRD and WSD projects. An explanation follows as to how the funding amounts are derived.

- Cooperative Funding Initiative (CFI). With the Governing Board's direction for a continued investment in vital projects to protect the region's water resource needs, the District's most recent long-range plan estimated approximately $1.33 billion in ad valorem tax dollars would be allocated for the CFI from 2021 through 2040. Assuming these funds are used for projects that would be matched by a partner on an equal cost-share basis, this would collectively result in $2.66 billion generated through the program. If the funding allocation of the program remains consistent with the previous five years, approximately $1.41 billion (53 percent) could potentially be utilized for water source development and water supply development assistance. However, the allocation of resources is typically driven by new requests submitted through the CFI program each year, which could significantly influence this funding projection, as the Governing Board may direct more funding for the District's other areas of responsibility (i.e., flood protection, water quality and natural systems). It is important to note that funding does not include state or federal funds, which the District and its partners continue to seek.

- District Initiatives. Also consistent with the District's most recent long-range funding plan, an estimated $579 million in ad valorem tax dollars would be allocated for District Initiatives from 2021 through 2040. If the funding allocation of the program remains consistent with the previous five years, approximately $214 million (37 percent) could potential be utilized for water source development and water supply development assistance. However, if the Governing Board elects to direct more funding for the District's other areas of responsibility (i.e., flood protection, water quality and natural systems), this funding projection could be significantly influenced. It is important to note that funding does not include state, federal or local funds, which the District continues to seek.

- 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 AWS 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.

If funding allocations remain consistent with the previous five years, approximately $1.62 billion could potentially be generated or made available to fund the CFI and District Initiative projects necessary to meet the WSD through 2040 and to restore MFLs for impacted natural systems. This figure may be conservative, since it is not possible to determine the amount of funding that may be available in the future from the federal government and state legislative appropriations.

Section 2. Evaluation of Project Costs to Meet Projected Demand

Of the 209.8 mgd of projected Districtwide demand increases during the 2015 to 2040 planning period to meet the demand for all users and to restore MFLs for impacted natural systems, it is estimated that 46 mgd, or 22 percent of the demand, has either been met or will be met by reclaimed water and conservation projects that are under development. The total District share of cost for the projects currently under development including regional transmission, ASR, and brackish groundwater treatment systems is $490 million.

To develop an estimate of the capital cost of projects necessary to meet demand, the District compiled a list of large-scale WSD projects that have been proposed for development within the 2040 planning timeframe. These projects proposed by the PRMRWSA, Tampa Bay Water, and Polk Regional Water Cooperative have the potential to produce up to 105 mgd of water supply. The estimated costs and the quantity of water they will produce are listed in Table 8-2. Many of these are AWS projects that would be eligible for co-funding by the District. The table shows the estimated total cost of the 100 to 105 mgd of water supply that will be produced by these projects is up to $1.57 billion.

The PRMRWSA draft 2020 Integrated Regional Water Supply Plan contains several AWS projects, many of which would be eligible for co-funding by the District. The PRMRWSA's priority projects would provide for up to 25 mgd in additional capacity with capital cost estimate of approximately $397 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 AWS 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 AWS and conservation projects chosen by users. The potential water supply project options are discussed in Chapter 5 for each planning region.

Table 8-2. *Proposed large-scale water supply and water resource development projects by 2040 (millions of $)*

Project	Entity to Implement	Quantities (mgd)	Capital Costs
Peace River Facility Surface Water System Expansion and Regional Reservoir	PRMRWSA	15	$208
Regional Loop System and ASR Projects	PRMRWSA	10	$189
Flatford Swamp Hydrologic Restoration	TBD	10	$44-96
Southeast Wellfield and West Polk County Lower Aquifer Deep Wells	PRWC	45	$650
Big Bend Desalination	TBW	10-12.5	$244
Enhanced Surface Water Expansion from Alafia River	TBW	10-12.5	$88
New Regional Feed Line to Balm Area	TBW	N/A	$76-97
Subtotal Southern Planning Region		**35**	**$441-493**
Subtotal Heartland Planning Region		**45**	**$650**
Subtotal Tampa Bay Planning Region		**20-25**	**$408-429**
Total – Districtwide		**100-105**	**$1,499-1,572**

Section 3. Evaluation of Potential Available Funding to Assist with the Cost of Meeting Projected Demand

The conservative estimate of $2.66 billion in cooperator and District financial resources that will be generated through 2040 for funding is sufficient to meet the projected $1.50 to $1.57 billion total cost of the large-scale projects listed in Table 8-3. State and federal funding sources may also assist with any remaining and/or high-end costs for future AWS 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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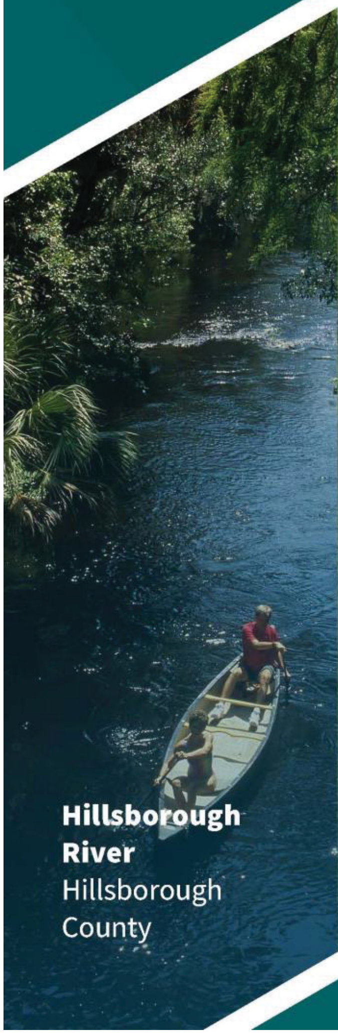
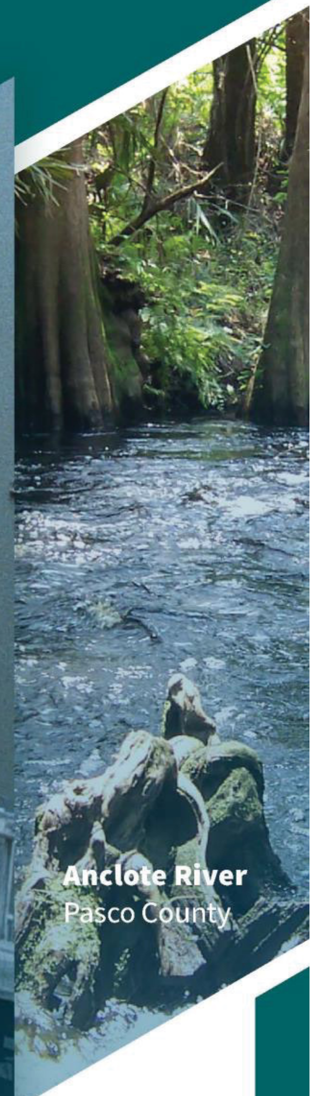
2020 Regional Water Supply Plan

Tampa Bay Planning Region

April 2020





Southwest Florida Water Management District

The Southwest Florida Water Management District (District) does not discriminate on the basis of disability. This nondiscrimination policy involves every aspect of the District's functions, including access to and participation in the District's programs, services and activities. Anyone requiring reasonable accommodation, or would like information as to the existence and location of accessible services, activities, and facilities, as provided for in the Americans with Disabilities Act, should contact Donna Kaspari, Sr. Performance Management Professional, at 2379 Broad St., Brooksville, FL 34604-6899; telephone (352) 796-7211 or 1-800-423-1476 (FL only), ext. 4706; or email ADACoordinator@WaterMatters.org. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1-800-955-8771 (TDD) or 1-800-955-8770 (Voice). If requested, appropriate auxiliary aids and services will be provided at any public meeting, forum, or event of the District. In the event of a complaint, please follow the grievance procedure located at WaterMatters.org/ADA.

2020 Regional Water Supply Plan
Tampa Bay Planning Region

Public Review Draft

April 2020

For further information regarding this plan, please contact the Water Supply Section at:

2379 Broad Street
Brooksville, FL 34604-6899
(352) 796-7211 or
(800) 423-1476 (Florida Only)

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Southwest Florida Water Management District

2020 Regional Water Supply Plan

This report is produced by the Southwest Florida Water Management District

April 2020 – Public Review Draft

District Project Manager: Joseph Quinn, AICP

District Contributors

Anthony Andrade
Ron Basso, P.G.
Mike Bray
April Breton
Miurel Brewer
Joel Brown
Mike Cacioppo
Cortney Cameron
Donna Campbell
Jake Cuarta
Corey Denninger, GISP
Don Ellison, P.G.
Randy Emberg
Carole Estes, P.G.
John Ferguson, P.G.
Mark Fulkerson, Ph.D., P.E.
Frank Gargano
Yonas Ghile
Jim Golden, AICP
Mohamed Hersi
Mary Margaret Hull, APR
Doug Leeper
Tamera McBride, P.G.
Lisann Morris, P.E., PMP
Cassidy Hampton
Mike Hancock, P.E.
Jerry Harding
Darrin Herbst, P.G.
Jay Hoecker, PMP
Ashlee Hollifield
Thomas Kiger, P.E.
Luke LeMond, P.G.
Josh Madden
Lydia Manos
Cara Martin, APR
Jeremy McKay
Jason Patterson
Ryan Pearson
Robert Peterson, P.G.
Amy Poxson
Dennis Ragosta
Patricia Robertshaw
Cindy Rodriguez
Danielle Rogers
Carmen Sanders
George Schlutermann, P.G.
Andrea Shamblin
Virginia Singer
Claire Stapley
Susanna Martinez Tarokh
Chris Tumminia
Don Weaver
Jeff Whealton, P.W.S.
Brent White
Kevin Wills
Marra Wood
Lei Yang
Allen Yarbrough
Chris Zajac

Other Contributors

Wade Trim, Inc.
Sarah Mastison
Brad Cornelius, AICP, CPM
Amanda Warner, AICP

This report is available online at: WaterMatters.org/RWSP
You may send a request for a printed copy to info@watermatters.org

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List of Abbreviations

AG	Agriculture
AMA	Advanced Metering Analytics
AR	Aquifer Recharge
ASR	Aquifer Storage and Recovery
AWE	Alliance for Water Efficiency
AWEP	Agriculture Water Enhancement Program
AWS	Alternative Water Supply
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
CFWI	Central Florida Water Initiative
CHAMP℠	Conservation Hotel and Motel Program
CII	Commercial, Industrial, and Institutional
COC	Cycle of Concentration
DEP	Florida Department of Environmental Protection
DO	Dissolved Oxygen
DOH	Department of Health
DPCWUCA	Dover/Plant City Water Use Caution Area
DSS	Domestic Self Supply
DWRM	Districtwide Regulation Model
EDR	Electro-Dialysis Reversal
ELA	Environmental Look Arounds
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
FDOT	Florida Department of Transportation
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
GOES	Geostationary Operational Environmental Satellites
GPD	Gallons per Day
GPF	Gallons per Flush
GRP	Gross Regional Product

HE	High Efficiency
HET	High Efficiency Toilets
HRWUCA	Highlands Ridge Water Use Caution Area
I/C	Industrial/Commercial
ICU	Intermediate Confining Unit
IAS	Intermediate Aquifer System
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
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
NDM	Northern District Model
NHARP	North Hillsborough Aquifer Recharge Program
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPR	Northern Planning Region
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
PRWC	Polk Regional Water Cooperative
PS	Public Supply
PSI	Pounds per Square Inch
QWIP	Quality of Water Improvement Program
RC&D	Florida West Coast Resource Conservation and Development Council
RIB	Rapid Infiltration Basin
RO	Reverse Osmosis
ROMP	Regional Observation and Monitor-well Program
RPC	Regional Planning Council
RWSP	Regional Water Supply Plan
SHARE	South Hillsborough Aquifer Recharge Expansion
SHARP	South Hillsborough Aquifer Recharge Project
SJRWMD	St. Johns River Water Management District

SMS	Soil Moisture Sensor
SPJC	Shell, Prairie, and Joshua Creek
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
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geologic Survey
WMD	Water Management District
WMP	Watershed Management Program
WPSPTF	Water Protection and Sustainability Program Trust Fund
WQMP	Water Quality Monitoring Program
WRAP	Water Resource Assessment Project or West-Central Florida Water Restoration Action Plan
WRD	Water Resource Development
WRWSA	Withlacoochee Regional Water Supply Authority
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 (SWFWMD) (District) is an assessment of projected water demands and potential sources of water to meet these demands for the period from 2020 through 2040. The RWSP has been prepared in accordance with the Florida Department of Environmental Protection's (FDEP) 2019 Format and Guidelines for Regional Water Supply Planning. The RWSP consists of four geographically based volumes that correspond to the District's four designated water supply planning regions: Northern, Tampa Bay, Southern and Heartland (Figure 1-1). This volume is the 2020 RWSP update for the Tampa Bay Planning Region, which includes Hillsborough, Pasco, and Pinellas counties. The District completed RWSPs in 2001, 2006, 2010, and 2015 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 (AWSs) 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 AWSs by local governments, water supply authorities and other water users.

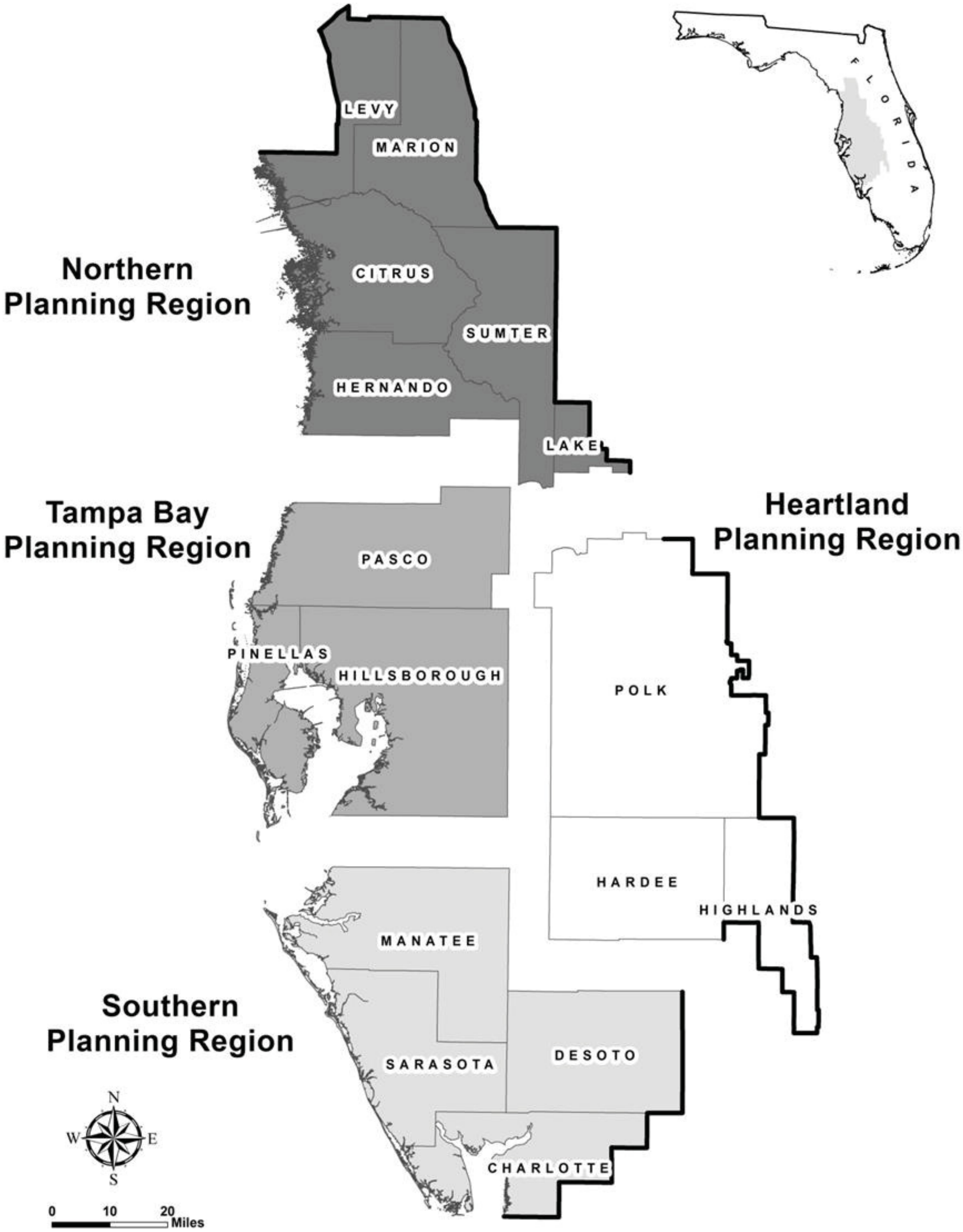

Figure 1-1. Location of the four water supply planning regions within the District

Part A. Introduction to the Tampa Bay Planning Region Regional Water Supply Plan

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 2015 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 2040 for public supply (PS), agricultural (AG), industrial/commercial (I/C), mining/dewatering (M/D), power generation (PG), and landscape/recreation (L/R) users. 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 AWS 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, Water Supply Projects Under Development, 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 (WRD). Chapter 8, Funding Mechanisms, provides an estimate of the capital cost of water supply and WRD projects proposed by the District and its cooperators to meet the water supply demand projected through 2040 and to restore MFLs to impacted natural systems. An overview of mechanisms available to generate the necessary funds to implement these projects is also provided.

Part B. Accomplishments since Completion of the 2015 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 2015 update was approved by the Governing Board in November 2015.

Section 1. Alternative Water Supply Conservation, and Reuse Development

1.0 Alternative Water Supply

The District has provided cooperative funding to Tampa Bay Water (TBW) for several projects, including the System Configuration II project and a surface water expansion study. In 2018, TBW completed its fourth update to its Long-Term Master Water Plan. The update indicates an additional 20 million gallons per day (mgd) of supply is needed through 2040 planning horizon and construction of these projects could be delayed by implementation of conservation and efficiency initiatives. These initiatives, which involve District cooperative funding, would also be more cost-effective than new water supply projects. Potential new projects for accomplishing the 20 mgd include upgrades and enhancements to TBW's surface water and desalination water treatment plants. Another potential option is New Groundwater via Net Benefit from the South Hillsborough Aquifer Recharge Program (SHARP). Several configurations of these three projects were investigated to meet future demands.

The District has also provided cooperative funding for aquifer storage and recovery (ASR) and recharge projects within the region. District-funded recharge feasibility and pilot testing projects include those for Hillsborough County and the cities of Tampa and Clearwater. The SHARP/Sothern Hillsborough Aquifer Recharge Expansion (SHARE) is a direct aquifer recharge pilot project utilizing reclaimed water. The TAP involves a study that explores the cost and feasibility of beneficially reusing reclaimed water from the Howard F. Current Advanced Wastewater Treatment Plant. The City of Clearwater Groundwater Replenishment Project (Phase 3) involves the design, third-party review, permitting and construction of a full-scale water purification plant and injection and monitor well systems to recharge the UFA with 2.4 mgd annual average of purified recycled water at the City's Northeast Water Reclamation Facility.

Finally, the District is cooperatively funding a Brackish Feasibility and Testing Project for the Town of Belleair. The study will evaluate the suitability of the aquifer as a potential AWS source.

2.0 Water Conservation

The District continues to promote and cooperatively fund water conservation efforts to more efficiently use existing water supplies. In the public supply sector, for fiscal years 2015-2019, this includes cooperatively-funded projects for toilet rebates, rain sensors, water-efficient landscape and irrigation evaluations, soil moisture sensors, Florida Water Star℠ (FWS) rebates, advanced metering analytics (AMA) customer portals, conservation kits, satellite leak detection, and clothes washers. The District has funded conservation projects undertaken by Pasco and Hillsborough counties and the cities of St. Petersburg, Tampa, New Port Richey, and Port Richey.

In the AG 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 (BMPs) to reduce groundwater use and improve water quality. To date, more than 194 operational projects Districtwide are providing a groundwater offset of more than 27 mgd. An additional nine projects in the planning, design or construction phase are expected to yield another 0.98 mgd of offset. Within the Tampa Bay Planning Region, FARMS has funded 49 operational projects providing 2.6 mgd of offset with another 2 projects under construction that are expected to yield an additional 0.04 mgd.

3.0 Reclaimed Water

The District has continued its highly successful program to cooperatively fund projects that make reclaimed water available for beneficial reuse. These include more than 385 projects between fiscal year (FY)1987 and FY2020 for the design and construction of transmission, distribution, recharge, natural system enhancement, storage and pumping facilities, metering, feasibility studies, reuse master plans, and research projects. As a consequence of District and utility cooperation, reuse projects were developed that will result in the 2025 Districtwide utilization of reclaimed water of more than 228 mgd and a water resource benefit of more than 137 mgd. Utilities are on their way to achieving the 2040 Districtwide goals of 353 mgd utilization (75 percent) and 269 mgd of water resource benefit (75 percent efficiency).

In 2015, utilities within the Tampa Bay region were utilizing approximately 36 percent or 89 mgd of the 248 mgd of available wastewater treatment plant flows resulting in nearly 63 mgd of water resource benefits (70 percent efficiency). There are 22 reclaimed water supply projects under development and at least one other that is estimated to experience additional future supply growth. When complete, these projects will supply 49 mgd of reclaimed water that will result in approximately 39 mgd of potable-quality water benefits at a total cost of approximately $70 million.

Section 2. Support for Water Supply Planning

The District is actively involved in providing technical support to local governments as they prepare statutorily required Water Supply Facilities Work Plans and related updates as part of their comprehensive plans. District staff worked with the Department of Economic Opportunity and its predecessor (Department of Community Affairs), the FDEP, and the other WMDs to develop a guidance document for preparing the work plans. Staff provides ad hoc assistance to local governments and instituted a utility services program to assist utilities with planning, permitting, and information/data needs.

Section 3. Minimum Flows and Levels Establishment

1.0 Established Minimum Flows and Levels

Minimum flows and water levels (MFLs) established in the planning region during or since 2015 and as of July 19, 2019 include those for lakes Alice, Allen, Big Fish, Bird, Brant, Buddy, Crews, Crystal, Dan, Deer, Dosson, Hanna, Harvey, Hobbs, Horse, Juanita, Keene, Kell, Little Moon, Merrywater, Moon, Padgett, Pasadena, Pierce, Rainbow, Round, Saddleback, Starvation, Sunset, Sunshine, and Virginia. Camp lake was reevaluated, and no changes were necessary to the adopted levels. Flowing water body MFLs made effective during or since 2015 include those for the lower and upper segments of the Pithlachascotee River. The District continues to re-evaluate and establish new MFLs per the Priority List and Schedule for the Establishment of Minimum Flows, Minimum Water Levels and Reservations, and as part of the Comprehensive Environmental Resources Recovery Plan for the Northern Tampa Bay Water Use Caution Area (NTBWUCA) (see Chapter 2, Part B, and Appendix 2).

2.0 Minimum Flows and Levels Recovery Initiatives

The northern portion of the Southern Water Use Caution Area (SWUCA) lies in the southern portion of the Tampa Bay Planning Region. In 2018, the District completed its second five-year assessment of the SWUCA recovery strategy (SWFWMD, 2018). The purpose of the five-year assessment, which is required by rule, is to evaluate and assess the recovery in terms of resource trends; trends in permitted and used quantities of water; and completed, ongoing, and planned projects. The assessment provides the information necessary to determine progress in achieving recovery and protection goals, and allows the District to revise its approach, if necessary, to respond to changes in resource conditions and issues. Results from the second five-year assessment indicate the District continues to make progress toward recovery, but challenges to full recovery by 2025 remain. Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing WRD projects designed to augment or preserve existing flows and water levels.

The NTBWUCA also occurs in the Tampa Bay Planning Region. The first phase of the recovery strategy for the NTBWUCA (2000-2010) was 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. Through conservation efforts and development of an enhanced surface water system and a seawater desalination facility, this objective has been achieved since 2010. The second phase of the recovery strategy (2010-2020) focuses on the assessment of recovery in waterbodies due to the reduced groundwater withdrawals.

The District expects to receive a Water Use Permit (WUP) renewal application for TWB's Consolidated Permit during the summer of 2020. The Consolidated Permit includes ten public supply wellfields, providing 90 mgd of water supply for most of the Northern Tampa Bay (NTB) area. In addition, the Comprehensive Environmental Resources Recovery Plan, also known as the Phase II Recovery Plan, developed and adopted by rule and as a permit condition for assessing the hydrologic recovery achieved in the Phase I Recovery Plan (1998 to 2010), will be submitted to the District by TBW by the end of 2020.

The District established revised minimum flows for the lower Hillsborough River (LHR) in 2007, along with a recovery strategy for achieving the minimum flows within a decade. As part of the recovery strategy, the District entered into a joint funding agreement and additional project-specific agreements with the City of Tampa to assess and implement projects associated with diversion of water from various sources to meet minimum flow requirements in the river. During and since 2015, the City has continued diversion of water from Sulphur Springs to the base of the Hillsborough River Reservoir Dam, as necessary to support river recovery. In addition, the District and more recently the City have continued the diversion of water from the Tampa Bypass Canal (TBC) to the Hillsborough River Reservoir for subsequent diversion to the lower river. The City assumed responsibility for these diversions in 2018, with transfers of water from the reservoir to the lower river made using a newly constructed sluice gate in the dam that was cooperatively funded by the District. In 2017, the City, with support from the District, completed the Blue Sink Project, which facilitates diversion of water from Blue Sink to the base of the dam for minimum flow recovery, and use of the sink as a recovery source was initiated in 2018. A project between the District and City associated with investigation of storage or additional supply options was completed in 2018 and identified the proposed TAP as a potential source for additional water that may be needed for recovery of the lower river. Permitting, design, and permit-required monitoring associated with a project involving potential diversion of water from Morris Bridge Sink for river recovery have also been completed, although project implementation is contingent upon future recovery need assessments.

During and since 2015, the District has continued to annually assess and report progress on the LHR recovery strategy. In addition, the first of three planned five-year recovery strategy assessments were completed in 2015 (SWFWMD and Atkins, North America, Inc., 2015) and completion of a second assessment is ongoing. The goals of the annual and five-year assessments, which are required by rule, include evaluation of the hydrology, selected water quality characteristics, and biological effects achieved from implementation of recovery strategy projects. The annual and five-year assessments have documented improvements in water quality and other ecological conditions in the LHR as a result of minimum flow implementation, although minimum flow requirements have not been met on all days. Flow deficits, i.e., flows needed to meet minimum flow requirements, are expected to be eliminated upon full implementation of all projects identified in the recovery strategy.

Section 4. Quality of Water Improvement Program and Well Back-Plugging

Since the 1970s, the Quality of Water Improvement Program (QWIP) has prevented waste and contamination of water resources (both groundwater and surface water) by reimbursing landowners for plugging abandoned or improperly constructed artesian wells. The program focuses on the southern portion of the District where UFA is under artesian conditions, creating the potential for mineralized water to migrate upward and contaminate other aquifers or surface waters. The program reimburses approximately 200 well-pluggings per year and more than 6,800 have been reimbursed since inception. In the Tampa Bay Planning Region, 1,313 well-pluggings have been reimbursed since the QWIP program began.

A related effort, now part of the FARMS Program, involves the rehabilitation (or back-plugging) of agricultural irrigation wells to improve water quality in groundwater and surface waters and improve crop yields. The program initially targeted the Shell Creek, Prairie Creek, and Joshua Creek watersheds to decrease the discharge of highly mineralized water into Shell Creek, the City of Punta Gorda's municipal water supply. The program has retrofitted 85 wells as of September 2018, with 63 of these in the target watersheds. 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 BMP 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 as 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.

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 3.2 million in

2015 to approximately 4.1 million in 2040. This is an increase of approximately 900,000 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 (2017)*

Lan- Use/Land Cover Types (2017)	Acres	Percent
Urban and Built-up	533,825.94	39.34
Agriculture	222,692.77	16.41
Rangeland	30,784.38	2.27
Upland Forest	141,072.70	10.40
Water	51,285.17	3.78
Wetlands	250,341.38	18.45
Barren Land	3,751.33	0.28
Transportation, Communication and Utilities	42,405.23	3.12
Industrial and Mining	80,892.82	5.96
Total	**1,357,051.72**	**100.00**

Source: SWFWMD 2017 LULC GIS layer (SWFWMD, 2019).

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

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 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. The TBC is the former Six Mile Creek/Palm River that was extensively altered by construction of the canal. 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 Tampa Bay Water.

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, The Lithia and Buckhorn Springs Group 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 minimum flows for the river and implementation of an 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, i.e., the Lithia and Buckhorn Springs Group, 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.

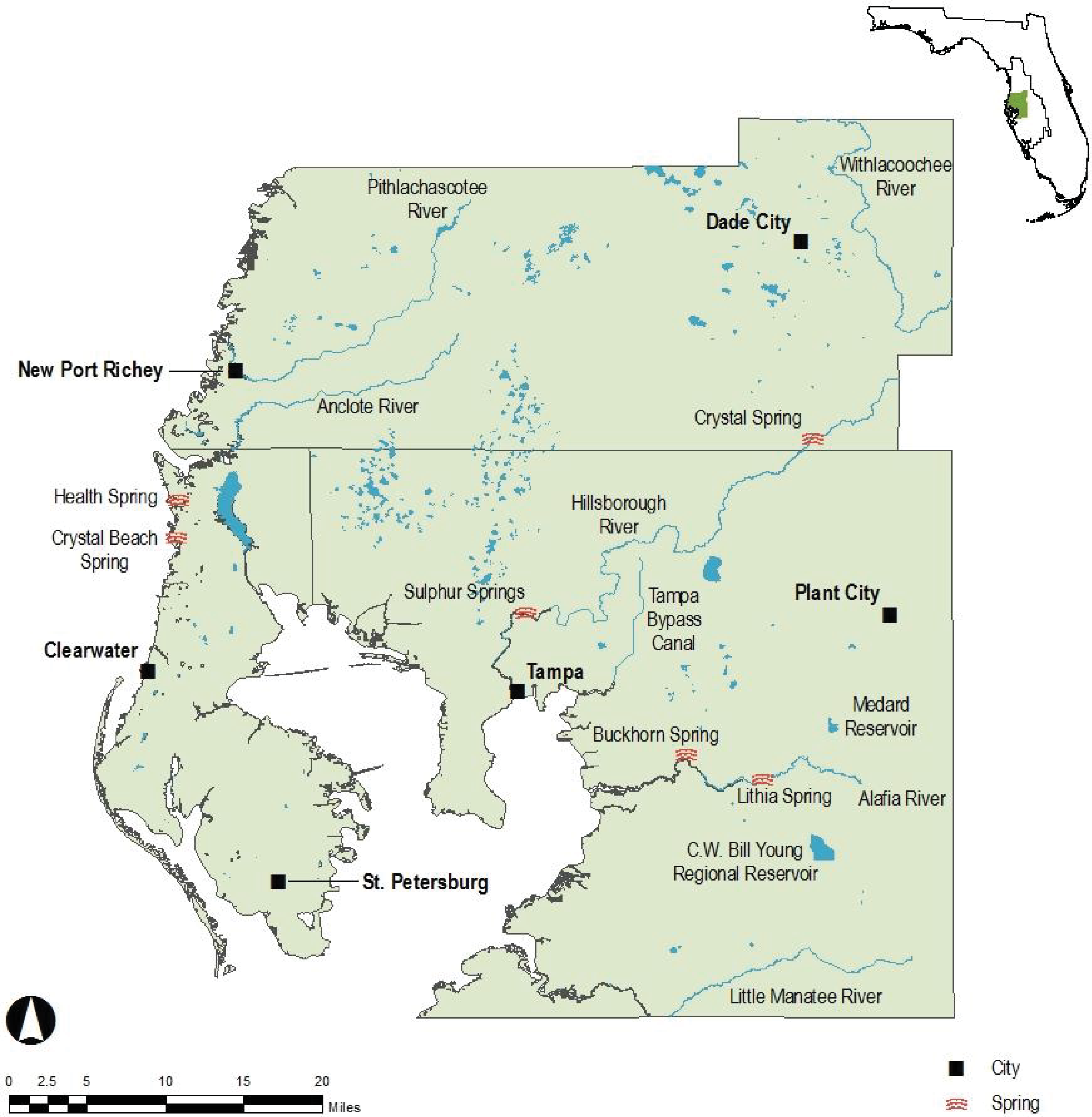

Figure 1-2. *Major hydrologic features in the Tampa Bay Planning Region*

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 Tampa Bay Planning Region 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.

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 (SWCFGWB) 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-leaky 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.

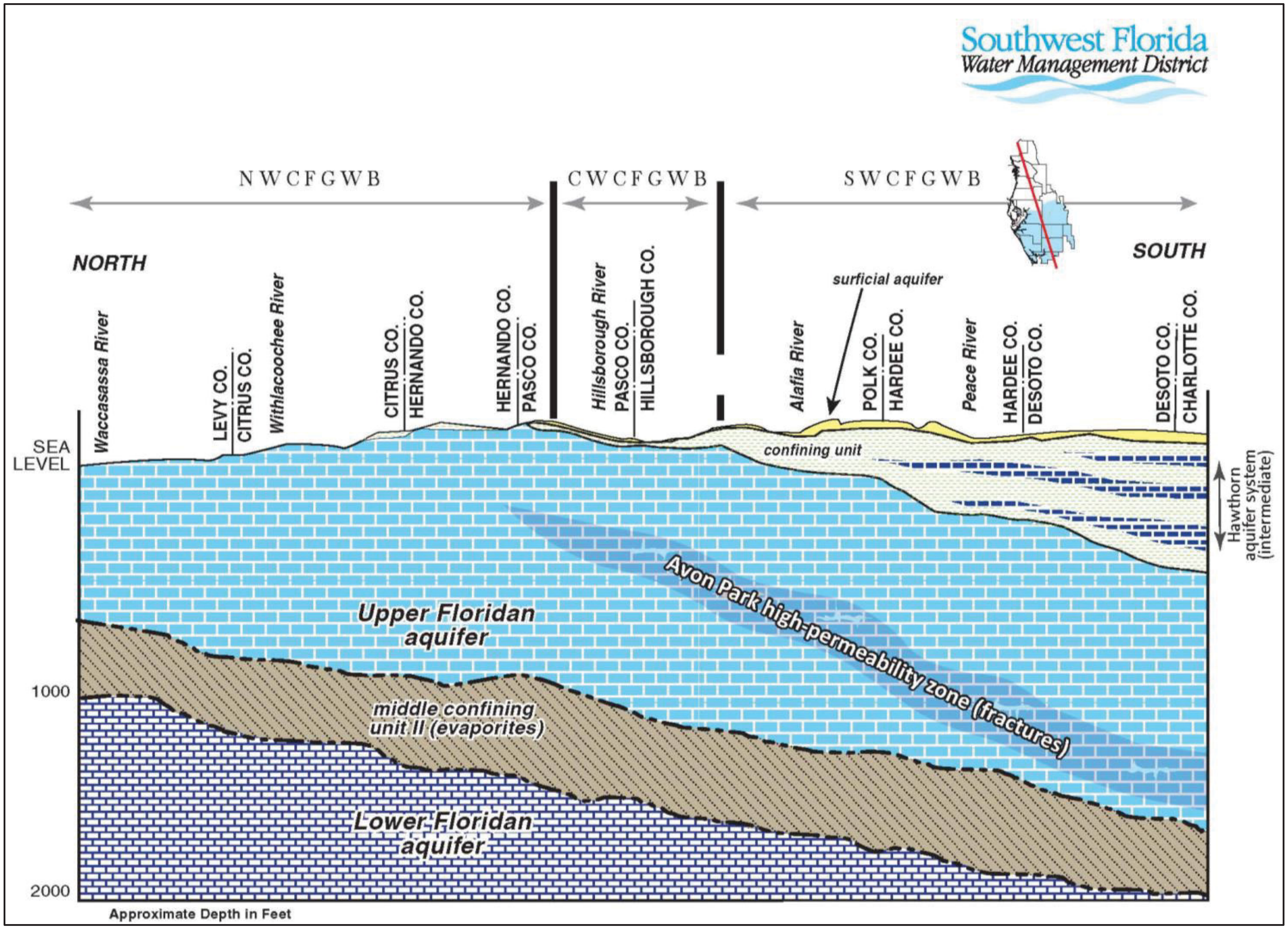

Figure 1-3. *Generalized north-south geologic cross section through the District*

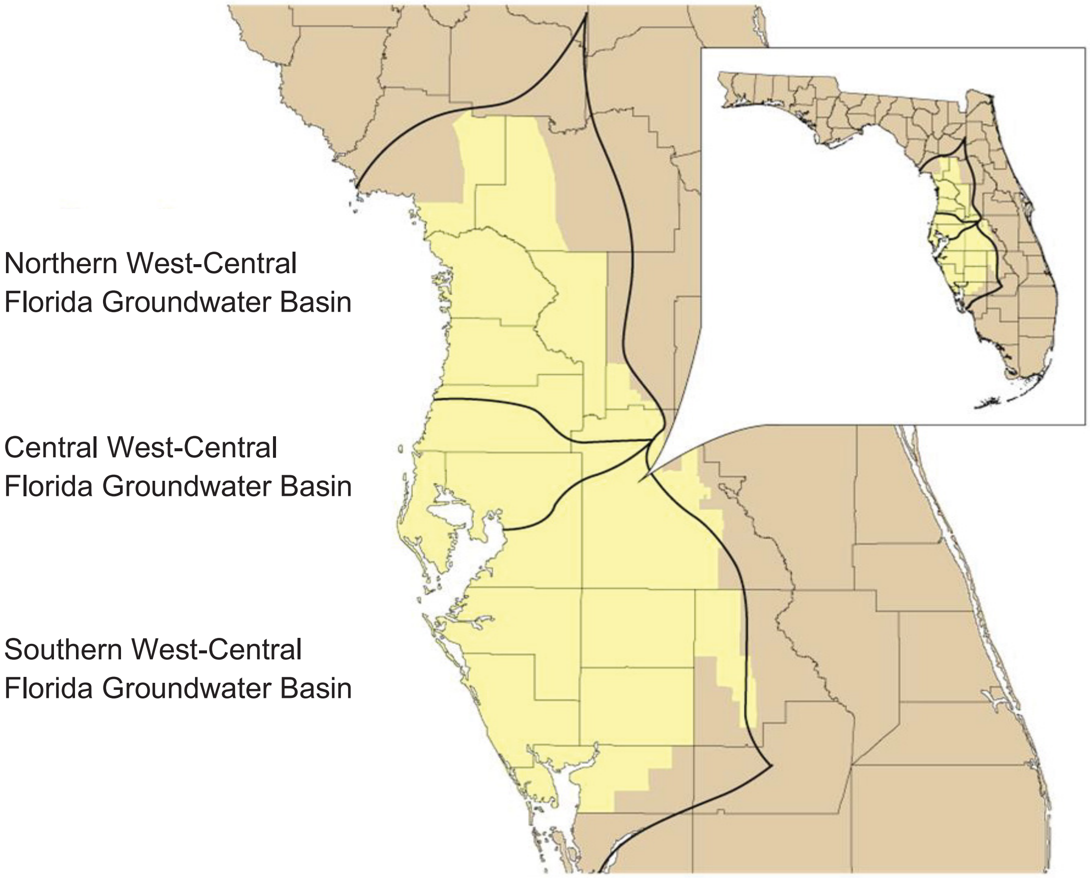

Figure 1-4. *The District and the West-Central Florida Groundwater Basins*

Part D. Previous Technical Investigations

The 2020 RWSP builds on a series of cornerstone technical investigations that were undertaken by the District and the U.S. 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 (Chapter 373, F.S.), 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 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 preliminary findings of the WRAP studies and continued concern about water resource impacts, the District established the NTB and ETB WUCAs (NTBWUCA and ETBWUCA) 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 ETBWUCA, NTBWUCA, 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 SWCFGWB.

Beginning in October 1998, the District adopted MFLs for several water bodies in the NTBWUCA (Chapter 40D-8, Florida Administrative Code [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 FY2007to FY2011 was completed in 2013 (SWFWMD, 2013), with the second five-year assessment for FY2012 to FY2016 completed in 2018 (SWFWMD, 2018). The District continues to work with key stakeholders and the public on the development and implementation of recovery options within the SWUCA.

Section 2. U.S. Geological Survey Hydrologic Investigations

The District has a long-term cooperative program with the U.S. Geological Survey (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 NTB
	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	MFL Data Collection
	Surface Water Flow, Level, and Water Quality Data Collection
	Statewide Light Detection and Ranging (LiDAR) Mapping
	Mapping Actual Evapotranspiration Over Florida Model Support
	Statewide Geostationary Operational Environmental Satellites (GOES) Evapotranspiration (ET) Project

Section 3. Water Supply Investigations

Water Supply investigations for the planning region were initiated in the 1960s as part of the U.S. Army Corps of Engineers (USACE) Four River Basins project. The Four River Basins project began as a flood control project developed in response to severe coastal and inland flooding caused by Hurricane Donna in September 1960. The District was formed in 1961 to help implement this federal project, which led to development of several large control structures including the 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 and 2015 RWSP updates extended the planning horizons to 2030 and 2035, respectively, and included four regional volumes covering all counties of the District. It was concluded that the Northern Planning Region demand for water through 2035 could be met with fresh groundwater; however, the need for additional fresh groundwater supplies could be minimized through the use of available reclaimed water and implementation of comprehensive water conservation measures. This could result in averting impacts such as those witnessed in other regions. For the remaining three planning regions, both the 2010 and 2015 RWSPs adopted several AWS options that were developed or are currently under development by the respective regional water supply authorities in those regions.

Section 4. Minimum Flows and Levels Investigations

Extensive field-data collection and analysis is typically required to support MFLs development. These efforts include measurement of water levels and flows, assessment of aquatic and semi-aquatic plant and animal species or communities and their habitats, water quality characterization, and assessment of current and projected withdrawal-related impacts. Ultimately, ecological and hydrological information are linked using some combination of conceptual, statistical, and numerical models to assess environmental changes associated with potential flow or level reductions. Goals for these analyses include identifying sensitive criteria that can be used to establish MFLs and prevent significant harm to a wide-range of human-use and natural system values.

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 Northern Planning Region groundwater flow model (also known as the Northern District Model [NDM]) covers the northern half of the District, and portions of the St. Johns and Suwannee River WMDs (HydroGeoLogic, Inc., 2008, 2010, 2011, 2013, Dynamic Solutions Inc. and HydroGeoLogic, Inc., 2016). This model, first completed in 2008, has been updated in 2010, 2011, 2013, and most recently in 2016 with version five. When first developed, the model was unique for west-central Florida in that it was the first regional groundwater flow model that represented 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 (LFA). The model was expanded eastward in 2013 to the St. Johns River to encompass all of Marion County through a cooperatively funded agreement between the District, St. Johns River Water Management District (SJRWMD), Withlacoochee Regional Water Supply Authority (WRWSA), and Marion County. The model was expanded at the request of Marion County so that one model could be used by both districts for Marion County water resource investigations. The Northern Planning Region model serves as an important tool to examine potential impacts to wetlands, lakes, springs, and the Withlacoochee River from regional groundwater withdrawals. The results of these predictions have been used by the District to support water supply planning assessments and establishment of MFLs, primarily from Hernando County north.

The District-Wide Regulatory Model (DWRM) was developed to produce a regulatory modeling platform that is technically sound, efficient, reliable, and has the capability to address cumulative impacts. The DWRM was initially developed in 2003 (Environmental Simulations, Inc., 2004). It is mainly used to evaluate whether requested groundwater withdrawal quantities in WUP applications have the potential to cause unacceptable impacts to existing legal users, off-site land uses, and environmental systems on an individual and cumulative basis. The DWRM Versions 1, 2, 2.1, and 3 (Environmental Simulations, Inc., 2004, 2007, 2011, 2014) incorporate Focused Telescopic Mesh Refinement (FTMR), which was developed to enable DWRM to be used as a base model for efficient development of smaller scale sub-models (FTMR models). The FTMR uses a fine grid around a well or group of wells and increasing grid spacing out to the edge of the model. It was specifically designed to enhance WUP analysis. DWRM Version 3 simulates groundwater flow of the entire District using a quasi-3D conceptualization of the Modular finite Difference Groundwater Flow Model code (MODFLOW2005). DWRM3 simulates groundwater flow in the surficial, intermediate, UFA and LFA. The DWRM3 supports current regulatory functions as a core business process addressed in the District's Strategic Plan.

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 ETB 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 ETBWUCA.

To address the three-dimensional nature of the interface, a sharp interface code, known as Saltwater Intrusion Model for Layered Aquifer Systems, 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 MAL to protect against saltwater intrusion in the most impacted area (MIA) of the SWUCA, a fully three-dimensional, solute transport model of the ETB area was developed in 2002 by HydroGeoLogic, Inc. 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 and Northern Planning Region areas is not a significant resource concern, salinity increases have been observed in local areas. Saltwater intrusion models completed for the area include Dames and Moore, Inc. (1988), GeoTrans, Inc. (1991), HydroGeoLogic, Inc. (1992) and Tihansky (2005). These models have generally confirmed the localized nature of saltwater intrusion in the NTB area. HydroGeoLogic, Inc. completed a regional saltwater intrusion model in 2008 that covered the coastal region of Pasco, Hernando, Citrus, and Levy counties. This work was completed in conjunction with the development of the Northern District groundwater flow model. Results of the saltwater intrusion model showed no significant regional movement of the saltwater interface over the next 50 years (HydroGeoLogic, Inc., 2008).

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 model (INTBM), 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 INTBM 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.

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:

- 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 (DPCWUCA) 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.

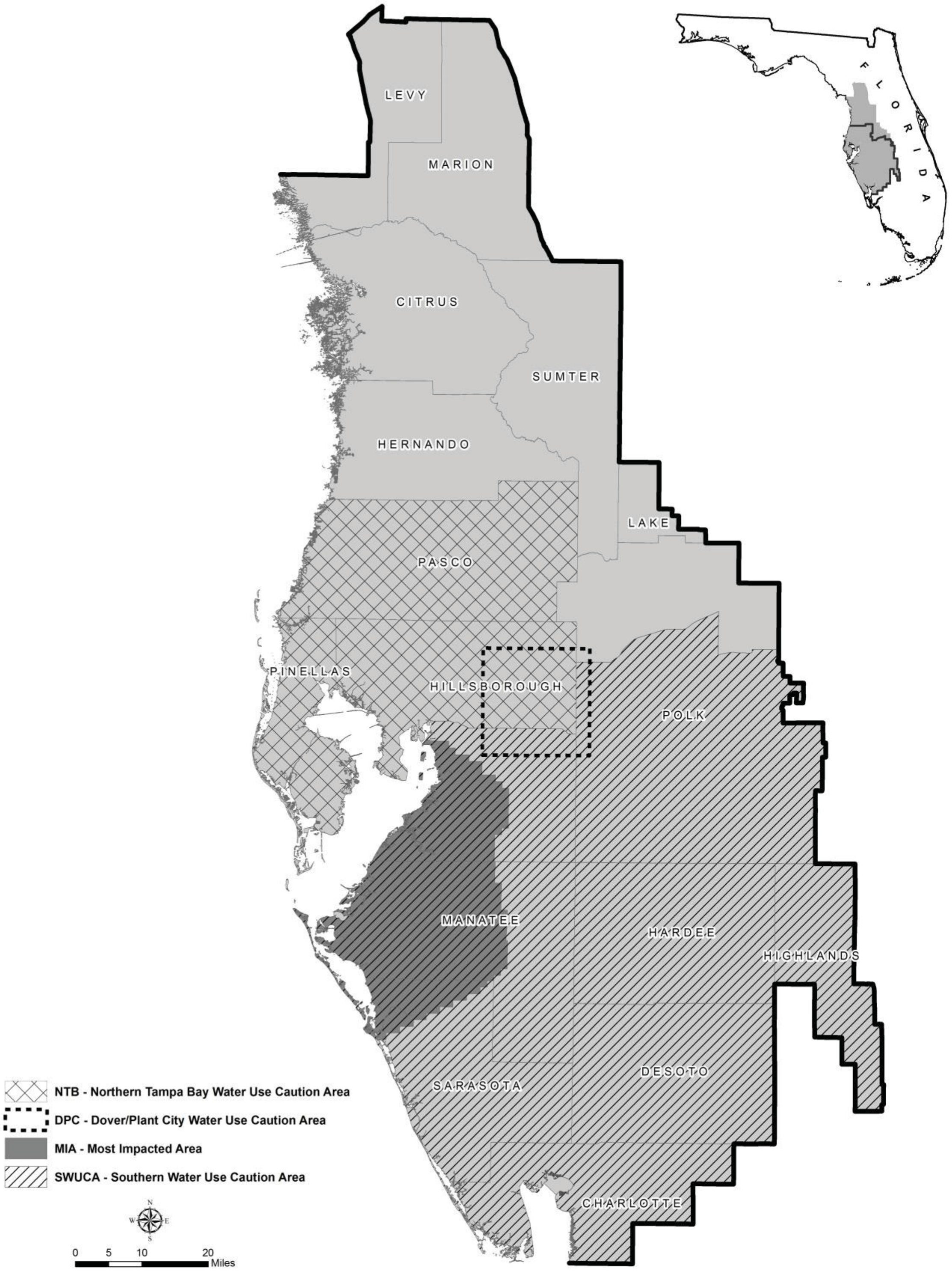

Figure 2-1. *Location of the District's water use caution areas and the MIA of the SWUCA*

1.0 Northern Tampa Bay Water Use Caution Area

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 (PS) 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 Northern Tampa Bay (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 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 million gallons per day (mgd) to 90 mgd (12-month moving average) by January 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 expects to receive a Water Use Permit renewal application for Tampa Bay Water's Consolidated Permit during the summer of 2020. The Consolidated Permit includes ten PS wellfields, providing 90 mgd of water supply for most of the NTB area. In addition, the Comprehensive Environmental Resources Recovery Plan, also known as the Phase II Recovery Plan, developed and adopted by rule and as a permit condition for assessing the hydrologic recovery achieved in the Phase I Recovery Plan (1998 to 2010), will be submitted to the District by Tampa Bay Water by the end of 2020.

2.0 Southern Water Use Caution Area

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 (MAL) and to allow renewal of existing permits, while gradually reducing permitted quantities as a means to recover aquifer levels to the established minimum level. A number of parties filed objections to parts of the rule and an administrative hearing was conducted. In March 1997, the District received the Final Order upholding the MAL, 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 MAL. Withdrawal of the MAL 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 (SWFMWD 2013) that addressed the period from 2007 through 2011. Because adopted MFLs for many water bodies were still not being met, the District initiated a series of stakeholder meetings to review results of the technical assessments and identify potential recovery options.

Four meetings were held in 2015 to address issues associated with MFLs recovery in the MIA and in the ridge lakes area. Meeting participants represented all the major water use groups, a variety of environmental organizations, state agencies and other interested parties. For the MIA, six options were identified to help meet the SWIMAL goal. The Governing Board voted to support five options (see below) and directed staff to gather more information on the exploration of aquifer recharge (AR) and aquifer storage and recovery (ASR). There was also subsequent approval of an increase to the District's cost share to 75 percent for Facilitating Agricultural Resource Management Systems (FARMS) projects in the MIA for a period of three years. This action was to encourage participation in the program. For the Ridge Lakes, three options were identified. The Board supported all three options (see below).

MIA Options:

- Continue Monitoring
- Update analytical tools
- Promote water conservation initiatives
- Expand FARMS
- Expand beneficial reuse

Ridge Lakes Options:

- Continue monitoring
- Reevaluate established minimum lake levels
- Evaluate options for individual lakes

The second SWUCA Recovery Strategy Five-Year Assessment addressed the period from 2012 through 2016 (SWFWMD 2018) and evaluated and assessed recovery in terms of trends in water resources, permitted quantities, and the development of projects and initiatives that address issues within the SWUCA. An important conclusion of the second five assessment was that the District continues to make progress toward recovery, but challenges to achieving full recover by 2025 remain. Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing water resource development (WRD) projects designed to augment or preserve levels and flows.

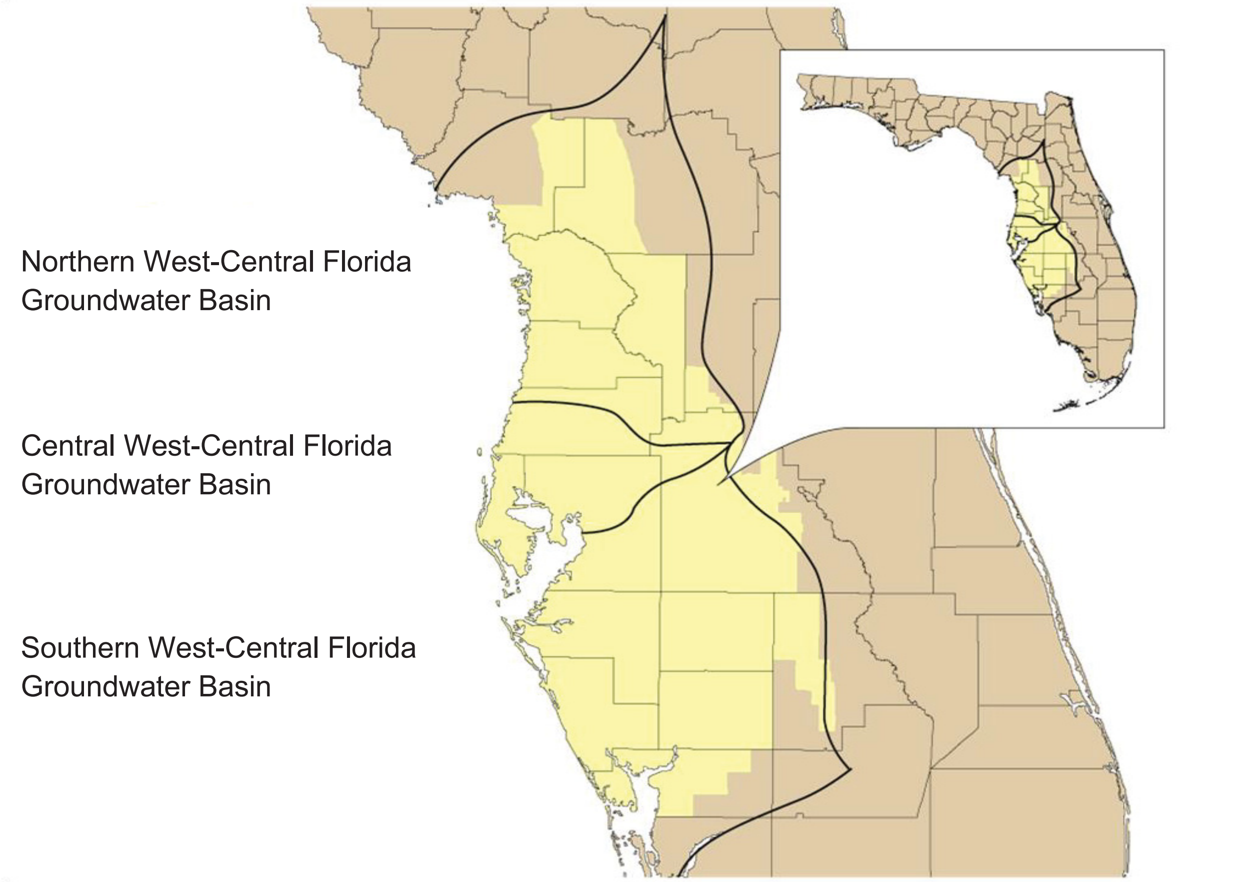

Figure 2-2. *Southwest Florida Water Management District and the West-Central Florida Groundwater Basins*

3.0 Dover/Plant City Water Use Caution Area

Groundwater withdrawals used for freeze protection of crops in the DPCWUCA between January 3, 2010, and January 13, 2010, resulted in UFA drawdown that contributed to a large number of sinkhole occurrences and more than 750 dry well complaints from neighboring domestic well owners. Agricultural users growing strawberries, citrus, blueberries, nursery ornamentals, as well as tropical fish farms at risk of frost/freeze damage and crop loss are permitted to use Floridan aquifer groundwater withdrawals as the primary freeze protection method. During an unprecedented nine nights of freezing temperatures over eleven consecutive days in January 2010, withdrawals totaling nearly 619,000 gpm occurred for approximately 65 hours in the Dover/Plant City area and were followed by withdrawals at a rate of approximately 433,000 gpm for an additional 19 hours.

In 2011, based on impacts associated with these withdrawals, the District established the DPCWUCA. This WUCA extends over a 256 square mile area in northeast Hillsborough County and eastern Polk County within portions of the NTBWUCA and the SWUCA (see Figure 2-1). Concurrent with the establishment of the DPCWUCA, the District adopted the MAL, Minimum Aquifer Level Protection Zone (MALPZ) and recovery strategy for the DPCWUCA.

The objective of the recovery strategy established by Rule 40D-80.075, F.A.C., for the DPCWUCA is to reduce groundwater withdrawals used for frost/freeze cold protection by 20 percent from the January 2010 withdrawal quantities by January 2020. Meeting this objective will lessen the potential for drawdown during future cold protection events to lower the UFA level at District monitor well DV-1 Suwannee below 10 feet (NGVD 1929). Recovery mechanisms identified in the rule include non-regulatory and regulatory approaches. The non- regulatory mechanisms include assistance in offsetting groundwater withdrawals for cold protection through the FARMS program, providing enhanced data for irrigation system management and other means. Projects are co-funded by the District and private enterprise to develop and enhance water conservation projects for the direct benefit of reducing cold protection groundwater withdrawals. For the regulatory approach, water use permitting rules in Chapter 40D-2, F.A.C., and the Water Use Permit (WUP) Applicant's Handbook, Part B, incorporated by reference in Rule 40D2.091, F.A.C., Section 7.4, address groundwater withdrawal impacts, alternative water supplies (AWSs), frost/freeze cold protection methods and resource recovery. New groundwater withdrawals for cold protection are not authorized within the MALPZ and any new permitted groundwater withdrawals outside the MALPZ cannot cause new drawdown impact at the MALPZ boundary. Alternative methods to groundwater withdrawals used for cold protection are to be investigated and implemented where practicable.

Part B. Minimum Flows and Levels

Section 1. Definitions and History

Section 373.042 of the Florida Water Resource Act of 1972 (Chapter 373, F.S.) directs the Florida Department of Environmental Protection (FDEP) or the water management districts (WMDs) to establish MFLs for priority water bodies using the best available information. The minimum flow for a given watercourse is defined by statute as the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. The minimum water level of an aquifer or surface waterbody is similarly defined 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 or ecology of the area.

Minimum flows and levels (MFLs) are established and used by the District for water resource planning as one of the criteria used for evaluating WUP applications and for the design, construction, and use of surface water management systems. Minimum flows and levels (MFLs) are also implemented through District funding of water resource and water supply development (WSD) projects that are part of a recovery or prevention strategy identified for achieving an established MFL. The District's MFLs program addresses all MFLs-related requirements expressed in the Florida Water Resources Act and the Water Resource Implementation Rule (Chapter 62-40, F.A.C.).

Section 2. Priority Setting Process

In accordance with the requirements of Sections 373.036(7) and 373.042(2), F.S., the District annually updates its priority list and schedule for the establishment of MFLs. As part of developing the priority list and schedule, which also identifies water bodies scheduled for development of reservations, the following factors are considered:

- Importance of the water bodies to the state or region.

- Existence of or potential for significant harm to the water resources or ecology of the state or region.
- Required inclusion of all first-magnitude springs and all second-magnitude springs within state or federally owned lands purchased for conservation purposes.
- Availability of historic hydrologic records (flows and/or levels) sufficient to allow statistical analysis and calibration of computer models when selecting particular water bodies in areas with many water bodies.
- Proximity of MFLs already established for nearby water bodies.
- Possibility that the water body may be developed as a potential water supply in the foreseeable future.
- Value of developing an MFL for regulatory purposes or permit evaluation.
- Stakeholder input.

The updated priority list and schedule is submitted to FDEP for approval by November 15th each year and, as required by statute, is published in the District's Consolidated Annual Report The District's current priority list and schedule is also posted on the District website and is included in the Chapter 2 Appendix to this RWSP.

Section 3. Technical Approach to the Establishment of Minimum Flows and Levels

District methods used to establish MFLs for wetlands, lakes, rivers, springs, and aquifers are briefly summarized in the Chapter 2 Appendix to this RWSP. Additional details regarding MFLs methods are provided in District rules (Chapter 40D-8, F.A.C.) and within MFLs reports that are developed for individual priority water bodies and posted on the District website. Refinement and development of new MFLs methods and ongoing and new data collection efforts ensure that MFLs are established and reevaluated, as necessary, using the best available information.

The District's technical approach for MFLs development assumes that alternative hydrologic regimes may exist that differ from historic conditions but are sufficient to protect water resource features from significant harm. For example, consider a historic condition for an unaltered river or lake system with no 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 includes water levels or flows that are lower or less than those of the historic regime, but which protects the water resources and ecology of the system from significant harm. This threshold regime could conceptually allow for water withdrawals while protecting the water resources and ecology of the area. MFLs established based on such a threshold hydrologic regime may therefore represent minimum acceptable, rather than historic or potentially optimal, hydrologic conditions.

1.0 Scientific Peer Review

Section 373.042(4), F.S., permits affected parties to request independent scientific peer review of the scientific and technical data and methodologies used to establish MFLs. In addition, the District or FDEP may decide to voluntarily subject MFLs to independent scientific peer review, based on guidelines provided in Rule 62-40.473, F.A.C.

Currently, the District voluntarily seeks independent scientific peer review of methods used to develop MFLs for all water body types. Similarly, the District voluntarily seeks peer review of MFLs proposed for all flowing water bodies and aquifer systems, based on the unique characteristics of the data and analyses used for the supporting analyses.

Section 4. Established and Proposed Minimum Flows and Levels

Figure 2-3 depicts priority MFLs water resources that are in or partially within the Tampa Bay Planning Region. A complete list of water resources with established MFLs in the District is provided in the Chapter 2 Appendix to this RWSP.

Water resources with established MFLs within or extending into the planning region include the:

- Alafia River (lower segment);
- Alafia River (upper segment, which is partially located in the Heartland Planning Region)/Lithia-Buckhorn Spring Group;
- Anclote River (lower segment);
- Anclote River (upper segment);
- Crystal Springs;
- Dover/Plant City Water Use Caution Area Minimum Aquifer Level;
- Hillsborough County Lakes – Alice (reevaluated), Allen (reevaluated), Barbara, Bird (reevaluated), Brant (reevaluated), Calm, Carroll, Charles, Church, Crenshaw, Crescent, Crystal (reevaluated), Cypress, Dan (reevaluated), Deer (reevaluated), Dosson (reevaluated), Echo, Ellen, Fairy [Maurine], Garden, Halfmoon, Hanna, Harvey (reevaluated), Helen, Hobbs (reevaluated), Hooker, Horse (reevaluated), Jackson, Juanita (reevaluated), Keene, Kell, Little Moon (reevaluated), Merrywater (reevaluated), Mound, Platt, Pretty, Rainbow (reevaluated), Raleigh, Reinheimer, Rogers, Round (reevaluated), Saddleback (reevaluated), Sapphire, Starvation, Stemper (reevaluated), Strawberry, Sunset (reevaluated), Sunshine (reevaluated), Taylor, Virginia (reevaluated), Wimauma;
- Hillsborough County Wetland Sites – CBRWF #32, Cosme WF Wetland, CR1, CR2, CR3, CR4, CR5, CR6, EWWF NW-44, MBWF Clay Gully Cypress, MBWF Entry Dome, MBWF Unnamed, MBWF X-4, S21 WF NW-53 East;
- Hillsborough River (upper segment, which is partially in the Heartland Planning Region)
- Hillsborough River (lower segment) (reevaluated);
- Northern Tampa Bay – 7 Wells – Upper Floridan aquifer/Saltwater Intrusion
- Pasco County Lakes – Bell, Big Fish (reevaluated), Bird, Buddy (reevaluated), Camp (reevaluated), Clear, Green, Hancock, Iola, Jessamine, King, King [East], Linda, Middle, Moon (reevaluated), Padgett (reevaluated), Parker aka Ann, Pasadena (reevaluated), Pasco, Pierce (reevaluated), Unnamed #22 aka Loyce;
- Pasco County Wetland Sites – CBARWF Q-1, CBARWF Stop #7, CBARWF T-3, CBARWF TQ-1 West, CBRWF A, CBRWF #4, CBRWF #16, CBRWF #20, CBRWF #25, CC Site G, CC W-11, CC W-12, CC W-17, CC W-41, NPWF #3, NPWF #21, SPWF NW-49, SPWF NW-50, SPWF South Cypress, STWF Central Recorder, STWF Eastern Recorder, STWF D, STWF M, STWF N, STWF S-75, STWF Z;
- Pinellas County Wetland Site – EWWF Salls Property Wetland 10S/10D
- Pithlachascotee River (lower segment);
- Pithlachascotee River (upper segment);
- Southern Water Use Caution Area - Upper Floridan aquifer (which is partially located in the Southern Planning Region, and is affected by withdrawals in the Tampa Planning Region, Southern Planning Region, and Heartland Planning Region);

- Sulphur Springs;
- Tampa Bypass Canal.

Priority water resources within or extending into the planning region for which MFLs have not yet been established or are being reevaluated include the:

- Cypress Creek;
- Hillsborough County Lakes (reevaluations) – Barbara, Calm, Charles, Church, Crenshaw, Cypress, Echo, Ellen, Garden, Halfmoon, Helen, Jackson, Mound, Sapphire, Strawberry (North Crystal);
- Hillsborough County Wetland Sites (reevaluations) – Cosme WF Wetland, CR4, CR5, CR6, S21 WF NW-53 East;
- Hillsborough County Wetland Sites (reevaluations) – CBRWF #32, CR1, CR2, CR3, EWWF NW-44, MBWF Clay Gully Cypress, MBWF Entry Dome, MBWF Unnamed, MBWF X-4;
- Little Manatee River (lower segment);
- Little Manatee River (upper segment, which is partially located in the Southern Planning Region);
- Pasco County Lakes (reevaluations) – Linda, Pasco;
- Pasco County Wetland Sites (reevaluations) – CBRWF #20, CBRWF #25, NPWF #3, NPWF #21, SPWF NW-49, SPWF NW-50, SPWF South Cypress, STWF Central Recorder, STWF Eastern Recorder, STWF Z;
- Pinellas County Wetland Site (reevaluation) – EWWF Salls Property Wetland 10S/10D
- Southern Water Use Caution Area Saltwater Intrusion Minimum Aquifer Level (SWIMAL) (reevaluation);
- Withlacoochee River (upper segment, upstream of U.S. Geological Survey Croom gage).

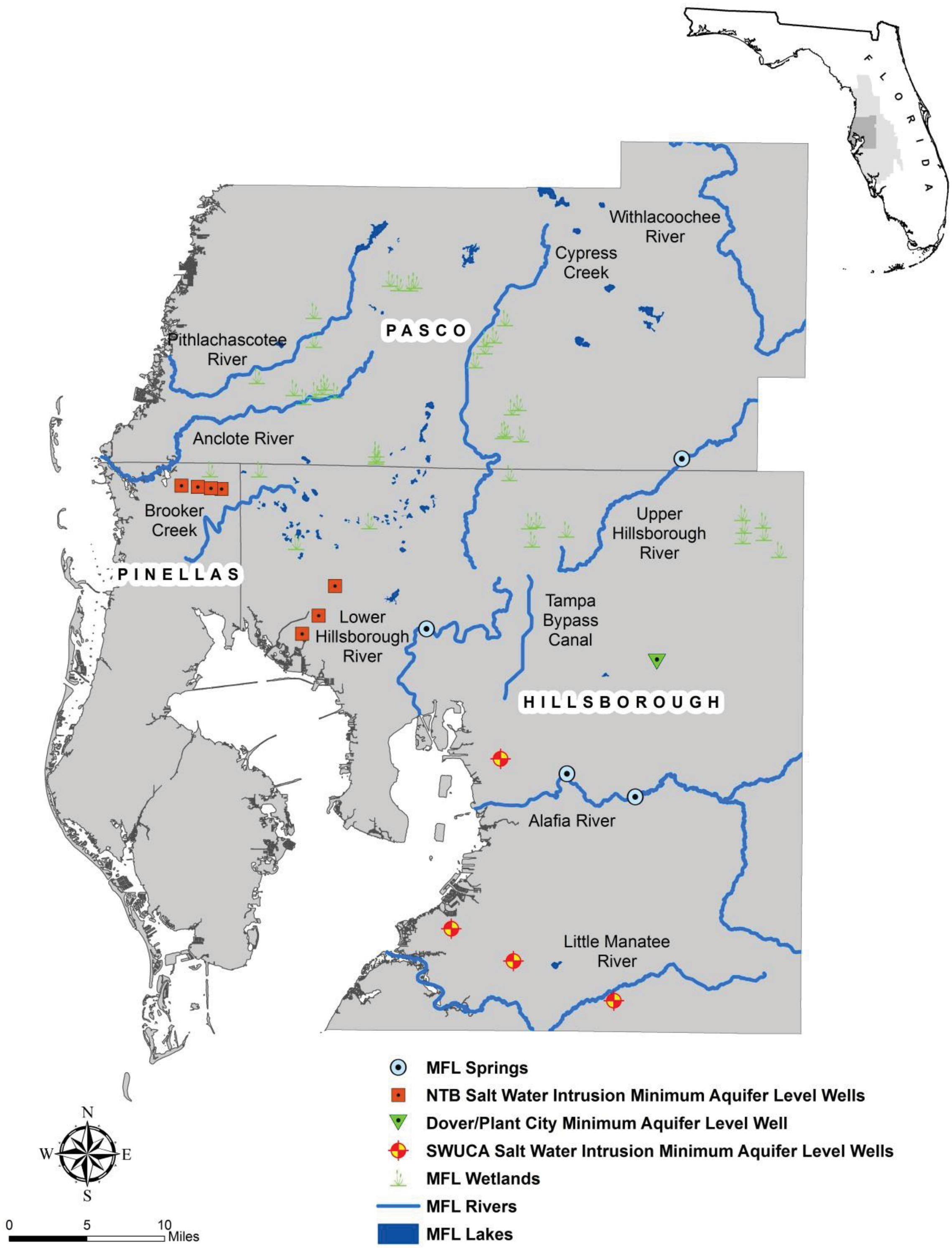

Figure 2-3. *MFL priority water resources in the Tampa Bay Planning Region*

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 engaged in planning efforts that are coordinated with and complement those of the District. A goal of these efforts is to ensure that future water supply demands will be met without adversely impacting proposed or established MFLs. 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 (fourth) update to the current Long-Term Master Water Plan was completed in 2018. This document analyzed current and future water supplies and demands to determine when new supplies will be required. The current Master Water Plan recommends the addition of 20 mgd to meet forecasted demands. TBW anticipates 10 mgd will be needed by 2025 with the remaining 10 mgd by 2040 planning horizon. TBW also continues to investigate a Demand Management Plan and Water Shortage Mitigation Plan to help conserve water.

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 AWSs.
- 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 DPCWUCA. 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 Northern Tampa Bay Water Use Caution Area

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 AWSs 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 AWS 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 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, which was adopted in 2010 as the Comprehensive Environmental Resources Recovery Plan for the Northern Tampa Bay Water Use Caution Area (Comprehensive Plan,) 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.

The current Consolidated Permit expires through 2020, at which time many of the requirements of the Comprehensive Plan are due for District approval. The District expects to receive a WUP renewal application for TBW's Consolidated Permit during the summer of 2020. The Consolidated Permit includes ten PS wellfields, providing 90 mgd of water supply for most of the NTB area. In addition, the Comprehensive Environmental Resources Recovery Plan, also known as the Phase

II Recovery Plan, developed and adopted by rule and as a permit condition for assessing the hydrologic recovery achieved in the Phase I Recovery Plan (1998 to 2010), will be submitted to the District by TBW by the end of 2020.

2.0 Lower Hillsborough River

The District established revised MFLs for the lower Hillsborough River (LHR) in 2007. Because the MFLs were not being met, the District incorporated a recovery strategy for the river into Rule 40D-80.073(8), F.A.C. As part of the recovery strategy, the District entered into a joint funding agreement and additional project-specific agreements with the City of Tampa to assess and implement projects associated with diversion of water from various sources to meet minimum flow requirements in the river. Estimated costs for recovery strategy projects, and their status are listed in Table 2-1.

In accordance with the recovery strategy, the City has diverted water from Sulphur Springs to the base of the Hillsborough River Reservoir Dam, as necessary to support river recovery. In addition, the District, and more recently the City, have diverted water from the Tampa Bypass Canal (TBC) to the Hillsborough River Reservoir for subsequent diversion to the lower river. The City assumed responsibility for these diversions from the TBC through the reservoir in 2018, with transfers of water from the reservoir to the lower river made using a newly constructed sluice gate in the dam that was cooperatively funded by the District and the City. In 2017, the City, with support from the District, completed the Blue Sink Project, which facilitates diversion of water from Blue Sink to the base of the dam for minimum flow recovery, and use of the sink as a recovery source was initiated in 2018. A project between the District and City associated with investigation of storage or additional supply options was completed in 2018 and identified the proposed Tampa Augmentation Project as a potential source for additional water that may be needed for recovery of the lower river. Permitting, design and permit-required monitoring associated with a project involving potential diversion of water from Morris Bridge Sink for river recovery have also been completed, although project implementation is contingent upon future recovery need assessments.

The District annually assesses and reports progress on the LHR recovery strategy. In addition, the first of three planned five-year recovery strategy assessments was completed in 2015 (SWFWMD and Atkins, North America, Inc., 2015) and completion of a second assessment is ongoing. The goals of the annual and five-year assessments include evaluation of the hydrology, selected water quality characteristics, and biological effects achieved from implementation of recovery strategy projects. The annual and five-year assessments have documented improvements in water quality and other ecological conditions in the LHR as a result of minimum flow implementation, although minimum flow requirements have not been met on all days. Flow deficits (i.e., flows needed to meet minimum flow requirements) are expected to be eliminated upon full implementation of all projects identified in the recovery strategy.

Table 2-1. *LHR recovery strategy projects*

Project	Cost	Status
Sulphur Spring Weir Modification and Pump Station	$5.8 million	Completed
Blue Sink	$7 million	Completed
Transmission Pipeline	$26 million	Completed (pipeline deemed not necessary)
Investigation of Storage Options	$28 thousand	Completed
Tampa Bypass Canal and Hillsborough Reservoir Diversions	$1.6 million	Completed
Morris Bridge Sink	$2.1 million	Ongoing

3.0 Southern Water Use Caution Area

The purpose of the SWUCA recovery strategy (Rule 40D-80.074, F.A.C. and SWFWMD, 2006) is to provide a plan for reducing the rate of saltwater intrusion and restoring low flows to the Upper Peace River and lake levels by 2025, while ensuring sufficient water supplies and protecting the investments of existing WUP holders. The strategy has six basic components: (1) regional water supply planning, (2) use of existing rules, (3) enhancements to existing rules, (4) financial incentives, (5) projects to achieve MFLs, and (6) 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 AWSs will help meet water needs, while implementation of WRD projects will help reestablish minimum flows to rivers and enhance recharge. Finally, resource monitoring, reporting, and cumulative impact analysis will provide data to analyze the success of recovery.

Resource recovery projects, such as the project to raise the levels of Lake Hancock for release to the Upper Peace River during the dry season, are actively being implemented and considered. 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 SWUCA recovery strategy will be determined through continued monitoring of area resources. The District uses an extensive monitoring network to assess actual versus anticipated trends in water levels, flows, and saltwater intrusion. Additionally, the District assesses the cumulative impacts of factors affecting recovery. Information developed as part of these monitoring and assessment efforts is provided to the Governing Board on an annually and on a five-year basis. Results from two five-year assessment of the SWUCA recovery strategy (SWFWMD 2013, 2018), indicate the District continues to make progress toward recovery, but challenges to achieving full recovery by 2025 remain. Recovery will ultimately be achieved through a combination of maintaining existing withdrawals at or below current levels and implementing WRD projects designed to augment or preserve levels and flows.

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 a WUP issued to Mosaic in 2009. Conditions in the current WUP (No. 20013228.001) require Mosaic to augment the South Prong of the Alafia River with up to 4.5 mgd of groundwater when flow in the Alafia River at the Lithia 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.

To meet adopted MFLs, the Alafia River is augmented with groundwater during low flow periods

5.0 Dover/Plant City Water Use Caution Area

In 2010, the District determined that groundwater withdrawals used for frost/freeze protection in the Dover/Plant City area contributed to water level declines that are significantly harmful to the resources of the area. In June 2011, the District adopted the DPCWUCA MAL (Figure 2-1), related MALPZ (Rule 40D-80.075, F.A.C.), and a recovery strategy as part of a comprehensive management program intended to arrest declines in area water levels in the UFA during frost/freeze events. These efforts were also undertaken to minimize the potential for impacts to existing legal users and sinkhole occurrence. The DPCWUCA MAL is the 10-foot potentiometric surface elevation (NGVD 1929) at District Well DV-1 Suwannee. The District concluded that this was the elevation below which the greatest incidence of well failures and sinkholes occurred during the 2010 frost/freeze event. The goal of the recovery strategy is a 20 percent reduction in frost/freeze protection groundwater withdrawals in the Dover/Plant City DPCWUCA by January 2020, as compared to the estimated frost/freeze withdrawals used during the 2010 event. This should reduce the potential for drawdown during future frost/freeze events to lower the aquifer level at District Well DV-1 Suwannee below 10 feet (NGVD 1929).

Part D. Reservations

Reservations of water are established by rule and authorized as follows: "The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety…" (Section 373.223(4), F. S.).

The District will consider establishing a reservation of water when a District WRD project will produce water needed to achieve adopted MFLs. The rule-making process associated with reservation adoption allows for public input to the Governing Board in its deliberations about establishing a reservation, including, among other matters, the amount of water to be reserved and the time of year the reservation would be effective. When a reservation is established and incorporated into Rule 40D-2.302, F.A.C., only those water use withdrawals that do not reduce the reserved quantity can be evaluated for permitting.

In 2007, as part of the recovery strategy for the LHR, 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.). In support of this reservation, the District has obtained a consumptive use permit from the FDEP, in 2016, that authorizes withdrawal of up to 3.9 mgd from for Morris Bridge Sink to help achieve minimum flow in the LHR. Project design and permit-required monitoring associated with the potential diversion of water from Morris Bridge Sink for river recovery have been completed. Project implementation is contingent upon future recovery need assessments.

Part E. Climate Change

Section 1. Overview

Climate change has been a growing global concern for several decades. According to the Intergovernmental Panel on Climate Change (IPCC), the global mean average land and ocean temperatures have likely increased approximately 1.4 to 2.2°F from pre-industrial levels (IPCC, 2018). Such increases are driving a slow but persistent increase in sea levels and are altering precipitation regimes. These conditions will likely have local impacts including changes to natural habitats, encroachment of seawater into surface and groundwater resources, risk to public infrastructure, warmer temperatures that increase evaporation and impact agriculture, and changes to seasonal and annual rainfall patterns. Climate change is a global issue that requires international coordination and planning, although strategies for assessing vulnerabilities and developing adaptation plans are necessary on the local, regional, and statewide level.

In recent years, numerous agencies and organizations in Florida have developed initiatives to address climate change. Many of the state's Regional Planning Councils (RPCs) have pooled resources and are developing vulnerability assessments, climate adaptation plans, and post-disaster redevelopment plans for member communities. The Florida Department of Environmental Protection's Community Resilience Initiative provides planning tools and promotes collaboration among RPCs and coastal communities. The WMDs and other agencies participate in focus groups organized by RPCs, Florida Sea Grant, and other entities to consolidate climate information, develop consistent approaches to planning, and provide technical expertise when appropriate. Other participants in these initiatives include the National Weather Service; regional water supply authorities; state universities; and Florida Fish and Wildlife Conservation Commission, Department of Transportation, Department of Health, Department of Environmental Protection, and the Division of Emergency Management. Climate change is one water supply challenge among others such as droughts, water quality deterioration, and limitations on the availability of water resources. This section of the RWSP addresses climate issues for water supply planning, identifies current management strategies in place to address these concerns, and considers future strategies necessary to adaptively manage water supply resources.

Section 2. Possible Effects

The District's water supply planning efforts may be affected by climate change in three primary ways: sea level rise, air temperature rise, and changes in precipitation regimes.

1.0 Sea Level Rise

Data from the National Oceanic and Atmospheric Administration (NOAA) tide gauge in St. Petersburg shows that monthly mean water levels have already increased 7.8 inches from the gauge's first reliable records in 1946 to 2019 (CSAP, 2019). The latest NOAA projections over this report's 20-year horizon (2020 through 2040) estimate that local sea levels will rise by 3.5 inches based a linear extrapolation, 4.3 inches by factoring the likely acceleration, and over 12 inches if accounting for potential polar ice sheet instabilities. With a 50-year horizon (2020 through 2070), a common lifecycle for infrastructure design, the NOAA projections range from 9 inches to over three feet (Sweet et al, 2017).

Sea level rise is likely to stress the District's water resources in a variety of ways. The inundation or upward migration of coastal wetlands may affect their ability to improve the quality of stormwater runoff and provide natural habitats. Estuarine water encroachment in coastal rivers may reduce the viable withdrawal periods at non-isolated freshwater intakes of water treatment facilities. Saltwater intrusion reduces water quality in aquifers that supply urban, agricultural, and industrial water users. Aging municipal sewer systems can experience infiltration that reduces the quality of reclaimed water currently used to offset fresh water demands.

One positive aspect is that sea level rise is projected to occur relatively slowly, although persistently, which allows time to thoroughly evaluate the impacts to natural resources and public infrastructure, plan and implement adaptation strategies, and continue to use most existing coastal infrastructure for several decades. The cost of initiating sea level rise planning or incorporating it into other existing efforts is relatively low compared to disaster recovery efforts.

2.0 Air Temperature Rise

The IPCC estimates that current green-house emission levels will cause mean global air temperatures to reach or stabilize at approximately 2.7°F above pre-industrial levels (1850through 1900) by the end of this century, with greatest warming at inland and polar regions (IPCC, 2018). The impacts to southwest Florida will likely be more hot days and few cold days seasonally. Evaporation is likely to increase with a warmer climate, which could result in lower surface water levels and increased irrigation demand. Increased evaporation is likely to impact stormwater runoff, soil moisture, groundwater recharge, and reservoir storage losses (Bates et al., 2008). Additionally, higher air temperatures may exasperate algal blooms and declines in reservoir water quality that could raise treatment costs for potable water supply.

3.0 Precipitation Regimes and Storm Frequency

Increasing temperatures are expected to change global precipitation patterns, although changes will likely be more pronounced in the earth's tropical and temperate zones. Southwest Florida, being sub-tropical, has climatic precipitation patterns largely influenced by Atlantic multidecadal oscillations (AMO) of ocean sea surface temperatures, along with shorter-term El Nino southern oscillations (ENSO). The AMO warm periods tend to make the region's summer-fall seasons wetter, while strong ENSO phases, caused by warming in the eastern Pacific, make the region's winter and spring seasons wetter (Cameron, 2018). An AMO warm phase is currently in effect.

Warming temperatures in the Atlantic and Gulf of Mexico can increase the likelihood of intense tropical storms and hurricanes that can generate storm surge, strong winds, and heavily concentrated rainfall. Hurricane activity near Southwest Florida is statistically more common during AMO warm periods. Higher summer temperatures and humidity may also increase the frequency of local convective weather events, resulting in thunderstorms, higher peak surface water flows, and increased flooding in some areas (Groisman et al., 2005).

Section 3. Current Management Strategies

The District has taken several steps to address the management of water resources that will also benefit efforts to plan and prepare for climate change impacts. First, the District's data collection and monitoring activities are likely to provide information critical to monitoring and responding to local climate change. Long-established networks of rainfall and streamflow gauge stations, many with real-time electronic reporting, provide continuous streams of data that will enable the District to monitor changes in local hydrology. In addition to monitoring rivers, lakes, springs, and wetlands to ensure adequate water for natural systems and human use, the District has an extensive network of coastal and inland surface and groundwater monitoring sites to collect and analyze water quality data, including information about saltwater intrusion. In those places where water quantity and quality issues become evident, the District implements programs, projects, and regulations to address them. The District also participates in local, state and national discussions on these issues in order to accommodate timely and effective responses to climate changes as they become evident.

The Coastal Groundwater Quality Monitoring and Water Use Permit networks are the largest and longest ongoing well sampling networks of their kind at the District. The networks currently have a combined total of over 350 wells that cover 13 counties, and new wells have been added to the networks at a rate of 5 to 10 wells per year. Having long-term water quality data will become increasingly important with continued demands for groundwater withdrawals in the District and statewide. Although the entire coastal region of the District is included in the monitoring effort, much emphasis is placed on the southern region of the District formally designated as the SWUCA. District staff is also determining how to use or modify existing groundwater models to predict density and water-level driven changes to aquifers utilized for water supply. Through cooperative funding, the District is assisting water utilities and regional water supply authorities with wellfield evaluations for improving withdrawal operations and planning for brackish treatment upgrades.

The District also encourages maximizing the use of diverse water supply sources and establishing system redundancies to ensure a resilient water supply. The District promotes water conservation across all use sectors, including agricultural and industrial uses, which not only saves supplies for the future but also reduces chemical and energy use. Through partnerships, the District continues to increase the availability and use of reclaimed water, the development of wet-weather storage facilities, and enhanced water efficiencies. Additionally, the District supports and co-funds projects to interconnect water supply systems, either potable or nonpotable, to ensure adequate supplies from dispersed sources and redundancy for emergencies. The District also helps to fund environmentally sustainable and drought-resistant water supply options such as reclaimed water, stormwater reuse, brackish groundwater treatment, surface water reservoirs, ASR, AR, and seawater desalination.

Section 4. Future Adaptive Management Strategies

While ongoing District efforts can provide critical information and allow flexibility to accommodate future changes in water supply, local governments and industries are principally tasked with developing and communicating the appropriate risk assessment and adaptation strategy for each municipality or other significant water user. The commonly evaluated community adaptation strategies can be grouped into three generalized approaches: armament, accommodation, or organized retreat. The District is able to provide a supporting role during the planning and implementation for each of these approaches.

- Armament. An armament strategy involves the erection of defensive barriers such as 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 AR systems, direct and indirect reuse, and reverse osmosis treatment options for these communities. The District would also have a role in assuring the transitional health of water bodies.
- Organized Retreat. An organized retreat strategy may involve the rezoning of property threatened by inundation, or transfer to public ownership, potentially through rolling easements or post-disaster development plans. Retreat strategies typically include ecological engineering projects to assist the transition of natural habitats that will also provide shelter to upland infrastructure.

The District would account for these strategies through the five-year update schedule of the RWSP. The schedule allows sufficient time to anticipate transitional changes to population centers in the water demand projections, and to develop appropriate water supply options. Continued development of regionally interconnected water systems also allows large-scale water treatment facilities to adjust distribution to new demand locations.

Climate change may have a significant potential to affect water supply sources and should be factored into evaluations of the adequacy of supplies to meet future demand. It also has the potential to dramatically change patterns of demand and could, therefore, be an important consideration in demand projections. Changes in the nature of supply and demand would necessitate infrastructure adaptation. High cost and relative uncertainty can make these adaptations problematic; however, as related information is generated, existing and proposed water sources and projects will be evaluated to determine their feasibility and desirability. For these reasons, the District is maintaining a "monitor and adapt" approach toward the protection of natural resources from climate change. The District will actively monitor research projects, both locally and nationally, interpret the results, and initiate appropriate actions necessary to protect the water resources in our region as the effects of climate change become more evident.

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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 2015-2040 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 (SWFWMD) (District) projected water demand for the public supply (PS), agricultural (AG), industrial/commercial (I/C), mining/dewatering (M/D), power generation (PG), and landscape/recreation (L/R) sectors for each county in the planning region. The methodologies used to project demand for each category are briefly summarized in this chapter and presented in greater detail in the Chapter 3 Appendix.

The demand projections represent reasonable and beneficial uses of water that are anticipated to occur through the year 2040. The District determined 5-in-10 (average condition) and 1-in-10 (drought condition) demands for each five-year increment from 2015-2040 for each sector. Decreases in demand are reductions in the use of groundwater for the AG, I/C, M/D, and PG 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 (FDEP), formed in 1997 as a means to reach consensus on the methods and parameters used in developing RWSPs. Some of the key guidance parameters include:

- <u>Establishment of a base year</u>: The year 2015 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 2015; whereas, data for the years 2020 through 2040 are projected demands.
- <u>Water use reporting thresholds</u>: Minimum thresholds of water use within each water use category were agreed upon as the basis for projection.
- <u>5-in-10 versus 1-in-10</u>: For reporting demand in average versus drought conditions, specific parameters were prescribed for at least a portion of the demand related to all water supply categories except I/C, M/D, and PG. In general, demand is reported for a 5-in-10 average annual effective rainfall condition and a 1-in-10 drought year condition (an increase in water demand having a 10 percent probability of occurring during any given year).

The projected demand represents the total amount of water required to meet reasonable and beneficial water needs through 2040. Total demand does not account for reductions that could be achieved by additional demand management measures. Water conservation and other sources are accounted for separately in Chapter 4 as a means by which demand can be met.

Part A. Water Demand Projections

Demand projections were developed for five sectors; (1) PS, (2) AG, (3) I/C, M/D, and PG, (4) L/R, and (5) 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 PS sector consists of four subcategories: (1) large utilities (permitted for 0.1 million gallons per day (mgd) or greater), (2) small utilities (permitted for less than 0.1 mgd), (3) domestic self-supply (individual private homes or businesses that are not utility customers that receive their water from small wells that do not require a water use permit (WUP)), and (4) additional irrigation demand (water from domestic wells that do not require a WUP and used for irrigation by residences that rely on a utility for indoor and other non-irrigation water needs).

2.0 Population Projections

2.1 Base Year Population

All WMDs agreed that 2015 would be the base year from which projections would be determined. The District calculated the 2015 population by extrapolating from GIS Associates, Inc.'s 2016 population estimate. Utilities with permitted quantities less than 100,000 gallons per day are not required to report population or submit service area information. Subsequently, population was obtained from the last issued permit.

2.2 Methodology for Projecting Population

The population projections developed by the University of Florida’s Bureau of Economic and Business Research (BEBR) are generally accepted as the standard throughout Florida. However, these projections are made at the county level only and accurate projections of future water demand require more spatially precise data. Subsequently, the District’s projections are BEBR projections disaggregated to land parcel level, which is the smallest area of geography possible for population studies. In turn, these parcel-level projections are normalized to the BEBR medium projection for the counties. Using this methodology, the District contracted with GIS Associates, Inc. to provide small-area population projections for the 16 counties entirely or partly within the District.

3.0 2015 Base Year Water Use and Per Capita Rate

3.1 Base Year Water Use

The 2015 PS base year water use for each large utility is derived by multiplying the average 2011 to 2015 unadjusted gross per capita rate by the 2015 estimated population for each individual utility. For small utilities, per capita information is found in the last issued permit. If no per capita information is available, the per capita is assumed to equal the average county per capita. Base year water use for small utilities is obtained by multiplying the per capita from the current permit by the 2015 estimated population from the last issued permit. Domestic self-supply (DSS) base year is calculated by multiplying the 2015 domestic self-supply population for each county by the average 2011 to2015 residential countywide per capita water use.

4.0 Water Demand Projection Methodology

4.1 Public Supply

Water demand is projected in five-year increments from 2020 to 2040. To develop the projections, the District used the 2011 to 2015 average per capita rate multiplied by the projected population for that increment. An additional component of public water supply demand is water derived from domestic wells for irrigation. These wells have a diameter of less than 6 inches, do not require a WUP and are used for irrigation at residences that receive potable water for indoor use from a utility. 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 gallons per day are used for each well.

4.2 Domestic Self-Supply

Domestic Self-Supply (DSS) is any portion of the county population not served by a utility. County DSS population estimates and projections were calculated as the difference between the total county population estimate or projection and the total population served by the utilities. For counties that are in multiple districts, only that portion of the population within the District was included.

5.0 Water Demand Projections

Table 3-1 presents the projected public supply demand for the planning period. The table shows that demand is projected to increase by 87.47 mgd for the 5-in-10 condition. These projections are lower than those in the District's 2015 RWSP. The differences can be attributed to slower than anticipated regional population growth and more accurate utility level population projections using a GIS model that accounts for growth and build-out at the parcel level.

Table 3-1. *Projected demand for PS, DSS, and private irrigation wells in the Tampa Bay Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Hillsborough	146.78	155.48	161.51	171.21	175.53	186.07	188.00	199.17	197.59	209.44	206.51	218.91	59.84	63.43	40.8%	40.8%
Pasco	56.60	60.00	61.93	65.64	66.86	70.88	71.06	75.32	74.92	79.42	78.38	83.08	21.78	23.09	38.5%	38.5%
Pinellas	101.25	107.33	102.44	108.59	103.97	110.21	105.33	111.65	106.58	112.98	107.10	113.52	5.85	6.20	5.8%	5.8%
Total	**304.63**	**322.81**	**325.88**	**345.44**	**346.36**	**367.16**	**364.39**	**386.14**	**379.09**	**401.84**	**391.99**	**415.51**	**87.47**	**92.72**	**28.7%**	**28.7%**

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 (AG) represents the second largest sector of water use in the District after PS. Included in this category are irrigated crops and other miscellaneous water uses associated with agricultural commodity production within the District. Irrigation demand was determined and reported in the RWSP for each of the following major categories of irrigated crops: (1) citrus, (2) field crops, (3), fruits (non-citrus), (4) greenhouse/nursery, (5) hay, (6) potatoes, (7) sod, and (8) fresh market vegetables. Most of these crop categories are self-explanatory, but some include several crops which are grouped together for reporting purposes by Florida Department of Agriculture and Consumer Services (FDACS). The fruits category includes several prominent crops in the District, such as strawberries, blueberries, and peaches, and the fresh market vegetables category includes tomato production along with cucumbers, peppers, and other vegetables. Water demands associated with non-irrigated AG such as aquaculture and livestock were also estimated and projected.

2.0 Water Demand Projection Methodology

Demand projections for irrigated commodities were determined by multiplying projected irrigated acreage by the irrigation requirements of each commodity. Acreage projections were developed by the FDACS as part of the Florida Statewide Agricultural Irrigation Demand (FSAID5) projections through 2040. These projections were based on trends in historic National Agricultural Statistics Service irrigated acreage data. Irrigation requirements were adjusted from the FSAID5 demands and were based on permit-level metered water use data. Where possible, permit by permit water use rates were maintained, and in non-metered operations, average application rates were developed for each crop category by county. Per acre water use for each crop category was held constant, and changes in projected water demands are based on increases of decreases in irrigated acreages for each crop type. The methodologies are described, and data provided in more detail in Appendix 3-1.

Non-irrigation demand (e.g., aquaculture and livestock) was based on a combination of metered water use at the permit level and estimated demands from the FSAID5 geodatabase which were based primarily on livestock count data and water demands per head. The projected trends were based on the FSAID5 projections, and demands were held steady throughout the planning period, based on steady statewide livestock counts and lack of data upon which to make better projections. The methodologies are described, and data provided in more detail in Appendix 3-1.

In addition to the method developed by the District, which is based on the FSAID5 acreage projections and District metered water use rates, the FDACS has also developed a complete set of alternate water use projections through 2040. The District elected to use its modified FSAID5 approach to meet the statutory directive to use the best available data in developing agricultural water use projections. In this case, the District has extensive metered data on AG water use at the permit level, and the use of direct metered water use application rates will provide a more accurate assessment of local water use than a synthesized modeled water use rates. This allows the District projections to capture permit-level and regional variations in grower irrigation practices. This also means that the application rates in the projections will also be reflective of the progress made in agricultural conservation through the District's FARMS program and other regional efforts such as the SWUCA Recovery Strategy.

3.0 Water Demand Projections

Trends indicate that agricultural activities are expected to continue to decrease in the Tampa Bay Planning Region as the area continues to urbanize during the planning period. Irrigated acreage is expected to decrease by twenty percent, from 37,700 acres in 2016 to about 30,000 acres in 2040. This reduction in irrigated acreage will likely be most prominent in Hillsborough County, which accounts for the vast majority of the irrigated lands in the region. Hillsborough County has historically been a major center for strawberry production in the Plant City area, but total irrigated acreage in the county has declined from a peak nearly 50,000 acres in the late 1990s to around 30,000 acres in 2016. Total AG water use in the Tampa Bay region has experienced a similar decline from over 80 mgd annually in the late 1990s to about 50 mgd from 2014-2016. Due to the abundance of strawberry production in the Plant City area, this region can be subject to large swings in annual water use due to demands for freeze protection in certain years depending on weather patterns. This has historically resulted in significant acute groundwater drawdown impacts, which the District is addressing through the Dover-Plant City Recovery Strategy.

Current average year demands are estimated at 48 mgd for 2016 acreage levels. In 2040, the District estimates that the projected decrease in acreage will result in a twenty-one percent decrease in water demands to about 38 mgd. Most of the decrease in acreage will be in strawberry acreage, with similar reductions in acreage for fresh market vegetables and citrus. FDACS forecasts that Hillsborough County will lose about 7,000 acres of irrigated land, while Pasco County is expected to have a slight decrease in irrigated acreage of about 500 acres. Pinellas County is already highly urbanized and has minimal active irrigated acreage. Urbanization and development pressure are expected to be major drivers in agricultural trends in this region. Table 3-2 displays projected combined agricultural irrigation and non-irrigation demands for the 5-in-10 (average) and 1-in-10 (drought) conditions for the planning period.

4.0 Stakeholder Review

District staff began presenting draft AG I demand projections to the District's Agricultural and Green Industry Advisory Committee, permit evaluation staff, and FDACS staff in September 2018. The District additionally requested input from the Agricultural and Green Industry Advisory Committee on the FSAID5 water use projections and methodology as well as the adjusted FSAID 5 method developed by the District. The Committee wished to take time to consider the proposed methods and adjourned to solicit feedback from industry groups and other stakeholders. In October 2018, the Committee reconvened, and District staff provided an additional presentation on the potential AG projections methods and draft results. Stakeholders present included representatives from the Florida Turfgrass Association, Florida Citrus Mutual, the Florida Strawberry Growers Association, the Florida Nursery Growers and Landscape Association, and the University of Florida Institute of Food and Agricultural Sciences, among others. After discussion, the Agricultural and Green Industry Advisory Committee voted to support the District's updated Agricultural Water Demands Projections Methodology based on the FSAID5 projected acreages and adjustments to incorporated District metered water use data. The vote was passed unanimously. Additionally, the District consulted with staff from the FDACS Office of Agricultural Water Policy on the proposed method, and FDACS accented to the Districts' method based on FSAID5 acreage projections, and District metered water use data.

Strawberries are a significant agricultural product in the Tampa Bay Planning Region

Table 3-2. *Projected total AG demand in the Tampa Bay Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Hillsborough	43.2	55.49	41.32	52.99	39.44	50.54	37.64	48.18	35.79	45.8	33.55	42.94	-9.65	-12.55	-22.3%	-22.6%
Pasco	4.89	6.76	4.78	6.61	4.72	6.53	4.69	6.47	4.64	6.41	4.59	6.34	-0.30	-0.42	-6.1%	-6.2%
Pinellas	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.0%	0.0%
Total	**48.11**	**62.27**	**46.12**	**59.62**	**44.18**	**57.09**	**42.35**	**54.67**	**40.45**	**52.23**	**38.16**	**49.30**	**-9.95**	**-12.97**	**-20.7%**	**-20.8%**

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 and Mining/Dewatering

1.0 Description of the Industrial/Commercial and Mining/Dewatering Water Use Sectors

The I/C and M/D uses within the District include chemical manufacturing, food processing and miscellaneous industrial and commercial uses. Much of the water used in food processing is for citrus and other AG commodities. Chemical manufacturing is associated with phosphate mining and consists mainly of phosphate processing. The M/D water use is associated with a number of products mined in the District, including phosphate, limestone, sand, and shell.

2.0 Demand Projection Methodology

Demand projections for the 2020 RWSP were developed by multiplying the 2015 amount of water used for each I/C and M/D facility by 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 2015 is derived from the District's 2015 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 2015 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 2015 baseline pumpage. Please see Appendix 3-2 for more detail.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 -4.53 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 has 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 2015 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 2019 Format and Guidelines, the 5-in-10 and 1-in-10 demands are the same. The uses "are assumed to be reasonably the same in a 1-in-10-year drought event as in an average year (i.e., no significant demand variation)" (FDEP et al., June 2009).

Table 3-3. *Projected I/C and M/D demand in the Tampa Bay Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Hillsborough	17.49	24.97	25.14	12.57	12.72	12.87	-4.61	-26.0%
Pasco	0.98	0.95	0.98	1.00	1.02	1.05	0.07	7.%
Pinellas	0.19	0.19	0.19	0.20	0.20	0.20	0.01	6.0%
Total	**18.66**	**26.11**	**26.30**	**13.83**	**13.91**	**14.14**	**-4.53**	**-24.0%**

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

1.0 Description of the Power Generation Water Use Sector

The PG uses within the District include water for thermoelectric power generation used for cooling, boiler feed make-up, or other purposes associated with the generation of electricity. The PG quantities have previously been grouped with I/C and M/D quantities but are provided separately in this section per the 2019 Format and Guidelines (FDEP et al., June 2019).

2.0 Demand Projection Methodology

Demand projections for the 2020 RWSP were developed by multiplying the 2015 amount of water used by each PG facility by growth factors based on Woods & Poole Economics' GRP forecasts by county in five-year increments. Water use for 2015 is derived from the WUWPD. For example, if a PG facility used 0.30 mgd in 2015 and the county calculated growth factor from 2015 to 2020 was 3 percent, the 2020 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.

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 0.12 mgd, or 46.15 percent. The demand projections do not include reclaimed, seawater, or non-consumptive use of freshwater.

In accordance with the 2019 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)" (FDEP et al., June 2009).

Table 3-4. *Projected PG demand in the Tampa Bay Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base	2020	2025	2030	2035	2040	Change 2015-2040	% Change
Hillsborough	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Pasco	0.26	0.34	0.35	0.36	0.37	0.38	0.12	46.2%
Pinellas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
Total	**0.26**	**0.34**	**0.35**	**0.36**	**0.37**	**0.38**	**0.12**	**46.2%**

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 PG sector stakeholders for review and comment. The projections were reviewed by the District's Industrial Advisory Committee, which concurred with the projection methodologies and outcome. Upon receiving additional stakeholder comments, the District reviewed suggested changes and, when appropriate, included updates.

Section 5. Landscape/Recreation

1.0 Description of the Landscape/Recreation Water-Use Sector

The L/R sector includes the self-supplied water use associated with the irrigation of golf courses, cemeteries, parks, medians, attractions, and other large self-supplied green areas. Golf courses are major users within this category.

2.0 Demand Projection Methodology

Landscape/Recreation (L/R) baseline use data is from the WUWPD (SWFWMD, 2017). 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 2015 baseline pumpage. The projected percentage changes were based on projected socioeconomic factors such as, household income and ethnicity, and golf play rates associated with those socioeconomic factors.

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 3.05 mgd for the 5-in-10 condition is projected between 2015 and 2040. This represents an increase in demand of 21.6 percent.

4.0 Stakeholder Review

The demand projection methodology, results, and analyses were provided to the District's water use permitting staff and L/R use sector stakeholders for review and comment. The District's Agricultural and Green Industry Advisory Committee generally confirmed stable or decreasing water demands for golf as part of the L/R projections.

Table 3-5. *Projected increase in L/R demand in the Tampa Bay Planning Region (5-in-10 and 1-in-10) (mgd)*

County	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
Hillsborough	8.45	10.77	9.01	11.48	9.54	12.15	10.02	12.75	10.42	13.26	10.80	13.73	2.35	2.96	27.8%	27.5%
Pasco	3.53	4.52	3.68	4.71	3.82	4.89	3.95	5.05	4.06	5.19	4.16	5.32	0.64	0.80	17.9%	17.7%
Pinellas	2.18	2.79	2.20	2.82	2.21	2.84	2.22	2.85	2.23	2.87	2.24	2.87	0.06	0.08	2.%	2.9%
Total	**14.15**	**18.08**	**14.89**	**19.01**	**15.57**	**19.88**	**16.19**	**20.65**	**16.71**	**21.32**	**17.20**	**21.92**	**3.04**	**3.84**	**21.55%**	**21.29%**

Note: Summation and percentage calculation differences occur due to rounding. See Appendix 3-4 for source values.

Section 6. Summary of Projected Demands

Tables 3-6 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 82.71 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 2040. Public supply water use will increase by 87.46 mgd during the planning period. This is the largest increase of all the water use categories. Table 3-6 shows a -9.95 mgd reduction in agricultural water use and a net decrease of -4.60 mgd in I/C and M/D water use, most of which is groundwater. Table 3-7 summarizes the projected demands by each county in the planning region for the 5-in-10 condition.

Table 3-6. *Summary of the projected demand in the Tampa Bay Planning Region (5-in-10 and 1-in-10)[1] (mgd)*

Water Use Category	2015 Base		2020		2025		2030		2035		2040		Change 2015-2040		% Change	
	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10	5-10	1-10
PS	304.53	322.81	325.88	345.44	346.36	367.16	364.39	386.14	379.09	401.84	391.99	415.51	87.46	92.71	28.7%	28.7%
AG	48.11	62.27	46.12	59.62	44.18	57.09	42.35	54.67	40.45	52.23	38.16	49.30	-9.95	-12.97	-20.7%	-20.8%
I/C & M/D	18.66	18.66	26.11	26.11	26.31	26.31	13.77	13.77	13.94	13.94	14.12	14.12	-4.54	-4.54	-24.3%	-24.3%
PG	0.26	0.26	0.34	0.34	0.35	0.35	0.36	0.36	0.37	0.37	0.38	0.38	0.12	0.12	46.2%	46.2%
L/R	14.16	18.08	14.89	19.01	15.57	19.88	16.19	20.65	16.71	21.32	17.20	21.93	3.04	3.85	21.5%	21.3%
Total	**385.72**	**422.08**	**413.34**	**450.52**	**432.77**	**470.79**	**437.06**	**475.59**	**450.56**	**489.7**	**461.85**	**501.24**	**76.13**	**79.17**	**19.7%**	**18.8%**

Note: Summation and/or percentage calculation differences due to rounding.

Table 3-7. *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 2015-2040	
	2015	2020	2025	2030	2035	2040	mgd	%
Hillsborough								
PS	146.68	161.51	175.53	188.00	197.59	206.51	59.83	40.8%
AG	43.20	41.32	39.44	37.64	35.79	33.55	-9.65	-22.3%
I/C & M/D	17.49	24.97	25.14	12.57	12.72	12.87	-4.62	-26.4%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	8.45	9.01	9.54	10.02	10.42	10.80	2.35	27.8%
Cumulative Total	**215.82**	**236.81**	**24.65**	**248.23**	**256.52**	**263.73**	**47.91**	**22.20%**
Pasco								
PS	56.60	61.93	66.86	71.06	74.92	78.38	21.78	38.5%
AG	4.89	4.78	4.72	4.69	4.64	4.59	-0.30	-6.1%
I/C & M/D	0.98	0.95	0.98	1.00	1.02	1.05	0.07	7.1%
PG	0.26	0.34	0.35	0.36	0.37	0.38	0.12	46.2%
L/R	3.53	3.68	3.82	3.95	4.06	4.16	0.63	17.8%
Cumulative Total	**66.26**	**71.68**	**76.73**	**81.06**	**85.01**	**88.56**	**22.30**	**33.66%**
Pinellas								
PS	101.25	102.44	103.97	105.33	106.58	107.10	5.85	5.8%
AG	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.0%
I/C & M/D	0.19	0.19	0.19	0.20	0.20	0.20	0.01	5.3%
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
L/R	2.18	2.20	2.21	2.22	2.23	2.24	0.06	2.8%
Cumulative Total	**103.64**	**104.85**	**106.39**	**107.77**	**109.03**	**109.56**	**5.92**	**5.71%**
Region Total	**385.72**	**413.34**	**432.77**	**437.06**	**450.56**	**461.85**	**76.13**	**19.7%**

Note: Summation and percentage calculation differences occur due to rounding.

Section 7. Comparison of Demands between the 2015 Regional Water Supply Plan and the 2020 Regional Water Supply Plan

There are notable differences between the 2015 and 2020 RWSP demand projections in the AG, PS, I/C, M/D, PG, and L/R water use categories. The 2015 base numbers are reduced for all sectors except PS from the 2015 projected numbers used in 2015 RWSP. The increase in PS is largely due to methodology changes that include a parcel-based population projection approach. Regarding the PS category, the 2015 RWSP projected an increase of 83.11 mgd for the 2010–2035 planning period while the 2020 RWSP projects an increase of 87.46 mgd from 2015–2040, slightly greater than the 2015 RWSP.

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Chapter 4. Evaluation of Water Sources

This chapter presents the results of investigations by the Southwest Florida Water Management District (SWFWMD) (District) to quantify the amount of water that is potentially available from all sources of water within the planning region to meet demands through 2040. Sources of water that 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 2040.

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 2017, approximately 61 percent (242 million gallons per day [mgd]) of the 397 mgd of water (including domestic self-supply) used in the planning region was from groundwater sources. Approximately 51 percent (154 mgd) of the fresh groundwater used was for public supply (PS) (permitted and domestic self-supply [DSS]). 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 UFA 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 PS 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 PS connection.

In 2014, the surficial aquifer yielded 3.7 mgd of unpermitted withdrawals in Pinellas County, which was mostly used for landscape irrigation. It is anticipated that an additional irrigation demand of 0.4 mgd can be met through the use of the surficial aquifer in Pinellas County. In Pasco County, there were 0.3 mgd of permitted withdrawals from the surficial aquifer in 2014. There were no quantities of permitted withdrawals in Hillsborough County.

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 2014 was 1.4 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 2 mgd in Hillsborough County in 2014.

Due to its limited extent, only approximately one-third of projected 2040 demand for domestic self-supply, landscape irrigation and recreational water use in Hillsborough County can be met from the aquifer. Projected 2040 demand supplied through withdrawals from the surficial and intermediate aquifers in the planning region is expected to total 4.8 mgd, with 0.8 mgd allocated to recreational use and 4.0 mgd to DSS and household irrigation use. 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	Total
Hillsborough	3.6[1]	0.8[1]	4.4[1]
Pinellas	0.4	0	0.4
Pasco	0	0	0
Total	**4.0**	**0.8**	**4.8**

[1] Reduced due to limited extent of the intermediate aquifer system 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 (AWS) 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 PS 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 PS water use permits (WUPs), approximately 33.1 mgd of additional groundwater quantities are available to PS 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 costs at existing treatment plants, such as the use of electricity for pumping and treatment or expensive water treatment chemicals.
- Fiscal Responsibility. Most water conservation measures have a cost-effectiveness that is more affordable than that of other AWS sources such as reclaimed water or desalination.

Cost-effectiveness is defined as the cost of each measure compared to the amount of water expected to be conserved over the lifetime of the measure.

- Environmental Stewardship. Proper irrigation designs and practices, including the promotion of Florida-Friendly Landscaping™ (FFL), can provide natural habitat for native wildlife as well as reduce unnecessary runoff from properties into water bodies. This, in-turn, can reduce nonpoint-source pollution, particularly from operations that use fertilizers, pesticides or fungicides which, in turn, may hamper a local government's overall strategy of dealing with total maximum daily load (TMDL) restrictions within their local water bodies or maintain spring water quality health.

Since the 1990s, the District has provided financial and technical assistance to water users and suppliers in the 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 Tampa Bay Planning Region through a combination of regulatory and economic measures, as well as incentive-based outreach and technical assistance for the development and promotion of the most recent technologies and conservation activities. Regulatory measures include WUP conditions, year-round water restrictions, and municipal codes and ordinances that require water-efficiency standards for new development and existing areas. For example, the National Energy Policy Act of 1992 requires all new construction built after 1994 to be equipped with low-flow plumbing fixtures. In Florida, Senate Bill 494, which took effect in July 2009, requires all automatic irrigation systems to use an automatic shutoff device. Senate Bill 2080 prohibits contractual and/or local government ordinance restrictions on the implementation of FFL. Periodically, water management districts (WMDs) in Florida issue water shortage orders that require short-term mandatory water conservation through situational BMPs and other practices.

Economic measures, such as inclining block rate structures, are designed to promote conservation by providing price signals to customers of public water supply systems to reduce inefficient use. Incentive programs include rebates, utility bill credits, or giveaways of devices and fixtures that will replace older, less water-efficient models. Such equipment includes, but is not limited to, high-efficiency toilets (HET), low-flow faucet aerators, high-efficiency showerheads, smart irrigation controllers, rain sensors, and soil moisture sensors SMSs. Recognition programs, such as the District's Water Conservation Hotel and Motel Program (CHAMP℠) and Florida Water Star℠ (FWS), are also incentive programs that recognize homeowners and businesses for their environmental stewardship.

FWS landscapes use large mulch beds to reduce irrigable turf.

The District's Utilities Services Group provides guidance and technical expertise to PS water utilities and helps identify and reduce water loss. The non-regulatory assistance and educational components of the program maximize water conservation throughout the PS water use sector and improve both local utility system efficiency and regional water resource benefits. Among the services provided upon request are comprehensive leak detection surveys, meter accuracy testing, and water audit guidance and evaluation. Since the program's inception, the leak detection team has conducted 154 comprehensive leak detection surveys throughout the District, locating 1,553 leaks of various sizes and totaling an estimated 5.9 mgd. For the Tampa Bay Planning Region, the leak detection team has conducted 33 comprehensive leak detection surveys, locating 313 leaks totaling an estimated 1.2 mgd.

For the past ten years, the District has administered the statewide FWS voluntary water conservation certification program for new and existing homes and commercial developments. Residences, businesses, and communities can earn FWS certification through meeting efficiency standards in appliances, plumbing fixtures, irrigation systems, and landscapes.

A single-family home built to meet FWS criteria may use at least 40 percent less water outdoors and approximately 20 percent less water indoors than a home built to the current Florida Building Code. Local governments that adopt FWS criteria as their standard for new construction can expect greater long-term savings to occur than for similar structures built to conventional standards. In addition, FWS offers installation and BMPs training for landscapers and irrigation contractors, providing an opportunity for them to become FWS accredited professionals.

Education is an important element of a successful conservation program. While the actual quantity of water saved as a result of customer education is not measurable, the effort greatly increases the success of all other facets of a conservation program by raising customer awareness and changing attitudes regarding water use. Educating the public is a necessary facet of every water conservation program, and conservation education programs accompanied with other effective conservation measures can be an effective supplement to a long-term water conservation strategy. On a Districtwide scale, water conservation efforts have contributed to declining unadjusted gross per capita use rates, from 115 gallons per day (gpd) per person in 2005 to 97 gpd per person in 2015. The per capita use rate for the District is the lowest of all five WMDs. The per capita trend for the Tampa Bay Planning Region is also decreasing as shown in Figure 4-1.

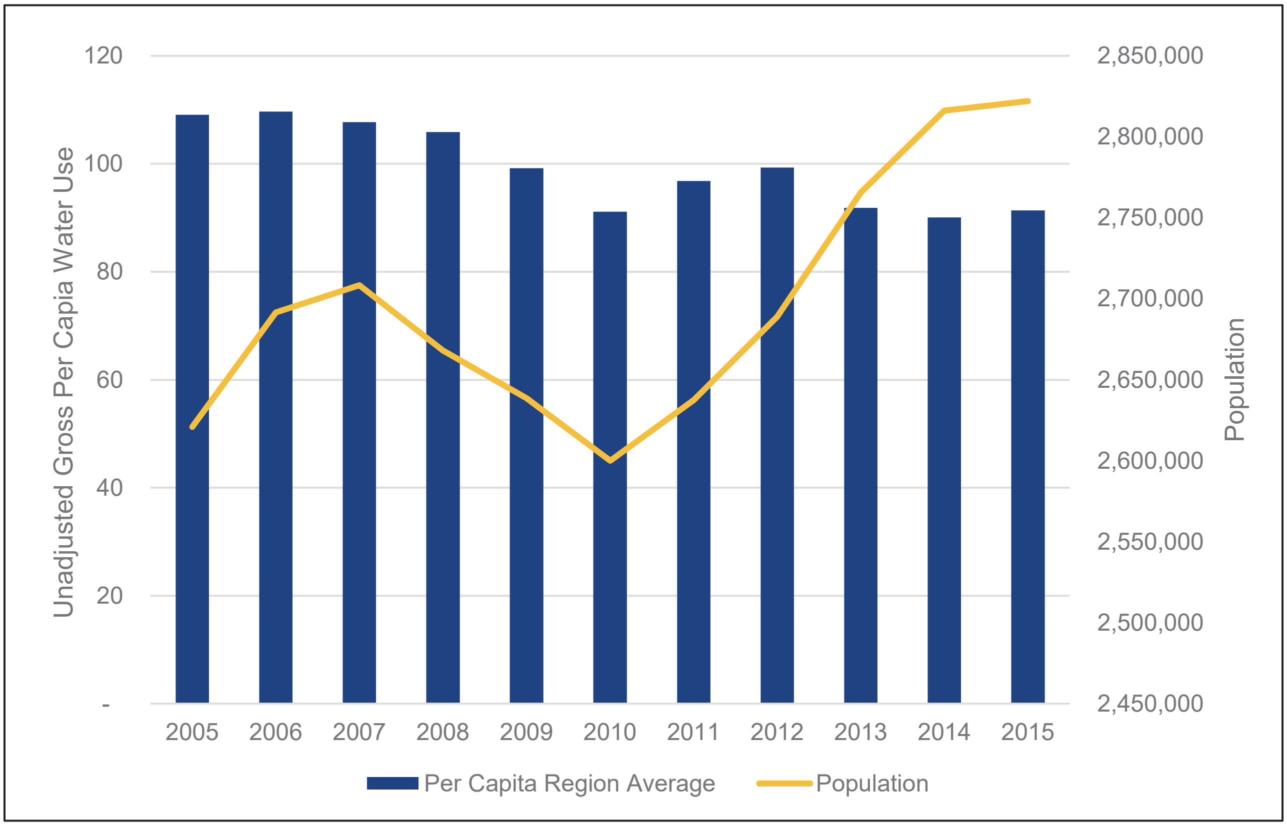


Figure 4-1. *Per capita water use rates in the Tampa Bay Planning Region, 2005-2015*

1.1 Public Supply

The PS sector includes all water users that receive water from public water systems and private water utilities. The PS sector may include non-residential customers such as hospitals and restaurants that are connected to a utility potable distribution system. Water conservation in the PS sector will continue to be the primary source of water savings in the District. Public supply (PS) systems lend themselves most easily to the administration of conservation programs since they measure each customer's water use and can focus, evaluate, and adjust the program to maximize savings potential. The success of the District's water conservation programs for PS systems to date is demonstrated by the 15.8 mgd in savings that has been achieved within the District since programs began in 1991. Within the region, it is estimated that savings for the PS sector could be 40 mgd by 2040, if all water conservation programs presented below are implemented (see Table 4-2).

1.1.1 Water Conservation Potential in the Tampa Bay Planning Region

Estimated conservation potential for the planning region is based on the 2018 TBW Water Demand Management Plan Update which is a part of TBW's 2018 Long-term Master Water Plan. The update uses the 2015-2040 planning horizon and is understood to be a well-quantified demand management plan. The plan analyzes the potential for 11 water conservation activities within the TBW member governments' service areas, using the Water Conservation Tracking Tool (Alliance for Water Efficiency, 2019) to calculate the associated savings and costs.

1.1.2 Assessment Methodology

Tampa Bay Water includes six member governments (City of New Port Richey, City of St. Petersburg, Hillsborough County, Pasco County, Pinellas County, and City of Tampa) and, as a single entity, accounted for 82.5 percent of PS water use in the planning region in 2015. In order to assess the region's entire conservation potential, including what is available for the other 17.5 percent of demand, the District has projected the TBW estimates onto the demand of the entire planning region. Water conservation is divided into two categories, passive and active, and the estimation methodology is described further below.

Passive Conservation

Passive water conservation savings refer to water savings that occur as a result of users implementing water conservation measures in the absence of utility incentive programs. These are typically the result of building codes, manufacturing standards, and ordinances that require the installation of high-efficiency plumbing fixtures and appliances in new construction and renovations. Passive water conservation has been observed as a major contributor to decreasing per capita water use across the country.

Tampa Bay Water (TBW) divides water demand into three major sectors: (1) single-family residential, (2) multi-family residential, and (3) non-residential. Single-family residential water demand is greater than multi-family residential and non-residential 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. These results show that the majority of indoor water use is attributable to showers, clothes washers, and toilets. This is consistent with national studies on the 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 for TBW member governments. To obtain the passive savings estimate across the planning region, the percent reduction in 2040 demand due to passive conservation was multiplied by the 2040 regional demand.

Active Conservation

Active water conservation encompasses a variety of measures, practices, and programs sponsored or encouraged by utilities and municipal governments which result in water use reductions. By their nature, active water conservation programs are typically funded and administered by PS utilities or other regional entities.

In the 2018 Demand Management Plan Update, TBW selected the 11 potential conservation activities listed below:

1. Alternative Irrigation Sources
2. High-efficiency Toilets (HET) (Single-family)
3. Smart Irrigation Controllers
4. Florida Water Star/Florida-Friendly Landscaping™
5. High-efficiency Toilets (HET) (Multi-family)
6. Cooling Towers
7. High-efficiency Toilets (HET), Valve (Industrial/Commercial)
8. High-efficiency Urinals (0.5 gallon) (Industrial/Commercial)
9. Pre-rinse Spray Valves (Industrial/Commercial)
10. I/C High-efficiency Toilets (HET), Tank (Industrial/Commercial)

11. Conveyor Dishwashers (Industrial/Commercial)

In the TBW 2018 Demand Management Plan Update, the implementation period for active conservation ends in 2030. This falls 10 years short of the 2020 Regional Water Supply Plan's (RWSP) planning horizon. In an effort to maintain savings beyond 2030, the number of implementations per year were extrapolated for four of the conservation activities: (1) smart irrigation controllers (referred to as SMS and evapotranspiration irrigation controllers by TBW), (2) Florida Water Star/Florida-Friendly Landscaping™, (3) cooling towers, and (4) pre-rinse spray valves. These activities either had a participation rate lower than 20 percent or a life expectancy shorter than the 20-year planning horizon. Those not selected for extrapolation were assumed to have a high participation rate at or above 50 percent in the TBW plan and were therefore left out in order to be more conservative in the 2020 RWSP estimates. The savings and costs for these four conservation activities were adjusted accordingly.

After extending the implementation period for the aforementioned conservation activities, the adjusted percent reduction in 2040 TBW demand was applied to the 2040 Tampa Bay Planning Region demand. Using the resulting total adjusted active savings across the planning region, the 2040 savings for each of the 11 activities were estimated. This was done by calculating the proportion of savings attributed to each activity according to TBW estimates and applying these same ratios to the District regional total. Similarly, the total costs for each conservation activity across the planning horizon were calculated.

1.1.3 Results

The TBW 2018 Demand Management Plan Update results adjusted for an extended implementation period project that there will be a passive savings rate of 6.30 percent in 2040. Applying this rate to the higher SWFMWD demand yields a passive savings of 21.68 mgd across the planning region in 2040, which is 53.9 percent of total savings. Similarly, the adjusted TBW figures project an active savings rate of 5.38 percent, which, when applied to the total regional demand, yields an active savings of 18.51 mgd by 2040. These active savings constitute 46.1 percent of total savings. Combined, passive and active savings total 40.19 mgd by 2040 for the planning region. The drop in regional demand over time associated with both passive and active savings is shown in Figure 4-2 below and table 4-2.

For the purposes of this RWSP, the cost effectiveness of the active conservation activities analyzed are calculated using SWFWMD methods rather than those of TBW. The unit cost is amortized at 8 percent and compared to the unit savings over the activity's anticipated service life. On average, the 11 conservation activities cost $0.99 per thousand gallons. The most cost-effective conservation activity is the cooling tower retrofit/upgrade at $0.13 per thousand gallons, while the least cost-effective activity is the Florida Water Star/Florida-Friendly Landscaping™ program at $2.14 per thousand gallons. The region-wide total cost for active programs across the planning horizon is estimated at $60.5 million.

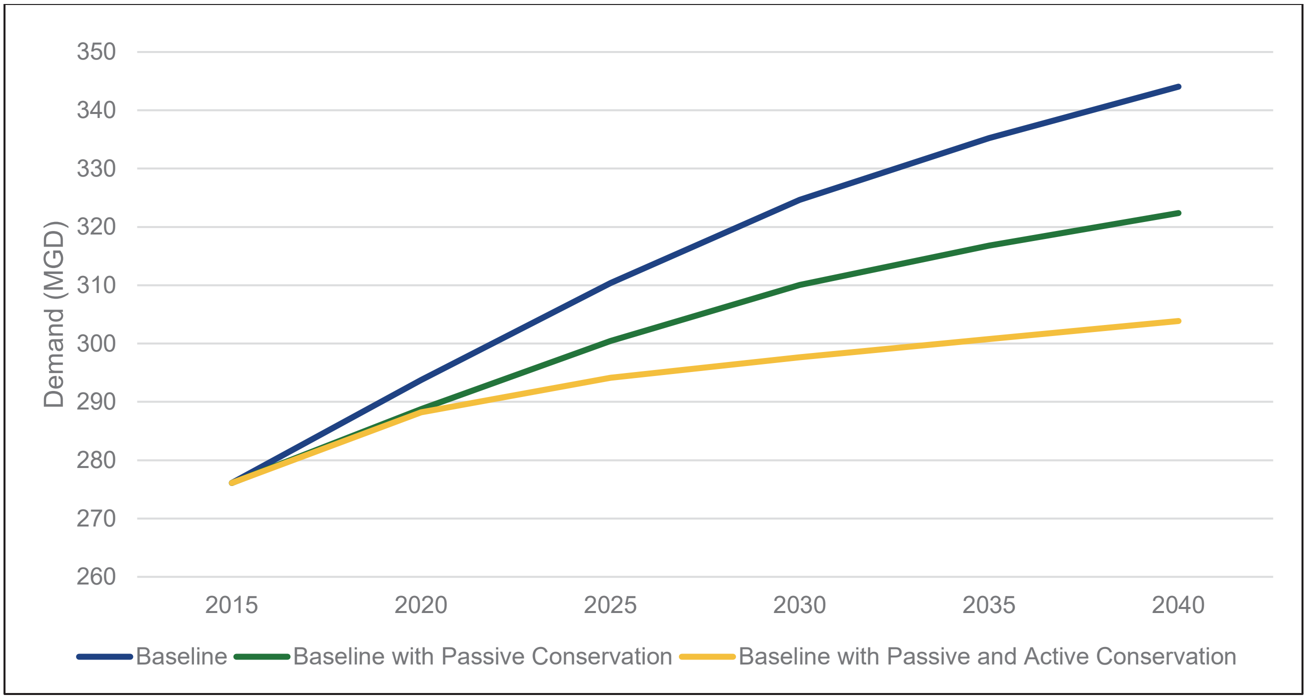


Figure 4-2. *Potential effects of conservation on projected PS demand*

1.1.4 Additional Considerations

The active conservation analysis builds on the passive estimate as it considers only the inefficient stock not already replaced passively. However, it is not comprehensive as there are many other activities that could result in substantial water savings. These active estimates also factor in the effective life of various activities; therefore, for items that have a short-expected life (e.g., rain sensors), repetitive implementations, and reoccurring costs are required just to maintain savings.

1.2 Domestic Self-Supply

The DSS sector includes individual private homes and businesses that are not utility customers and receive their domestic water supply from a well or from a surface supply for uses such as irrigation. Domestic Self-Supply (DSS) wells do not require a District WUP, as the well diameters do not meet the District's requirement for a permit. Domestic Self-Supply (DSS) systems are not metered and, therefore, changes in water use patterns are less measurable than those that occur in the PS sector. Only passive conservation was estimated for DSS systems in this RWSP. Within the region, it is estimated that passive savings for the DSS sector could be 2.0 mgd by 2040.

1.2.1 Domestic Self-Supply Assessment Methodology

To calculate DSS passive savings, it was assumed that the DSS sector will experience the same percent savings as the PS sector over the planning horizon. The percent of passive savings calculated in the PS analysis was therefore applied to the SWFWMD total DSS 2040 demand projection for the Tampa Bay Planning Region to obtain passive savings specific to the DSS sector. In other words, the DSS 2040 demand (31.7 mgd) was multiplied by the PS passive savings rate (6.3 percent) to yield the DSS passive savings estimate (1.9 mgd).

1.3 Industrial/Commercial Self-Supply

This water use sector includes factories and other industrial enterprises that obtain water directly from surface water and/or groundwater sources through a WUP. Businesses try to minimize water use to reduce pumping, purchasing, treatment 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 HET. 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 0.32 mgd by 2040 (See Table 4-2).

1.3.1 Industrial/Commercial Assessment Methodology

The I/C savings estimate utilized the same methodology outlined in the 2020 Draft Central Florida Water Initiative (CFWI) RWSP. This methodology was based on a study by Dziegielewski et al. (2000) that examined the impact of water audits on improving water efficiency within this sector. The lower-bound savings determined in this study was 15 percent, and this number was used in lieu of the higher estimate to be more conservative. The 15 percent participation rate used in the 2020 Draft CFWI RWSP was also assumed. Therefore, the self-supplied I/C 2040 demand (14.11 mgd) multiplied by both the savings and participation rates (15 percent for both) yields the estimated water savings over the planning horizon for the self-supplied I/C sector within the Tampa Bay Planning Region (0.32 mgd).

1.4 Landscape/Recreation Self-Supply

The Landscape/Recreation (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 PS 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 0.99 mgd by 2040 (See Table 4-2).

1.4.1 Landscape/Recreation Assessment Methodology

As with the self-supplied I/C sector, the estimate of the water conservation potential of the L/R sector was derived using the same methodology as the 2020 Draft CFWI RWSP. Conservation in this sector primarily comes from updating inefficient sprinkler heads and installing smart irrigation controllers, such as SMS or weather-based controllers. Based on two studies by the University of Florida, it was determined that the lower-bound savings from retrofits and smart irrigation controllers are 10 percent and 20 percent, respectively. These values were used along with the 15 percent savings rate also assumed in the 2020 Draft CFWI RWSP to estimate self-supplied L/R water conservation. In other words, the 2040 L/R demand (21.93 mgd) was multiplied by the participation rate (15 percent), and this product was multiplied by each of the savings rates (10 percent and 20 percent). The sum of these final two numbers (0.33 mgd and 0.66 mgd) equates to the total L/R savings over the planning horizon (0.99 mgd). The 1-in-10 2040 demand projections were used instead of the 5-in-10 projections in an effort to be more conservative.

1.5 Summary of the Potential Water Savings from Non-Agricultural Water Conservation

Table 4-2 summarizes the potential non-agricultural water conservation savings in the Tampa Bay Planning Region. This table shows that, through the implementation of all conservation measures listed above for the PS, DSS, I/C, and L/R water use sectors, it is anticipated that approximately 43.5 mgd could be saved by 2040 at a total projected cost of $60.5 million. This is a 10.56 percent reduction in total demand.

Table 4-2. *Potential non-agricultural water conservation savings in the Tampa Bay Planning Region*

Sector	2040 Demand (mgd)	Savings (mgd)	Potential Reduction in Demand (%)	Average Cost Effectiveness ($/kgal)
PS Total	344.06	40.19	11.68%	-
PS Passive	-	*21.68*	*6.31%*	-
PS Active	-	*18.51*	*5.38%*	*$0.99*[1]
DSS	31.71	2.00	6.30%	-
I/C	14.11	0.32	2.27%	-
L/R	21.93	0.99	4.51%	-
Total	**411.81**	**43.50**	**10.56%**	**-**

[1]Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.

2.0 Agricultural Water Conservation

The Florida Department of Agriculture and Consumer Services (FDACS) develops conservation projections as part of the Florida Statewide Agricultural Irrigation Demand (FSAID5) projections. Those conservation projections were based on historical trends (1973-2013) in irrigation of water applied per acre per year. The historical trend of the ratio was used to predict future irrigation conservation through 2040. The trend accounts primarily for gains in irrigation system distribution uniformity. This methods limitation is that it does not completely account for existing regulatory constraints (SWUCA rules) that have resulted in increased water use efficiency, thus limiting future water conservation savings potential. However, future savings could still come from developing new technology, sensor-based automation, and scheduling changes.

This RWSP uses the trend as a percent reduction (approximately 13 percent) in 2040 demand. The county-by-county savings percentages derived from FSAID5 data were applied to the 2040 agricultural (AG) demands shown in Table 3-2 which are District specific demand projections and lower than FSAID5 demands. Results are shown below in Table 4-3.

Table 4-3. Potential agricultural water conservation savings in the Tampa Bay Planning Region

County	Projected 2040 demand (mgd)	Savings as a percentage (derived from FSAID5)	Agricultural Conservation Potential by 2040 (mgd)
Hillsborough	31.41	13.37%	4.20
Pasco	4.47	12.97%	0.58
Pinellas	0.02	0%	0
Total	**35.90**		**4.78**

These estimates should be considered as potential conservation and should not be treated as "water supply" or directly removed from AG water demand estimates. Substantial investments will be necessary to realize these savings. District investment paired with other government assistance programs like those for the FDACS and the Natural Resources Conservation Service could accelerate the rate at which these savings occur. Water resource benefits from the Facilitating Agricultural Resource Management Systems (FARMS) Program are categorized as water resource development (WRD) or water conservation (gains in efficiency). Benefits associated with WRD (primarily tail water recovery) projects are estimated to be 0.75 mgd during the planning horizon. Additional information on the FARMS Program and its potential impact on water resources is located in Chapters 5 and 7.

Section 3. Reclaimed Water

Reclaimed water is defined by the Florida Department of Environmental Protection (FDEP) as water that is beneficially reused after being treated to at least secondary wastewater treatment standards by a domestic wastewater treatment plant (WWTP). Reclaimed water can be used to accomplish a number of goals, including decreasing reliance on potable water supplies, increasing groundwater recharge and restoring natural systems. Figure 4-3 illustrates the reclaimed water infrastructure, utilization, and availability of reclaimed water within the District in 2015, as well as planned utilization that is anticipated to occur by 2025 as a result of funded projects. Existing and funded projects are expected to result in reclaimed water increases of 36 mgd, bringing utilization within the planning region to approximately 126 mgd by 2025. Appendix 4-1 contains anticipated 2025 reclaimed water utilization.

The benefit that can be obtained from the use of reclaimed water is governed by the concepts of utilization and water resource benefit. Utilization rate is the percent of treated wastewater from a WWTP that is beneficially used in a reclaimed water system. The utilization rate of 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 330 gpd for irrigation. However, if the same single-family residence converts to an unmetered flat rate, reclaimed water irrigation supply without day-of-week restrictions, it will use approximately two and one-half times (804 gpd) this amount. In this example, the benefit rate would be 41 percent (330 gpd benefit for 804 gpd reclaimed water utilization). Different types of reclaimed water uses have different benefit potentials. For example, a power plant or industry using 1 mgd of potable water for cooling or process water 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 75 percent utilization rate of all WWTP flows and benefit efficiency of all reclaimed water used of 75 percent by the year 2040. This goal is intended to reduce the overuse of reclaimed water and increase potable and groundwater benefits. Opportunities may exist for utilization and 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.

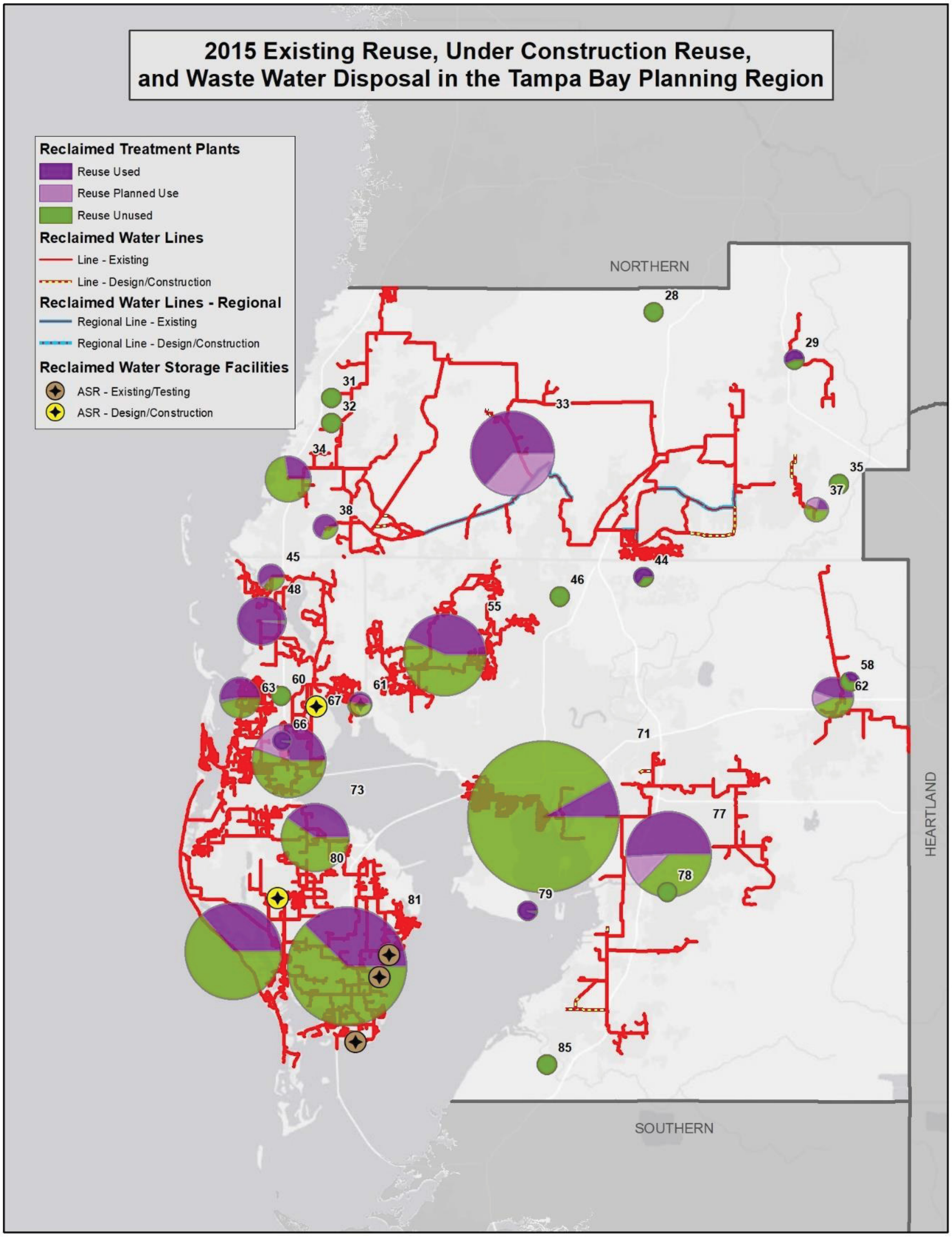


Figure 4-3. *Districtwide reclaimed water map (information on numbered facilities is available at http://www.swfwmd.state.fl.us/conservation/reclaimed/*

1.0 Potential for Water Supply from Reclaimed Water

Table 4-4 provides information on the current and future availability of reclaimed water in the planning region and the potential to achieve potable-quality water benefits through 2040. In 2015, there were 44 WWTPs in Hillsborough, Pasco, and Pinellas counties that collectively produced approximately 248 mgd of treated wastewater. Of that quantity, 89.31 mgd was used resulting in approximately 62 mgd of benefits to traditional water supplies. Therefore, only approximately 36 percent of the wastewater produced in the region was utilized for irrigation, industrial cooling, or other beneficial purposes. By 2040, it is expected that more than 75 percent of wastewater available in the planning region will be utilized, and that efficiency of use will average more than 75 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 2040, it is estimated that 221.26 (approximately 75 percent) of the 295.02 mgd of wastewater produced will be beneficially reused. This will result in approximately 166 mgd of benefits, of which 104.07 mgd is additional post-2015 (75 percent efficiency).

Table 4-4. *2015Actual versus 2040 potential reclaimed water availability, utilization, and benefit (mgd) in the Tampa Bay Planning Region*

County	2015 Availability, Utilization, and benefit[1]				2015–2040 Potential Availability, Utilization, and benefit[2]			
	Number of WWTPs in 2015	WWTP Flow in 2015	Utilization in 2015 (36%)	Potable-Quality Water Benefit (69%)	2040 Total WWTP Flow	2040 Utilization (75%)[3]	2040 Potable-Quality Water Benefit (75%)[3]	Post 2015 Benefit
Hillsborough	15	109.49	26.62	19.27	141.75	106.31	79.73	60.46
Pasco	14	29.79	17.85	11.09	40.08	30.06	22.54	11.45
Pinellas	15	109.10	44.84	31.51	113.19	84.89	63.67	32.16
Total	**44**	**248.38**	**89.31**	**61.87**	**295.02**	**221.26**	**165.94**	**104.07**

[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. Tampa bay Water (TBW) also uses the Hillsborough River and the TBC. From January 2007 to December 2018, TBW supplied an average of 36.9 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 (WTP) 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 criterion 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 included 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 AG 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 through 2018 at the most downstream gauging station was 43. 7mgd (67.6 cubic feet per second [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 surface withdrawals upstream of the gulf. According to *Anclote River System Recommended Minimum Flows and Levels* (Heyl et. al., 2010) and more recently completed MFLs status assessments, 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 within Hillsborough County, the headwaters are located in an area of Polk County that has been extensively mined 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. Two minor permitted agricultural-use withdrawals are located in the upper watershed, on Bell Creek and Howell Branch. The annual average flow of the Alafia River at Lithia

Pinecrest Road at Lithia, FL, not adjusted for these withdrawals was 213.8 mgd (331.0 cfs) for the period from 1933 through 2018.

Mosaic Fertilizer is permitted to withdraw an annual average of nearly 6.0 mgd from Lithia and Buckhorn springs, which both supply base flow to the river downstream of Lithia Pinecrest Road. Tampa Bay Water (TBW) also withdraws water from the downstream portion of the river for direct use or diversion to the C.W. Bill Young Regional Reservoir for storage. Tampa Bay Water's (TBW) withdrawals are permitted according to a flow-based withdrawal schedule, which for the period from 2007 through 2018, authorized an average withdrawal of up to 18.9 mgd. For this period, combined withdrawals from the springs and lower river averaged 13.9 mgd. Based on the annual flow in the lower river of 236.5 mgd adjusted for these withdrawals, consideration of established MFLs for the lower and upper Alafia River and existing permitted quantities, an additional 6.4 mgd of water supply is potentially available from the river.

2.3 Hillsborough River

The Hillsborough River, with a watershed area of 650 square miles, is the most hydrologically significant river in the planning region. 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 Planning 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 UFA 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.

The annual average discharge from 1965 through 2018 was 185 mgd (286 cfs) as measured at the Hillsborough River. 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 PS 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 WTP, located upstream of the dam. Tampa Bay Water (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 2018, the City of Tampa's annual average withdrawal from the Hillsborough River was approximately 70 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 approximately 72 mgd. During the same period, TBW diverted 6.74 mgd from the TBC Middle Pool to augment the Hillsborough River.

2.4 Tampa Bypass Canal

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.

Tampa Bay Water (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. Tampa Bay Water (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 District Structure S-162, which separates the Middle and Lower canal pools. Tampa Bay Water's (TBW) Harney Canal augmentation permit allows withdrawals up to an annual average of 20 mgd. Tampa Bay Water's (TBW) 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 District Structure S-161 into the TBC for subsequent use by TBW. Tampa Bay Water's (TBW) withdrawals from the TBC Lower Pool are based on stage. The minimum flow at Structure S-160 is zero, so no flow downstream of Structure S-160 is required. Tampa Bay Water (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. Tampa Bay Water (TBW) manages the pool stages in the Middle Pool and Lower Pool to maximize the availability of water on a day-to-day basis. Tampa Bay Water's (TBW) 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.

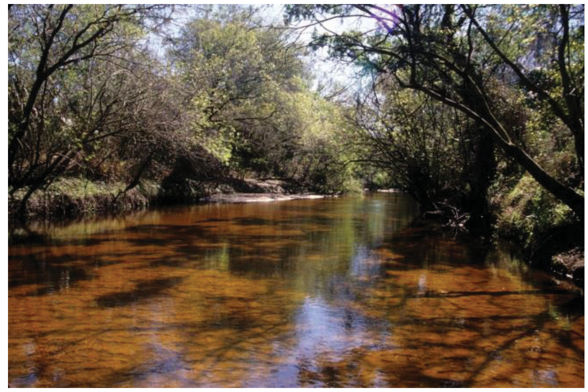
From 2007 through 2018, TBW withdrew a 12-year average of 47.9 mgd from the TBC for distribution to their regional system. Approximately 3.6 mgd was water taken from the Middle Pool of the TBC and 44.3 mgd was non-augmented water from the Lower Pool of the TBC. During the same period, TBW diverted 6.74 mgd from the Middle Pool to augment the Hillsborough River. Total net diversions from 2007 through 2018 were 54.7 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 U.S. Geological Survey (USGS) gage near Wimauma, average annual discharge for the Little Manatee River is approximately 113 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 2018 were approximately 6 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 2017, FPL is now authorized to withdraw up to an annual average of 8.5 mgd, with maximum daily withdrawals limited to 122 mgd. 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 0.54 mgd is permitted to AG 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 Potential for Water Supply from Surface Water

Table 4-5 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 89.9 mgd to 108.9 mgd. The lower end of the range is the amount of surface water that has been permitted but is currently unused (235.4 mgd minus 143.9 mgd), and the upper end includes permitted, but unused quantities (89.9 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 4-5. *Summary of current withdrawals and potential availability of water from rivers/Tampa Bypass Canal 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	43.7	TBD	0.0	0.0	TBD	--	--	--
Alafia River @ Bell Shoals Rd.[8]	No	236.5	31.2	24.9	13.9	6.4	109	33	182
Hillsborough River @ Dam[9,10]	Yes	185	18.5	113.0	70.0	TBD	TBD	TBD	TBD
Tampa Bypass Canal @ S-160[10,11]	Yes	NA	0	88.5	55.0	TBD	TBD	TBD	TBD
Little Manatee River @ FPL Reservoir	No	113.0	11.3	9.0	5.0	TBD	--	--	--
Total				**235.4**	**143.9**	**6.4**			

[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 1965–2018. An MFL of zero has been established for the TBC at 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. Establishes MFLs were 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 2007–2018.
[5] Equal to remainder of 10 percent of total flow after permitted uses allocated, with minimum flow cutoff for new withdrawals of P85 and max system diversion capacity of twice median flow (P50), except as noted in subsequent footnotes.
[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 AG permitted withdrawals. Current use for TBW withdrawals is water sent to regional distribution system and was 11.1 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 PS 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 PS. 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. 2018 includes 70 mgd used by city and 1.9 mgd by TBW for total of 72 mgd. Current use does not include 6.74 mgd 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. 2018 from TBC Middle Pool to Hills. River is 6.74 mgd. Current use based on Jan. 2007–Dec. 2018 is difference between 44.3 mgd withdrawn by TBW from Lower and Middle Pools and 3.6 mgd transferred from Hills. River to augment TBC Middle Pool. Net withdrawal from TBC is 47.9 mgd. Total current use for TBC is 54.7 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 suitable for water supply is available from two general sources within the District: (1) in the UFA and intermediate aquifer system along coastal areas and (2) inland at greater depths within the Lower Floridan aquifer (LFA) below Middle Confining Unit 2 (MCU II). The coastal brackish groundwater is found as a depth-variable transition between fresh and saline waters. Figure 4-4 depicts the generalized location of the freshwater/saltwater interface (as defined by the 1,000 milligrams per liter (mg/L) isochlor) in the Avon Park high production zone of the UFA in the southern and central portions of the District. Generally, water quality declines to the south and west of the District.

Outside of the immediate coastal zone, brackish water sources in the LFA originate from mixing with relic seawater or contact with evaporitic and organic-rich strata. Recent hydrogeologic investigations in Polk County have found groundwater below MCU II to be mildly brackish, and also reasonably confined from the UFA, to suggest development of the source may be feasible. At further depths the groundwater is saline, so future projects must address potential upwelling of saline groundwater to supply wells that could deteriorate water quality over time.

Brackish groundwater is defined as groundwater having impurity concentrations greater than drinking water standards (i.e., 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. Brackish water treatment facilities typically use source water that slightly or moderately exceeds potable water standards. Raw water with TDS values less than 6,000 mg/L is preferable for treatment due to recovery efficiency and energy costs. Groundwater with TDS greater than 10,000 mg/L generally exceeds feasibility because treatment would require high-pressure pumps and reverse osmosis (RO) membranes that are more costly to operate. Many treatment facilities will blend fresher water or recirculate some RO permeate to maintain a consistent raw water quality for efficient operation. Pure RO permeate can have very low TDS and may be corrosive to pipe metals and prior mineral deposits, so bypass blending of some raw water into the RO permeate is common for buffering, and also increases the total yield.

While RO is the most common brackish water treatment technology, electro-dialysis reversal (EDR) systems may also be viable and are in use within the District at the T Mabry Carlton facility in Sarasota County. The EDR method uses an electrical current to pull ionic minerals outward from water flowing through a gel membrane, and the electrical current is frequently reversed to prevent buildup in the membrane. Both RO and EDR systems should be considered in brackish water supply project conceptualization and feasibility studies.

Both RO and EDR treatment systems generate a concentrate byproduct that must be disposed of through methods that may include surface water discharge, deep-well injection, or dilution at a WWTP. Surface water discharges require a National Pollutant Discharge Elimination System (NPDES) permit and may be restrained by TMDL limitations. In some cases, brackish water treatment facilities have been required to run below their potential efficiencies to reduce the strength of the concentrate. Because of these environmental considerations, deep-well injection is becoming more prevalent. Deep-well injection may not be permittable in some areas with unsuitable geologic conditions. An additional but costly disposal option is zero liquid discharge (ZLD). Zero liquid discharge (ZLD) is the treatment of concentrate for a second round of high-recovery desalination, then crystallization or dehydration of the remaining brine. The resulting solids might have economic value for various industrial processes.

The Florida Legislature declared brackish groundwater an AWS in 2005 (Senate Bill 444). However, it remains a groundwater withdrawal and must occur in a manner that is consistent with applicable rules, regulations, and water use management strategies of the District. Factors affecting the development of supplies include the hydrologic properties and water quality of the aquifer, rates of groundwater withdrawal, and well configurations.

The District revised its Cooperative Funding Initiative policy in December 2007, recognizing brackish groundwater as an AWS and allowing for assistance with construction projects. Since then, the District has assisted constructing five brackish groundwater treatment projects in the cities of North Port, Oldsmar, Tarpon Springs, Clearwater, and Punta Gorda. Each City has a regionally interconnected water supply system. The District is also co-funding two additional brackish groundwater projects for the Polk Regional Water Cooperative that are under design. The funding is intended to incentivize the development of integrated, robust, multijurisdictional systems that are reliable, sustainable, and utilize diverse water sources. While the District's regional water supply development processes have traditionally been based on meeting increasing demand projections, several brackish groundwater projects have been pursued for other needs: to blend permeate with treated surface water in order to meet finished water quality standards, to maintain viability of existing wellfields with deteriorating water quality, and to provide seasonal source substitution to meet an MFL. Future projects might also incorporate indirect potable reuse. The District recognizes the importance of maintaining the viability of existing supplies, but also encourages the consideration of alternate options based on economics and long-term regional benefit. A phased approach to brackish groundwater development is recommended that includes hydrogeologic evaluations to determine project viability, design phases that help refine the economic and permitting feasibility, and construction procured through a competitive bidding process.

Historically, the District's regional water supply planning process has evaluated brackish groundwater (and other AWS 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.

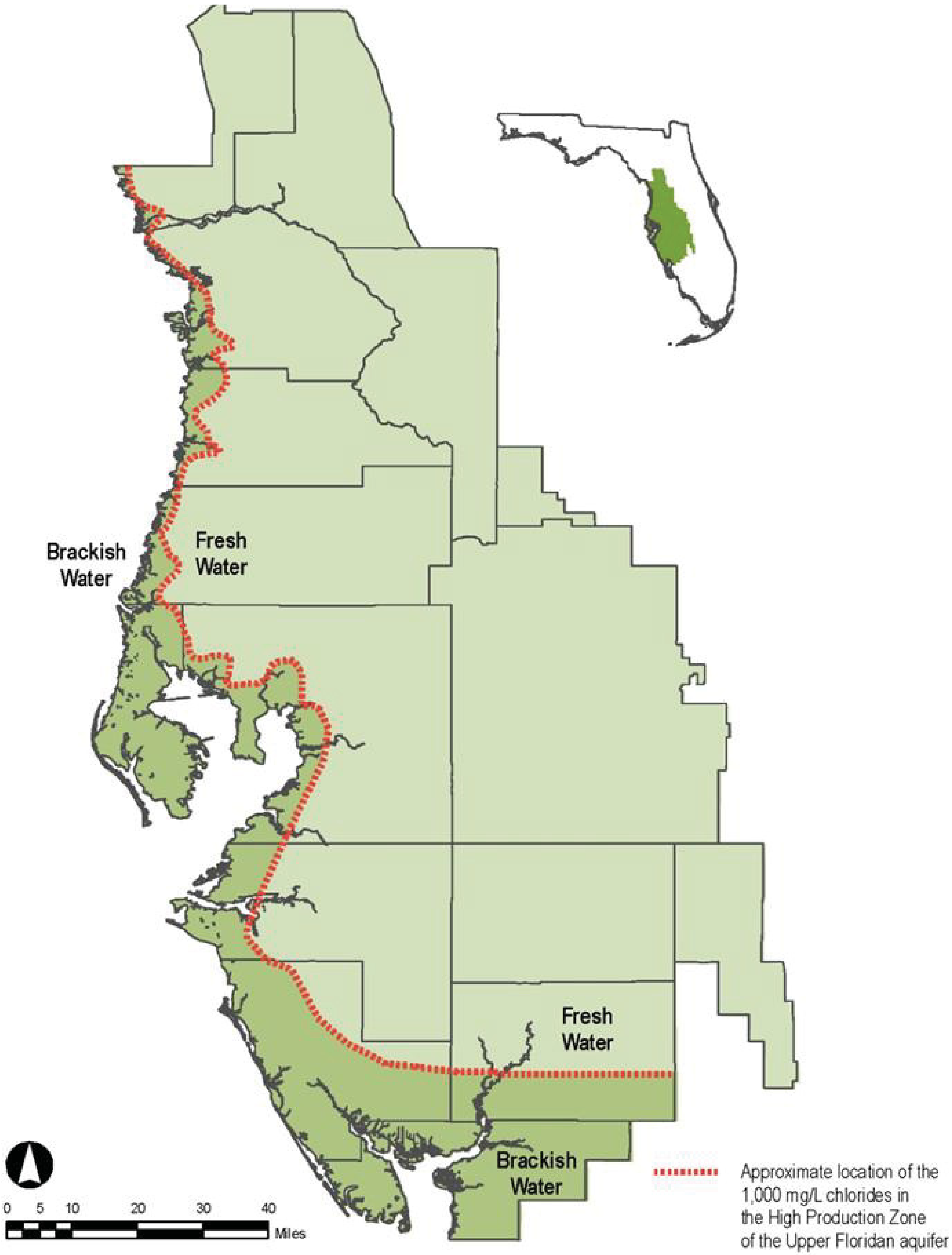


Figure 4-4. *Generalized location of the freshwater/saltwater interface*

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 PS. Approximately three quarters of the PS 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. 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. Brackish groundwater wellfields 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 Clearwater has three water treatment facilities, and two have RO systems. The City 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 4.5 mgd average treatment capacity. The City's RO facility #2 is located in the southeast portion of the city and began operation in 2015. The facility was built with a 5.0 mgd average treatment capacity, but poorer-than-anticipated raw water and other technical issues have limited production to approximately 2.5 mgd to date. The City is pursuing improvements to Facility #2 to reach the design capacity. The third facility is a freshwater wellfield located in the northeast portion of the City. Some of Facility #3 wells have deteriorating water quality, and the City is evaluating whether to integrate the wellfields so a milder blend of brackish raw water can be treated at Facility #2. The City is also evaluating additional wells near Facility #2 and aquifer recharge projects that would use highly treated reclaimed water to alleviate lateral seawater intrusion and improve aquifer levels near existing or expanded wellfields.

Table 4-6. *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) [1]	2018 Total Withdrawals (mgd)	2018 Finished Supply (mgd)	Estimated Available Supply [2] (mgd)	Source Aquifer	Raw Water Quality TDS (mg/L)	Concentrate Discharge Type [3]
Dunedin	Pinellas	9.50	5.243	4.655	3.461	0.437	UFA	250 - 990	WWTP
City of Clearwater (Plants 1 & 2)	Pinellas	9.25	14.300	7.692	6.674	1.352	UFA	300 –5,000	WWTP
City of Tarpon Springs	Pinellas	5.00	4.200	3.476	2.561	0.533	UFA	480 - 9,800	Surface/ Deep Well
City of Oldsmar	Pinellas	2.00	2.700	1.845	1.383	0.116	UFA	200 - 2,600	Deep Injection Well

[1] Estimated available supply is calculated as either the Treatment Capacity or Permit Capacity (whichever is less) subtracted by the 2018 withdrawals, then multiplied by the treatment efficiency (Finished Supply/Withdrawal).
[2] WWTP: wastewater treatment plant, SWP: surface/stormwater pond.
[3] WWTP: wastewater treatment plant, DIW: Deep Injection Well.
Note: The utilities shown have water use permits with the District. Other small RO systems exist for self-supplied users.

In 2015 the City of Tarpon Springs completed a brackish wellfield and RO facility with a 5.0 mgd flow capacity located north of the Anclote River. The City also withdrawals fresh groundwater from wells located south of the Anclote River and imports water from Pinellas County Utilities.

The City of Oldsmar completed construction of a 2.0 mgd RO facility and brackish wellfield in 2012. 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 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 up 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 has cooperatively funded studies with the Town to determine the feasibility of brackish water treatment, along with innovative wellfield withdrawal management strategies.

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 2018 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 4-6.

Section 6. Aquifer Storage and Recovery

Aquifers are reservoirs and conveyance systems that can provide tremendous storage capabilities, enabling rapid storage or recharge of captured excess wet season flows. Aquifer Storage and Recovery (ASR) and recharge projects enable 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 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.

Aquifer Storage and Recovery (ASR) is the process of storing water in an aquifer when water supplies exceed demand and subsequently withdrawing the water when supplies are low and/or demands are high. The locations of ASR projects in the District are shown in Figure 4-5. Aquifer Storage and Recovery (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

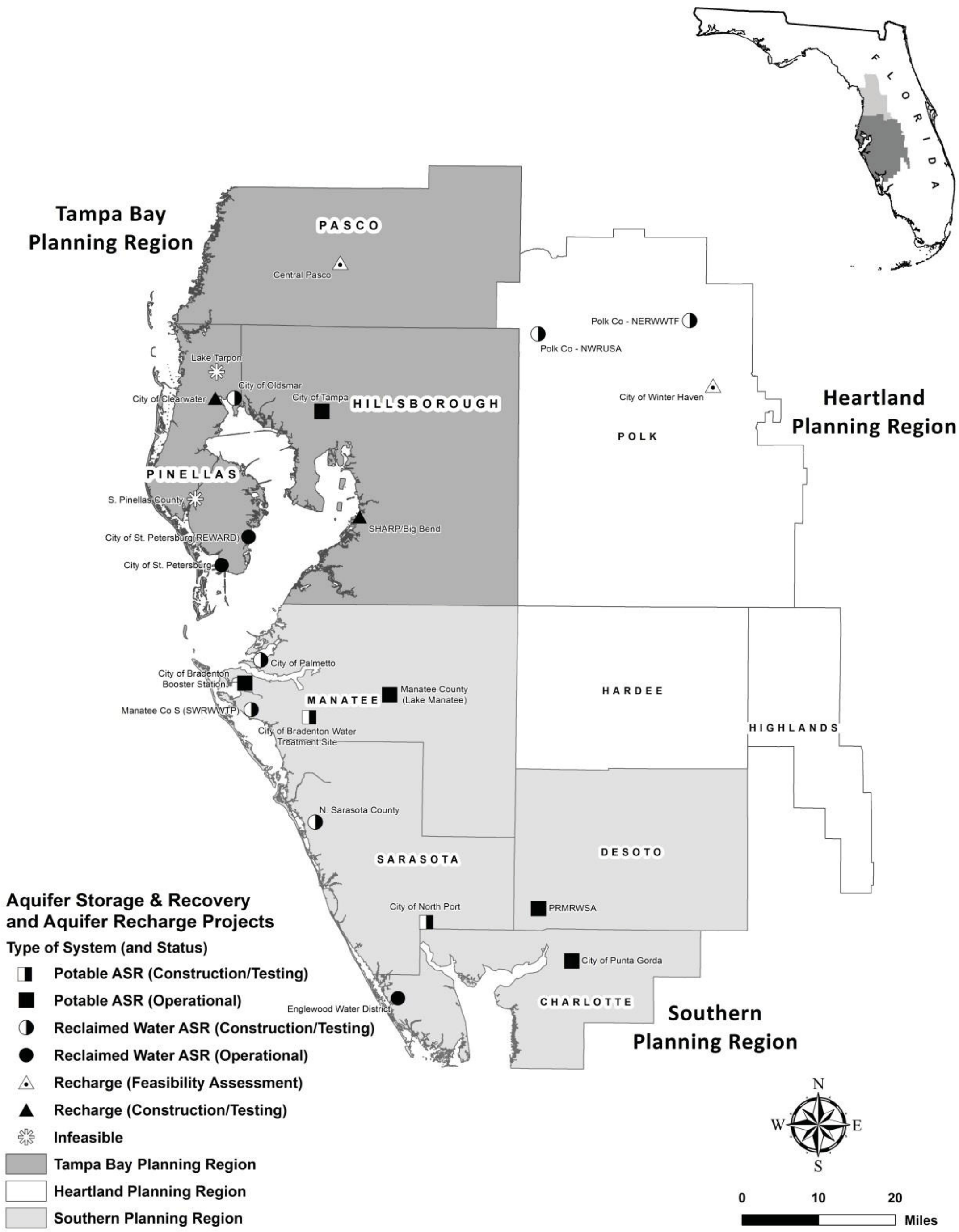


Figure 4-5. *Location of aquifer storage and recovery and aquifer recharge projects in the District that are operational or under development.*

Projects under development are those the District is co-funding and are either (1) actively in the planning, design, or construction phase, or (2) not yet in the planning phase but have been at least partially funded through fiscal year 2015, or (3) been completed since the year 2010 and are included to report on the status of implementation since the previous RWSP.

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.

Aquifer Storage and Recovery (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 five 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.

1.0 Aquifer Storage and Recovery Hydrologic and Geochemical Considerations

The science behind ASR has advanced significantly since the first project at Manatee County's reservoir site. The focus in the early years was on the hydrologic conditions that control the rate of injection/recovery and degree of mixing with elevated TDS in the receiving zone. Early studies of the geochemical processes focused on the liberation of low concentrations of naturally occurring radionuclides at the Lake Manatee ASR site. Because the concentrations were below the drinking water standards, ASR projects proceeded while continuing to check for this issue. None of the ASR projects checked ever exceeded the radio-nuclide standards.

While checking the radionuclides for the City of Tampa ASR project, the first incidence of arsenic at concentrations greater than the drinking water standards were found, and geochemical processes became important to understand. Extensive research efforts to understand the cause of arsenic mobilization and methods to control it were successful, and multiple strategies to handle the arsenic mobilization are now available. Geochemical considerations have led to the reduction of oxidants such as dissolved oxygen (DO) and chlorine in the injection water, either through physical or chemical methods.

Hydrologic conditions that maximize the recoverability of the injected water include a moderately permeable storage zone that is adequately confined above and below by less permeable layers and that contains fairly 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 Aquifer Storage and Recovery Permitting

Permits to develop ASR systems must be obtained from the District, the FDEP, the Department of Health (DOH), and possibly the U.S. Environmental Protection Agency (EPA) if an aquifer exemption is requested. The District is responsible for permitting the quantity and rate of recovery, including potential impacts to existing legal users (e.g., domestic wells), off-site land uses and environmental features. The FDEP is responsible for permitting the injection and storage portion of the project, and the DOH is responsible for overseeing the quality of the water delivered to the public.

Significant clarifications of ASR regulations, as they apply to public water supply systems storing treated drinking water underground, were issued by the EPA in 2013. The 2013 guidance allows the FDEP to evaluate ASR systems on a case by case basis to determine if mobilization of arsenic and subsequent recovery and treatment of the water can be done in a manner that 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.

3.0 Aquifer Storage and Recovery and Arsenic

When the last RWSP was under development in 2015, permitting of potable water ASR facilities in Florida hindered by the mobilization of naturally occurring arsenic in the aquifer was possible on a case by case basis under a zone of discharge approach. Reclaimed water ASR projects, however, can't have a zone of discharge for any primary drinking water standards and the issue of using a similar zone of discharge for arsenic mobilization is still unanswered by FDEP. Since the last RWSP, effective solutions to the arsenic mobilization issue continue to be developed. The City of Palmetto successfully managed arsenic mobilization through the use of a chemical oxygen scavenger. Bradenton is presently running a pilot project that removed DO from the injection water via a vacuum degasification tower. Dissolved oxygen (DO) control offers one method of achieving an operation permit for ASR and recharge facilities. Dissolved oxygen (DO) control can be achieved through physical removal, chemical scavenging or direct use of groundwater as a source for injection. Projects are currently testing chemical scavenging as a method for arsenic control.

Another method of achieving an operation permit is the attenuation of arsenic through removal during successive cycles of operation. The City of Tampa has seen arsenic concentrations consistently diminish over the years since startup in 1996. Most of the City's wells are now within the drinking water standard for arsenic and those that exceed it are just barely over the limit for a brief period during recovery. In 2013, the City received 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. Aquifer Recharge (AR) is the intentional process of beneficially using excess water to directly or indirectly recharge aquifers to achieve improved aquifer levels or water quality improvements (reduced saltwater intrusion). Aquifer Recharge (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 improving local groundwater quality, mitigating or offsetting existing drawdown impacts due to withdrawals, providing storage of seasonally available waters and thereby augmenting water supplies, and potentially allowing additional new permitted groundwater withdrawals in areas of limited water supply. Aquifer Recharge (AR) project success criteria can include demonstration of the level to which aquifers have been restored, demonstrated improvements to aquifer water quality and/or increases in available water supply for existing and future users.

Sources of water for use in AR projects are often available seasonally and may include high quality reclaimed water, surface water, and stormwater. A total volume of 738 mgd of reclaimed water was used statewide in 2015 (FDEP, 2015), for water uses including residential, industrial, recreational (golf courses), WTPs, rapid infiltration basins, and spray field applications.

Each individual AR project will have distinctively different construction specifications, regulatory requirements and operational maintenance considerations. The hydrogeologic setting of an area often determines which AR approach can be used.

1.0 Direct Aquifer Recharge

Direct AR uses wells to inject water meeting applicable FDEP water quality standards into an aquifer. Direct AR water recovery may occur through other wells constructed in the area. However, direct AR projects are often designed to improve aquifer conditions.

Characterization of the targeted aquifer for direct AR is fundamental in the design, operation, and maintenance of a direct AR system. Understanding the permeability and the degree of aquifer confinement above and below the injection interval, along with a characterization of the difference in water quality between the injection source water and the ambient groundwater in the injection interval and existing aquifers above and below, is critical to direct AR project success. Direct AR system designs must address the potential for mobilization of naturally occurring arsenic on a site-specific basis. If not addressed in the design of a direct AR project, the related and undesirable geochemical reactions may occur when the injection water reacts with the aquifer. Properly designed projects can avoid or manage these reactions through the adjustment of injection water chemistry, such as the removal of DO. In certain circumstances, the FDEP may allow these chemical reactions to occur if an adequate property area is controlled by ownership and it can be demonstrated the reaction is limited to the controlled area and will not require any other users of the aquifer to implement additional treatment to continue their use.

Recent experience with operational ASR projects incorporating oxygen degasification systems and post treatment stabilization have proven that metals mobilization can be minimized and controlled by reducing the DO content in the injection source water, in addition to maintaining a negative oxygen reduction potential. Aquifer Recharge (AR) projects 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 FDEP. Infiltration capacity and permeability of the soil; presence of drainage features; depth to the water table; local hydrogeology; locations of nearby drinking water wells; as well as locations of nearby wetlands and lakes are all important to identify, test and 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 2015, 20 mgd of available reclaimed water (Districtwide) was being applied through RIBs for indirect AR (FDEP, 2015).

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: (1) an intake structure to acquire the source water, (2) pretreatment to remove organic matter and suspended solids, (3) RO desalination to remove dissolved minerals and microscopic constituents, (4) post-treatment to stabilize and buffer product water and prepare it for transmission, and (5) concentrate disposal management (National Research Council, 2008). Each of these elements is briefly discussed below.

The intake structure is utilized to withdraw large amounts of source water for the treatment process. The volume of water withdrawn may significantly exceed the amount treated if concentrate dilution is necessary. The intake design and operation must address environmental impacts, because much of the District's near-shore areas have been designated as either Outstanding Florida Waters (OFW) or aquatic preserves. Ecological concerns include the risk of impingement and entrainment of aquatic life at the intake, entrainment of sediments and oils, and perturbation to seagrasses and hard-bottom communities.

The pretreatment of source water is imperative to protect the sensitive RO membranes from fouling prematurely from organic carbon and particulates, and this may be the most critical design element. A pretreatment system may require coagulation and/or microfiltration technology similar to the treatment of fresh surface water. A robust pretreatment may seem duplicative, but lessons learned from TBW and other facilities have demonstrated the importance of pretreatment to the long-term viability of the facility.

High-pressure RO membrane treatment is the most widely accepted seawater desalination technology. The RO system pressurizes saline water above the osmotic pressure of the solutes and passes the water through a network of semi-permeable membranes. Fresh water passes through the membranes, while a constant flow of raw water prevents the dissolved minerals from fouling the membrane's surface. The membranes are susceptible to fouling or damage from dissolved organic matter and fine suspended particles, which is why an effective pretreatment method is necessary. The pressurization step can be energy intensive. Seawater treatment requires pressures from 600 to 1,000 pounds per square inch (psi), compared to brackish groundwater systems (with <10,000 mg/L TDS) operating at 30 to 250 psi (FDEP, 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 FDEP report entitled *Desalination in Florida: Technology, Implementation, and Environmental Issues* (FDEP, 2010).

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 (2018). The options include 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, while the Anclote River desalination facility option was evaluated as a 25 mgd design capacity project. 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 4-6.

Section 9. Stormwater

The FDEP and the water management districts define stormwater as the flow of water which results from, and which occurs immediately following, a rainfall event and which is normally captured in ponds, swales, or similar areas for water quality treatment or flood control. Development of the natural landscape can result in significant changes to the characteristics of stormwater flows. Stormwater runoff can provide considerable volumes of water that can be captured and beneficially used, resulting in water supply, aquifer recharge, water quality, and natural system benefits. Rule 62-40, F.A.C., defines "stormwater recycling" as the capture of stormwater for irrigation or other beneficial use. The reliability of stormwater can vary considerably depending upon climatic conditions and storage capability. Therefore, the feasibility of effectively utilizing stormwater as an AWS source often relies on the ability to use it in conjunction with another source (or sources) in order to decrease operational vulnerability to climatic variability (aka "conjunctive use"). Stormwater represents a potentially viable AWS at the local level, particularly for reclaimed water supplementation and irrigation water uses.

In the SWUCA and Dover/Plant City WUCA, the District FARMS program has had much historical success in developing tailwater recovery systems for AG operations to utilize stormwater supplies to reduce demands for fresh groundwater. A major future opportunity for stormwater development

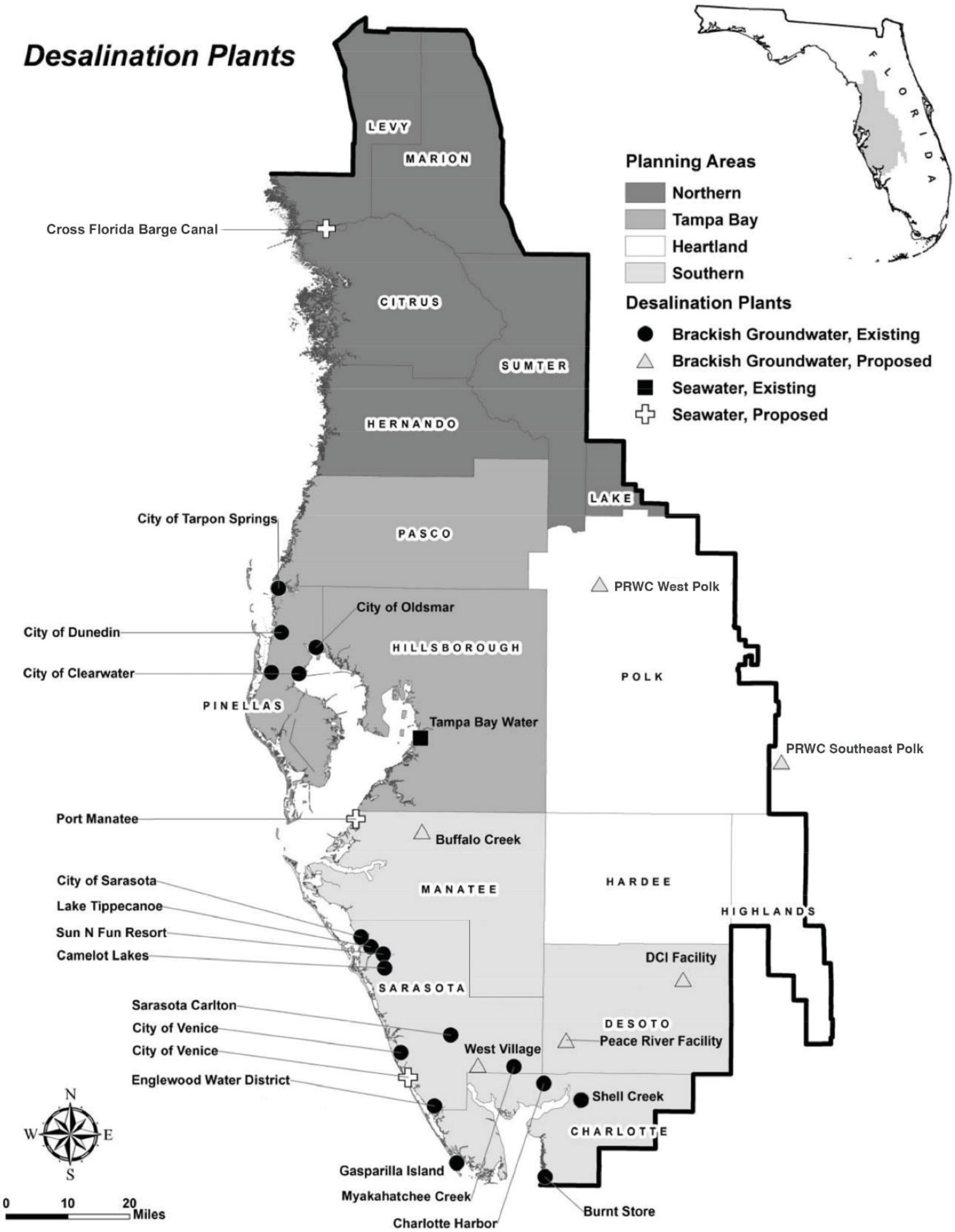


Figure 4-6. *Location of existing and potential seawater and brackish groundwater desalination facilities in the District*

is the ability for local governments and utilities to partner with the Florida Department of Transportation (FDOT) on stormwater capture and harvesting projects. Presently, FDOT's Efficient Transportation Decision Making Process gives the water management districts and other agencies an opportunity to provide comments during the Planning Screen phase of a project. When FDOT projects advance to the Project Development and Environment phase, FDOT uses Environmental Look Arounds (ELAs) to proactively look for cooperative and regional stormwater management opportunities. Environmental Look Arounds (ELAs) can assist the districts, other agencies, and local utilities with identifying sources of stormwater for activities such as reclaimed water augmentation and MFL recovery.

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 2015 through 2040. The table shows that the total quantity available is 294.71 mgd.

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 2040 and demands calculated for the 2015 base year (Table 3-6). The projected additional water demand in the planning region for the 2015–2040 planning period is approximately 82.71 mgd. As shown in Table 4-9, up to 294.71 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 2040.

Table 4-9. *Potential additional water availability (mgd) in the Tampa Bay Planning Region through 2040*

County	Surface Water		Reclaimed Water	Desalination		Fresh Groundwater		Water Conservation		Total
	Permitted Unused	Available Unpermitted	Benefits	Seawater	Brackish Groundwater (Permitted Unused)[1]	Surficial and Intermediate	Upper Floridan[1] Permitted Unused	PS	AG	
Pasco	-	-	11.45	25.00	-	-	0.75	7.36	0.58	45.14
Pinellas	-	-	32.16	-	2.44	0.40	4.45	11.65	0	51.00
Hillsborough	91.5	6.40	60.46	10.00	-	4.40	0.33	21.18	4.20	199.27
Total	**91.5**	**6.40**	**104.07**	**35.00**	**2.44**	**4.80**	**5.53**	**40.19**	**4.78**	**294.71**

[1] Groundwater that is permitted but unused for PS. Based on 2018 Estimated Water Use (SWFWMD, 2019).

Chapter 5. Overview of Water Supply Development Options

The water supply development (WSD) component of the Regional Water Supply Plan (RWSP) requires the Southwest Florida Water Management District (SWFWMD) (District) to identify water supply options from which water users in the planning region can choose to meet their individual needs. In addition, the District is to determine the associated costs of developing these options. As discussed in Chapter 4, the sources of water that are potentially available to meet projected water demand in the planning region include fresh groundwater, water conservation, reclaimed water, surface and stormwater, brackish groundwater desalination, Aquifer Storage and Recovery (ASR) and Aquifer Recharge, and seawater desalination. Investigations were conducted to identify reasonable options for developing each of the sources, to provide planning level technical and environmental feasibility analyses, and to determine costs to develop the options.

The RWSP Executive Summary presents statutory guidance on how water supply entities are to incorporate WSD options from the 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 2015 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 2015 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 million gallons per day (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.

A Thonotosassa Wells Feasibility Study was completed and documented in a Technical Memorandum dated April 2016. The study identified significant regulatory and environmental challenges associated with the Thonotosassa Wells and estimated that the average yield available from this water supply project would be limited to approximately 1 mgd.

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

Tampa Bay Water (TBW) identified a series of conservation activities that are appropriate for implementation by the public supply (PS) sector in their 2018 Water Demand Management Plan Update. However, while the analysis in this 2020 RWSP only estimates active conservation savings and costs for PS, some of these activities can also be implemented by the domestic self-supply industrial/commercial (I/C), and landscape/recreation water use sectors. A complete description of the criteria used in selecting these activities and the methodology for determining the water savings potential for each activity are described in detail in Chapter 4.

Some readily applicable conservation activities are not addressed due to the wide variance in implementation costs and the site-specific nature of their implementation. Two such measures are water-conserving rate structures and local codes/ordinances, which have savings potential, but are not addressed as part of the 2020 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 process. Below is a description of each non-agricultural water conservation option. Savings and costs for each conservation activity evaluated in the 2020 RWSP are summarized in Table 5-1 below. Total savings are also depicted in Figure 5-1.

Table 5-1. *Conservation activity options for PS sector*

Conservation Activity	2040 PS Savings (mgd)	Average Cost Effectiveness ($/kgal)	Total Cost
Residential			
Alternative Irrigation Sources	5.07	$0.57	$11,312,173
High-efficiency Toilets (Single-family)	2.31	$0.99	$8,638,020
Smart Irrigation Controllers	2.44	$0.79	$8,713,635
Florida Water Star/Florida-Friendly Landscaping™	3.89	$2.14	$20,372,969

High-efficiency Toilets (Multi-family)	1.16	$1.05	$4,877,616
Non-residential			
Cooling Towers	0.65	$0.13	$389,731
High-efficiency Toilets, Valve	1.07	$0.46	$2,205,991
High-efficiency Urinals (0.5 gallon)	1.37	$0.54	$2,605,175
Pre-Rinse Spray Valves	0.10	$0.30	$131,959
High-efficiency Toilets, Tank	0.41	$0.78	$1,191,866
Dishwashers, Conveyor	0.04	$0.72	$94,597
Total Public Supply	**18.51**	**$0.99[1]**	**$60,533,732**

[1]Total cost efficiency is weighted by each project's percent share of total savings in relation to the cost.

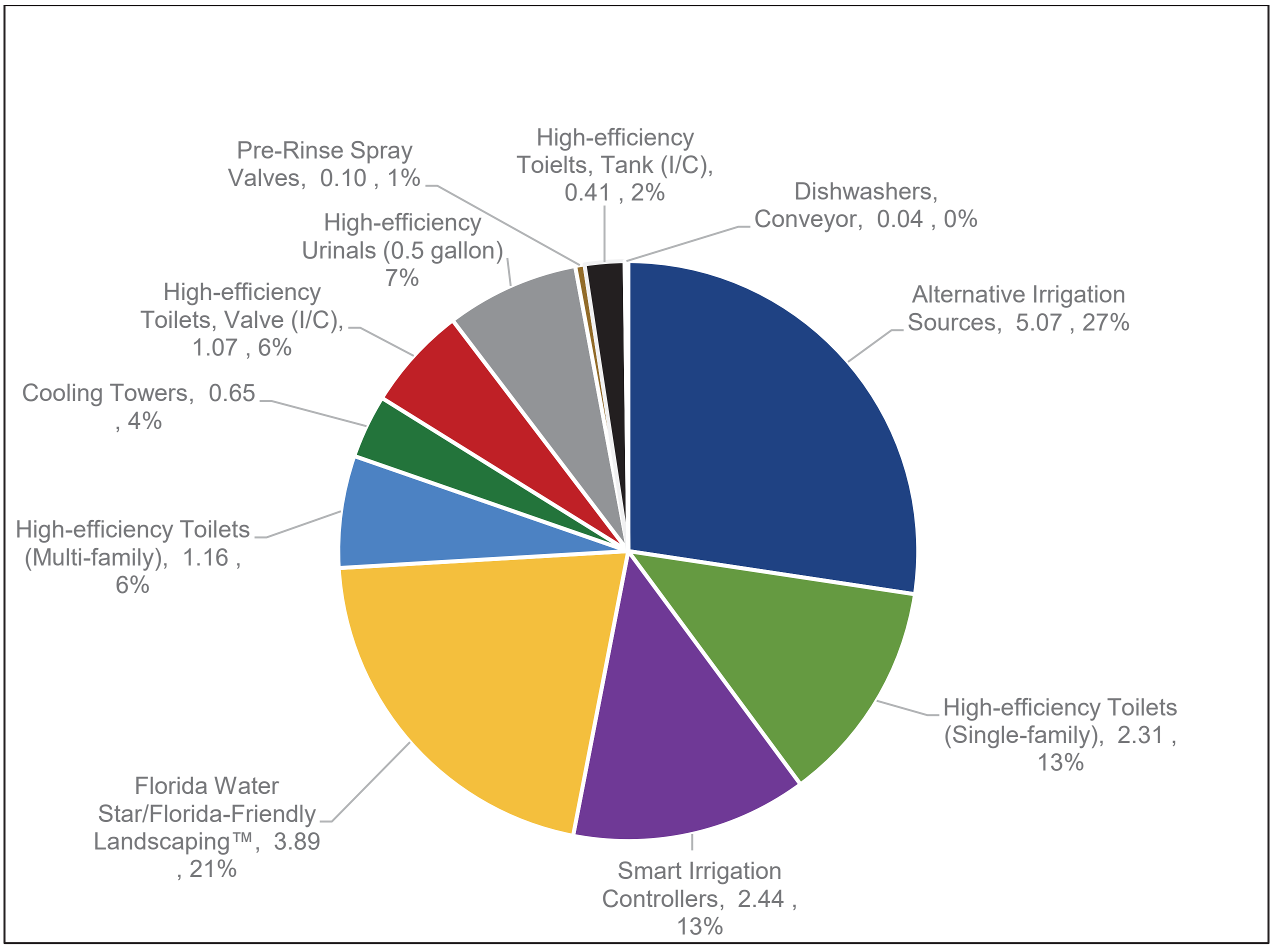


Figure 5-1. *Total 2040 active water savings (mgd) in Tampa Bay Region, by conservation activity*

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.

Toilet replacements were identified as a major potential source of water conservation.

1.1.2 High-Efficiency Toilet Rebates (Residential)

High-efficiency toilet (HET) rebate programs offer $100 rebates as an incentive for replacement of inefficient high-flow toilets with more water-efficient models. High-efficiency toilets (HETs) use 1.28 gallons per flush (gpf) as opposed to older, less-efficient models that could use 3.5 gpf or more, depending on the age of the fixture. Savings estimated in this plan are based on converting a 3.5 gpf or greater to a 1.28 gpf model. High-efficiency toilets (HETs) and dual-flush toilets are WaterSense® labeled by the U.S. Environmental Protection Agency. Also, gradually becoming more popular on the marketplace are 0.8 gpf models, which offer a 50% savings compared to 1.6 gpf models that are currently required by building code.

1.1.3 High Efficiency Toilet (Industrial/Commercial)

Similar to the residential HET retrofit programs, a non-residential fixture replacement program provides financial incentives to water customers to encourage conversion of higher flush volume toilets to HET models. These measures apply to office buildings, sports arenas, hospitals, schools, dormitories, and other commercial facilities.

1.1.4 High-efficiency Urinals (Industrial/Commercial)

In addition to toilets, urinals can also be replaced at non-residential facilities to high-efficiency models that use 1.0 gpf or less. Savings estimated in this plan are based on converting models that use 1.0 gpf or greater to a 0.5 gpf model. 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.

1.1.5 Smart Irrigation Controllers and Soil Moisture Sensors

Smart irrigation controllers go a step further than rain sensors. This technology automatically adjusts irrigation runtimes according to the needs of the local landscape. It is often based on temperature, climate, rainfall, soil moisture, wind, slope, soil, plant type, and more. This data is obtained by an on-site evapotranspiration sensor or through the internet. Some units can be operated by smart phone and can incorporate a weather forecast to anticipate coming rain. As an example, winter season run times may be automatically dialed down 30 percent from summer run times. Soil moisture sensors (SMSs) have been available on the market for approximately 10 years, and costs have come down considerably since they were first released. These devices override (prevent) scheduled irrigation events when enough moisture is present at the site, thus reducing water usage by skipping irrigation cycles.

1.1.6 Florida Water Star℠ and Florida-Friendly Landscaping™

Florida Water Star℠ (FWS) is a certification program for both residential and commercial buildings. Certified buildings uphold higher standards for water conservation and efficiency, both indoors and outdoors. The primary water saving feature of FWS is the limit on high volume irrigation (maximum of 60 percent of the irrigable area). Many of the conservation activities discussed here are implemented within FWS properties. Florida-Friendly Landscaping™ (FFL) is a set of 9 principles developed by the University of Florida that detail landscaping practices for protecting Florida's natural resources, including water. Florida Water Star℠ (FWS) encourages the inclusion of FFL-approved landscaping.

1.1.7 Cooling Towers (Industrial/Commercial)

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, 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. Cycles of concentration (COC) 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.

1.1.8 Pre-Rinse Spray Valves (Industrial/Commercial)

This measure offers rebates to hospitality/restaurants facilities to replace high water-volume spray valves with water-conserving low-volume spray valves. The measure applies to non-residential customers of the PS sector or any other applicable users within the I/C sector. A traditional pre-rinse spray valve uses 2 to 5 gallons per minute (gpm), while high-efficiency spray valves use no more than 1.6 gpm. High-efficiency valves are also more effective at removing food from dishware.

1.1.9 Dishwashers (Industrial/Commercial)

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, high-efficiency jets, and innovative dish rack designs that reduce energy and water consumption, as well as improve performance. In this RWSP, only conveyor dishwashers are considered for the savings and cost analysis.

2.0 Agricultural Water Conservation Options

The District has a comprehensive strategy to significantly increase the efficiency of the agricultural (AG) 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 AG 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 200 projects that have helped farmers increase the efficiency of their water use and improve water quality. Water conservation options for which the District will provide assistance as part of Facilitating Agricultural Resource Management Systems (FARMS) and other programs are described below.

2.1 Facilitating Agricultural Resource Management Systems

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 AG best management practices (BMPs) that involve both water-quantity and water-quality aspects. It is intended to expedite the implementation of production-scale AG 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. Facilitating Agricultural Resource Management Systems (FARMS) achieves resources benefits through two main types of projects, alternative water supply (AWS) and conservation through precision irrigation. These types of projects will be discussed below. The goal for the FARMS Program is to offset 40 mgd of groundwater use for agriculture within the SWUCA.

2.2 Facilitating Agricultural Resource Management Systems Conservation Potential

Districtwide, as of September 2019, FARMS has funded more than 200 projects with AG cooperators, for a total estimated reduction in groundwater use of more than 28 mgd. In the Tampa Bay Planning Region, there are 51 projects with an estimated reduction in groundwater use of more than 2.6 mgd. While the rate of FARMS participation has varied over time, difficulties within the citrus industry has resulted in a decreasing participation trend. This historical funded project information (2004-2019) was used to develop a long-term trend line as a means of estimating potential future program activity. Even with the decreasing participation trend, during the current planning horizon from fiscal year (FY)2015 through FY2040, if the current trends in agriculture and District cooperation continue, the FARMS program has the potential to reduce groundwater use by nearly 24 mgd through development of AWSs and more than 1.6 mgd through precision irrigation or other groundwater conservation BMPs. Within the Tampa Bay Planning Region, the District projects that AWSs could save approximately 0.75 mgd and conservation BMPs could save nearly 0.78 mgd over the same planning horizon of FY2015 through FY2040.

Table 5-2. *FARMS conservation potential within Tampa Bay Planning Region*

Project type	Potential resource benefit (mgd)	Estimated costs	Cost Benefit (cost per 1000 gallons saved)
Alternative water supply (tailwater recovery)	0.75	$4,800,000	$3.72
Conservation	0.78	$3,360,000	$2.57

Typical FARMS Project #1. Tailwater Recovery

Tailwater recovery has proven to achieve both water-quality improvements and groundwater conservation. Tailwater ponds are typically excavated below ground level at the low end of a farm to collect excess irrigation water and stormwater runoff. To utilize the pond as a source of irrigation water, pumps, filters and other appurtenances are needed to connect the pond to the existing irrigation system. The use of these ponds for irrigation offsets a portion of the groundwater used to irrigate the commodity and can improve water quality of the downstream watershed by reducing the concentration of mineralized groundwater applied to fields.

An example of a tailwater recovery project is the Loop Farms – Flowers Road project in Hillsborough County. The farm is permitted to withdraw up to 0.483 mgd of groundwater to irrigate citrus, strawberries, and melons. The goal of the project is to reduce groundwater withdrawals through the use of two tailwater recovery/surface water collection reservoirs. The project includes three surface water pump stations, filtration, and infrastructure necessary to operate and connect the reservoir to an existing irrigation system. The projected reduction in groundwater withdrawals is 37 percent, or 0.191 mgd of its permitted quantities.

Typical FARMS Project #2. Conservation Systems

Precision irrigation systems allow for the automatic remote control of irrigation pumps based upon information derived from SMSs that measure and monitor discrete sub-surface moisture levels. The system enables the grower to maintain soil moisture within optimized ranges, which reduces the potential for overwatering and prevents under-watering to avoid reduction in crop yields. A second system that increases irrigation efficiencies involves the use of automatic valves and on-off timers. These devices can be programmed to start and stop irrigation pumps to achieve maximum efficient irrigation durations. Without automatic valves and timers, the pumps must be manually turned off, which may not occur at the most optimum time. Several different types of electronic systems that increase irrigation system efficiency have been implemented through the FARMS Program.

An example of precision irrigation in the Tampa Bay Planning Region is Ocean Breeze Properties sod farm. The farm is a 230-acre sod farm just south of Ruskin in Hillsborough County. It is permitted for 0.58 mgd for supplemental irrigation. The FARMS program funded two irrigation conversion projects in addition to pump automation. It is estimated that the project will reduce groundwater use by approximately four percent or about 0.025 mgd. Because the District classifies FARMS projects as water resource development, additional information pertaining to the program, status of project implementation, and water savings achieved to date is provided in Chapter 7.

2.3 Mobile Irrigation Laboratory

The mobile irrigation lab program is a cooperative initiative between the District and the U.S. Department of Agriculture (Natural Resources Conservation Service (NRCS). The NRCS conducts efficiency and conservation evaluations of AG irrigation systems. Since 1986, the mobile irrigation lab service has evaluated irrigation systems at more than 900 sites in the District and recommended management strategies and/or irrigation system adjustments.

2.4 Best Management Practices

Best Management Practices (BMPs) are individual AG practices or combinations of practices that, based on research, field testing, and expert review, have been determined to be the most effective and practical means for maintaining or improving the water quality of surface and groundwaters and conserving groundwater resources. Best Management Practices (BMPs) typically are implemented in combination to prevent, reduce, or treat pollutant discharges off-site. Best Management Practices (BMPs) must be based on sound science, be technically feasible, and be economically viable. In Florida AG BMPs are detailed in crop specific BMP manuals developed by the FDACS in cooperation with a wide spectrum of stakeholders within the community specific to that crop. Best Management Practices (BMP) manuals are available on the FDACS website and are used to evaluate a farm's intent to implement practices that conserve groundwater, protect water quality, reduce nutrient impacts, control erosion, and implement integrated pest management to reduce environmental impacts.

Section 3. Reclaimed Water Options

The 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
- **ASR:** injection of reclaimed water into an aquifer during times of excess supply and the recovery of that same water for use during high demand
- **Distribution:** expansion of a reclaimed water system to serve more customers
- **Efficiency/Research:** the study of how utilities can maximize efficiency and offset potential of reclaimed water systems to conserve water (rate structures, telemetry control, watering restrictions, metering, and others) and research (water quality and future uses)
- **Interconnect:** interconnection of systems to enhance supply and allow for better utilization of the resource or to enable agricultural or other water use permit exchanges
- **Natural System Enhancement/Recharge:** introduction of 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, and storage) necessary to deliver reclaimed water to more customers
- **Transmission:** construction of large mains to serve more customers
- **Potable reuse:** purification of reclaimed water to meet drinking water standards prior to introduction into a potable raw water source.

The beneficial utilization of reclaimed water has for decades been a key component of water resource management within the District. For the past several years, Districtwide reclaimed water utilization has been at around 50 percent for non-potable purposes such as landscape irrigation, agricultural irrigation, aesthetic uses, groundwater recharge, industrial uses, environmental enhancement, and fire protection purposes.

Recently, as drought and long-term water shortages have occurred within other states and countries, reclaimed water has been investigated as a potable source. The “unintentional” use of reclaimed water as a potable source is not new, as many surface water sources that are used for potable raw water supplies have upstream wastewater/reclaimed water discharges. For instance, much of the flow of the Trinity River in Texas during the dry season comes from Dallas and Fort Worth 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 seven reclaimed water project options (Table 5-3) 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 2040 at a utilization rate of 75 percent or greater (see Chapter 4 Appendix, Table 4-1). The District recognizes that the viability of some options depends on whether certain other options are developed, and not all options can be developed because some would utilize the same reclaimed water source. The options are listed in Table 5-3.

Flow and capital cost data for the 39 funded reclaimed water construction projects identified as being under development (FY2015 through FY2020) 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 the 39 new reclaimed water projects anticipated to come online between 2015 and 2025, the average capital cost is $10.27 million for each 1 mgd supplied. This figure was used in cost calculations for individual reclaimed water options unless specific cost data were available.

Construction of Pasco County's 500 MG Boyette Reclaimed Water Reservoir

Table 5-3. *List of reclaimed water options for the Tampa Bay Planning Region*

Option Name and Entity	County	Type	Supply (mgd)	Benefit (mgd)	Capital Cost (Millions $)
TECO-Bayside Tampa Power Reuse	*Hillsborough*	*System Expansion*	*0.50*	*0.50*	*$3.50*
Tampa/Hillsborough Co./TBW-Tampa Bypass Canal Indirect Potable Reuse	*Hillsborough*	*Streamflow Augmentation*	*15.00*	*15.00*	*$43.60*
Tampa-Hillsborough River MFL & IPR Reuse	*Hillsborough*	*Streamflow Augmentation, Natural System Enhancement*	*10.00*	*10.00*	*$61.00*
St. Petersburg REWARD Type IPR Reuse	*Pinellas*	*Recharge*	*5.00*	*5.00*	*$55.00*
Pinellas Co. Lake Seminole IPR-SWIM Reuse	*Pinellas*	*Natural System Enhancement, Streamflow Augmentation*	*5.00*	*5.00*	*$80.00*
Pasco Co. SR54 Transmission	Pasco	System Expansion	TBD	TBD	TBD
Hillsborough Co. SHARE Expansion	Hillsborough	Recharge	14.00	TBD	TBD
Totals: 7 Options			**49.50**	**35.50**	**$243.10**

The use of italics denotes SWFWMD estimations.
Offset = (if estimated) Annualized Supply: 1. x 75% for Ag, & R/A/C, 2. x 100% for I/C, NSR, & PG. 3. x 75% for Variety and 4. for RES is number of customers X 300 gpd.

1.0 Reclaimed/Recharge Options

Reclaimed/Recharge Option #1: New Ground Water Supply and Treatment Plant via Net Benefit from South Hillsborough Aquifer Recharge Program

- Entity Responsible for Implementation: TBW/Hillsborough County

This water supply project involves the construction of a groundwater withdrawal wellfield and groundwater treatment facility in south Hillsborough County, with accommodations for finished water to be delivered to the regional system or to Hillsborough County by way of a new point of connection in proximity to the new groundwater treatment facility. The groundwater supply for this water supply project would be enabled by Hillsborough County's South Hillsborough Aquifer Recharge Program (SHARP), in which reclaimed water is used to recharge the coastal aquifer, thus serving as a barrier to saltwater intrusion, providing a net benefit to the aquifer, and also generating credits for additional groundwater withdrawals. The groundwater supply project is initially limited to a maximum yield of 7.5 mgd based on the availability of reclaimed water in south Hillsborough County. Hillsborough County and TBW have engaged in discussion to collaboratively evaluate the implications of SHARP, mutual commitments, and future negotiations regarding credit valuation. An additional option that was evaluated by TBW was the potential yield of 20 mgd with the requirement of 30 mgd of aquifer recharge. For the remaining 12.5 mgd of yield, it was assumed that reclaimed water would be obtained from the City of Tampa and delivered to an expanded aquifer recharge program for the generation of additional credits.

The project concept shown in Table 5-4, below, consists of the initial configuration from TBW's Long Term Water Supply Plan Update (2018).

Table 5-4. *Aquifer Recharge options quantity/costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual Operation and Maintenance /1,000 gal
7.5	$116,265,000	$15,502,000	$3.11	$0.38

Section 4. Surface Water/Stormwater Options

The Hillsborough River/Tampa Bypass Canal 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.

1.0 Surface Water/Stormwater Options

Surface Water/Stormwater Option #1. Surface Water Treatment Expansion

- Entity Responsible for Implementation: TBW, District

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 (WTF) in Hillsborough County, or at the expanded City of Tampa WTF. 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 5-5 consists of two potential configurations from TBW's Long Term Water Supply Plan Update (2018).

Table 5-5. *Surface Water option costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual Operation and Maintenance/1,000 gal
10-12.5	$88,238,000	TBD	$1.42-$1.78	$0.36-$0.38

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

Tampa Bay Water (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.

<u>System interconnect/Improvement Option #1 New Regional Feed Line to Balm Area:</u>

- Entity Responsible for Implementation: TBW

The Regional Surface Water Treatment Plant (WTP) Expansion and possibly the Seawater Desalination Plant Expansion would require a new regional pipeline to be constructed from the Regional Facilities Site to south Hillsborough County (Balm Point of Connection) in order to meet south Hillsborough County's growing water needs by 2025. This would be the delivery of existing regional supply to a new Point of Connection in the Balm area via approximately 20 miles of 42-inch transmission main from the TBW Regional Facilities Site to the Balm area, which could supply up to 25 mgd.

Table 5-6. *New Regional Feed Line to Balm Area options costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual Operation and Maintenance/1,000 gal
10-12.5	$75,900,000-$96,700,000	TBD	$1.23-$1.95	$1.08

Section 5. Brackish Groundwater Desalination

Brackish groundwater is considered to be a viable source of water supply that can be obtained from the Upper Floridan aquifer 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 ten 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 operation and maintenance project costs shown in Table 5-7 are from a preliminary engineering report prepared for the town in 2015. 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 5-7. *Town of Belleair WYP option costs*

Quantity Available (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual Operation and Maintenance / 1,000 gallons
1.0	$5,702,400	$5,702,400	$TBD	$0.41

Section 6. Seawater Desalination

There is one seawater desalination option within the planning region associated with TBW's existing desalination facility on Tampa Bay in Hillsborough County. Conceptual costs for this option have been updated by TBW and reflected in their 2018 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 RO 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 mgd of treated water from the RO plant would be delivered to the Tampa Bay Regional Surface WTP for blending prior to distribution. The pretreatment and chemical facilities would be modified to accommodate the expansion. Additional RO 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 5-8 are in 2018 dollars.

Table 5-8. *TBW Big Bend Desalination option costs*

Quantity Produced (mgd)	Capital Cost	Cost/mgd	Cost/1,000 Gallons	Annual Operation and Maintenance /1,000 gal
10-12.5	$244,442,000	TBD	$4.88-3.89	$1.70-1.69

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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 fiscal year 2019, or (3) have been completed since the year 2015 and are included to report on the status of implementation since the previous Regional Water Supply Plan.

The demand projections presented in Chapter 3 show that approximately 82.7 million gallons per day (mgd) of new water supply will need to be developed during the 2020–2040 planning period to meet demand for all use sectors in the planning region. As of 2019, it is estimated that at least 23 percent of that demand (20.3 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; 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 2015, the District has cooperatively funded the distribution of approximately 4,537 high-efficiency fixtures within the Tampa Bay Planning Region. These programs have cost the District and cooperating local governments a combined $770,649 and have yielded a potable water savings of approximately 107,769 gallons per day. Table 6-1 provides information on indoor water conservation projects under development in the planning region.

1.2 Outdoor/Other Water Conservation Projects

Since 2015, the District has cooperatively funded a variety of demand management projects to include 1,111 rain sensor rebates and landscape and irrigation evaluations. These programs have cost the District, Tampa Bay Water and cooperating local governments a combined $2,185,338 and have yielded a potable water savings of approximately 711,229 gallons per day. Table 6-1 provides information on outdoor water conservation projects that are under development. Table 6-1 provides information on outdoor water conservation projects under development.

Table 6-1. *Water conservation projects under development in the Tampa Bay Planning Region*

Cooperator	Project Number	General Description	Savings (gpd)	Devices and Rebates	Total Cost[1]	District Cost	$/1,000 gal Saved
Indoor Projects							
City of New Port Richey	N593	Toilet Rebate	1,902	75	$11,221	$5,602	$1.65
City of Port Richey	N603	Toilet Rebate	114	7	$997	$499	$2.44
City of St. Petersburg	N655	Toilet Rebate	10,839	596	$99,465	$49,732	$2.56
Pasco County	N662	Toilet Rebate	9,372	556	$79,876	$39,871	$2.38
Pasco County	N732	Toilet Rebate	13,564	508	$72,707	$36,353	$1.50
Pasco County	N789	Toilet Rebate	11,321	424	$61,108	$30,554	$1.51
City of St. Petersburg	N819	Toilet Rebate	8,640	377	$65,782	$32,891	$2.12
Pasco County	N852	Toilet Rebate	9,585	359	$54,913	$27,456	$1.60
City of New Port Richey	N876	Toilet Rebate	1,874	80	$14,940	$7,470	$2.22
City of St. Petersburg	N890	Clothes Washer Rebate	1,500	100	$24,700	$12,350	$6.32
City of St. Petersburg	N955	Toilet Rebate	6,725	275	$50,000	$25,000	$2.07
Pasco County	Q014	Toilet Rebate	13,956	500	$100,000	$50,000	$2.00
City of New Port Richey	Q041	Toilet Rebate	1,874	80	$14,940	$7,470	$2.22
City of Tarpon Springs	Q068	Toilet Rebate	2,547	100	$20,000	$10,000	$2.19
Pasco County	Q078	Toilet Rebate	13,956	500	$100,000	$50,000	$2.00
Indoor Total			*107,769*	*4,537*	*$770,649*	*$385,276*	*$2.02*[2]
Outdoor/Other Projects							
City of St. Petersburg	N728	Irrigation System Evaluation	39,000	289	$96,088	$48,044	$1.69
City of St. Petersburg	N875	Florida Water Star	9,400	71	$49,700	$24,850	$2.16

City of St. Petersburg	N909	Irrigation System Evaluation	56,000	300	$100,000	$50,000	$1.23
Hillsborough County	N988	Soil Moisture Sensor and Rain Sensor Rebate	13,380	150	$50,000	$25,000	
City of St. Petersburg	N961	Satellite-based Leak Detection	110,000	NA[3]	$120,000	$60,000	
Temple Terrace Golf Course	Q074	Advanced Irrigation System	47,449	1	$510,000	$255,000	
City of St. Petersburg	Q089	Irrigation System Evaluation	56,000	300	$100,000	$50,000	$1.23
Pasco County	Q109	Satellite-based Leak Detection	100,000	NA[3]	$60,000	$30,000	
Tampa Bay Water	Q087	Demand Managemen t Project	280,000-400,000	NA[4]	$1,099,550	$549,775	$1.12
Outdoor/Other Total			*711,229*	*1,111*	*$2,185,338*	*$1,092,669*	
Total			**818,998**		**$2,955,987**	**$1,477,945**	

[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.
[3] These projects involve the detection of leaks, rather than the provision of rebates.
[4] Ten types of conservation activities will be made available through this project, rather than a set number of devices/rebates.

2.0 Agricultural Water Conservation Projects

The District's largest agricultural water conservation initiatives, the Facilitating Agricultural Resource Management Systems (FARMS) Program is 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.

3.0 Institute of Food and Agricultural Sciences Research and Education Projects

The District provides funding for Institute of Food and Agricultural Sciences (IFAS) to investigate a variety of agricultural/ urban issues that involve water conservation. These include, but are not limited to, development of tailwater recovery technology, determination of crop water use requirements, evaluation of alternative irrigation methods, field irrigation scheduling, frost/freeze protection, residential irrigation, and urban water use. Institute of Food and Agricultural Sciences (IFAS) conducts the research and then promotes the results to the agricultural community. The District has funded research on strawberries, citrus, tomatoes, potatoes, peaches, biofuel grasses, turf grass, peppers, blueberries, and various landscape and nursery ornamental plants and trees. Of the 58 research projects, 48 have been completed. Completed projects include ten projects dealing with urban landscape issues and 38 involving various agricultural commodities. While the research projects are not specific to each planning region, they are specific to a commodity group that has a strong presence in each region. The research will help develop best management practices that will conserve water Districtwide. Specific benefits to the planning region are dependent on the commodities dominant in that planning region. The 10 ongoing projects are described in Table 6-2.

Table 6-2. *List of water conservation research projects*

Project	Total Project Cost + District Cooperator	Total Project and Land Cost	Funding Source	Planning Region(s)[1]
Leaching Fraction-Adjusted Irrigation Impact on Nutrient Load and Plant Water Use	$81,320	$81,320	District	All
Florida Automated Weather Network Data Dissemination and Education	$100,000	$100,000	District	All
Blueberry Water Allocation and Irrigation Scheduling Using Evapotranspiration-based Methods	$ 210,000	$ 210,000	District	All
Reduction of Water Use for Citrus Cold Protection	$21,000	$21,000	District	All
Effect of Water Scheduling and Amounts on Growth of Young Citrus Trees in High Density Plantings	$168,623	$168,623	District	All
New Practical Method for Managing Irrigation in Container Nurseries	$165,310	$165,310	District	All
Effect of Composting at Animal Stock Facilities on Nutrients in Groundwater	$175,000	$175,000	District	All
Evaluating Fertigation with Center Pivot Irrigation for Water Conservation on Commercial Potato Production	$400,000	$400,000	District	All
Evaluation of Water Use & Water Quality Effects of Amending Soils & Lawns with Compost Material	$60,000	$60,000	District	All
Evaluation of Nitrogen leaching from reclaimed water applied to lawns, spray fields, and rapid infiltration basins.	$294,000	$294,000	District	All
Total	**$1,675,253**	**$1,675,253**		

[1] Projects affecting several planning regions. The outcome of research projects can benefit all planning regions

The District funds IFAS water conservation research and education projects for many types of agricultural commodities, such as strawberries

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 6-3 is a list, description and summary of the benefits and costs that have been, or will be, realized by the 21 reclaimed water projects currently under development and others that are estimated to experience additional future supply growth. It is anticipated that these projects will be online by 2025. Table 6-4 includes general descriptions and a summary of 10 research projects for which the District has provided more than $1,026,000 in funding. The District has also committed to developing a comprehensive reclaimed water education strategy. All reclaimed water construction projects funded by the District require education programs that stress the value and benefits of efficient and effective 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 6-3. *List of reclaimed water supply projects under development in the Tampa Bay Planning Region*

Cooperator	General Project Description	Reuse	(mgd)	Customer (#)			Costs	
		Produced	Benefit	Storage	Type	Total	Total	District[1]
Hillsborough County								
Hillsborough County	Trans N776	1.20	0.60	NA	Res	2000	$5,427,343	$2,713,671
Hillsborough County	Transmission N863	0.07	0.05	0	Rec	1	$155,000	$77,500
Hillsborough County	Trans, Env Q084	1.00	1.00		NAT	1	$1,200,000	$600,000
Hillsborough County	Trans Q117	0.09	0.07		Rec	1	$800,000	$400,000
City of Plant City	Trans/Pump L816	0.55	0.33	0	Rec, GC, Com	8	$6,126,000	$3,192,730
Pasco County								
Pasco County	Trans N743	0.41	0.31	0	Res	TBD	$1,910,000	$955,000
Pasco County	Trans N778	0.20	0.12	0	Res	TBD	$225,000	$112,500
Pasco County	Trans N791	0.29	0.22	0	Res	TBD	$913,600	$456,800
Pasco County	Trans N792	0.40	0.24	0	Res	TBD	$2,500,000	$1,250,000
Pasco County, Shady Hills Energy	Treat, Trans, Store	2.82	2.82	0.5	Ind	1	$27,100,000	$0
Pasco County	Trans N442	0.50	0.38	0	GC	2	$600,000	$300,000
Pasco County	Recharge N666	2.20	2.20	NA	NA	NA	$14,300,966	$7,150,483
Pasco County	Transmission N670	0.42	0.21	0	Res, Com	388	$1,221,660	$610,830
Pasco County	Trans N697	0.10	0.06	0	GC	1	$300,000	$150,000
Pasco County	Trans N547	0.43	0.26	0	Res	725	$1,266,600	$933,300
Pasco County	Trans/Store N837	0.19	0.11	0	Res	557	$315,000	$157,500
City of Zephyrhills	Trans Q057	0.33	0.22	0	Res, Ind	515	$1,421,300	$710,650

Pinellas County								
City of Clearwater	Trans N561	0.19	0.08	0	Res	145	$1,500,000	$750,000
City of Clearwater	Purification/ Recharge N665	2.4	2.4	0	City	1	$32,716,000	$16,358,000
City of Dunedin	Pump/ Storage N555	0.10	0.10	2	NA	NA	$2,165,820	$1,082,910
City of Tarpon Springs	Pump/ Store N805	0.07	0.04	0	Res	310	$595,417	$297,708
Total	**21 Projects**	**13.96**	**11.82**	**2.50**		**4,656**	**$102,759,706**	**$38,259,582**

[1] Costs include all revenue sources budgeted by the District[1]

Table 6-4. *Reclaimed water research projects co-funded 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. Aquifer Storage and Recovery Projects

There are no new reclaimed or potable water ASR projects under development in the Tampa Bay Planning Region.

Section 4. Aquifer Recharge Projects

One indirect Aquifer Recharge (AR) project being pursued in the planning region is the Pasco County Reclaimed Water Natural Systems Treatment and Restoration project located in central Pasco County. This cooperator, in partnership with the District, has completed construction and two years of operation of beneficial groundwater recharge at wetlands on the 4G Ranch. The facility consists of 175 acres of constructed wetlands divided into fifteen cells planted with native wetland vegetation. Each cell is operated independently through a valve manifold that includes flow control valves and flow meters and operated based on water elevation setpoints. These water level setpoints change frequently based on recommendations defined in the Operation and Maintenance Manual to achieve a wetland hydroperiod that mimics natural Florida wetlands, with high levels in the summer wet season and lower levels in the winter dry season. The project is expected to provide between 2 to 5 mgd of potential recharge on a long-term annual average basis.

In the case of direct AR projects, the City of Clearwater's Groundwater Replenishment Project (Table 6-5) is currently delayed for a period of two years for the City to complete a master water plan investigation of their water supply and water treatment systems. This investigation is being pursued due to rising construction costs. If constructed, this project will use state-of-the-art water treatment technology and injection systems to recharge a brackish water interval of the Upper Floridan aquifer 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.

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. These projects are referred to as the South Hillsborough Aquifer Recharge Project (SHARP I), with a single recharge well, and the South Hillsborough Aquifer Recharge Project (SHARP II), with two additional recharge wells in the same area (Table 6-5). If these projects are properly located, they have the potential to slow or reverse saltwater intrusion rates.

Table 6-5. *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. 100 % Design and all construction related permits issued. Project delayered.	3	4[2]	Full construction = $16,358,000
SHARP I	Operational	4	1	$2,765,000
SHARP II	Under Construction	20	2	$9,700,000

[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 fiscal year (FY)2020 budget and anticipated five-year funding levels for Districtwide data collection and analysis activities. Approximately $40.8 million will be allocated toward these activities annually for a five-year total of approximately $204 million. Because budgets for the years beyond FY2020 have not yet been developed, but are projected to be fairly constant, future funding estimates for activities are set equal to FY2020 funding. Funding for these activities is primarily from the Governing Board's allocation of ad valorem revenue collected within the District. In some cases, additional funding is provided by water supply authorities, local governments, and the U.S. Geological Survey (USGS). The activities listed in Table 7-1 are described in subsections 1.0 through 5.0, below.

Table 7-1. *Water Resource Development data collection and analysis activities (Districtwide)*

WRD Data Collection and Analysis Activities		FY2015 Funding	Anticipated 5-Year Funding	Funding Partners
1.0	**Hydrologic Data Collection**			SWFWMD, other WMDs, USGS, FDEP, FWC
1.1	Surface Water Flows and Levels	$2,715,842	$13,579,210	
+1.2	Geohydrologic Data Well Network (includes ROMP)	$3,149,091	$15,745,455	
1.3	Meteorologic Data	$278,408	$1,392,040	
1.4	Water Quality Data	$1,003,524	$5,017,620	
1.5	Groundwater Levels	$891,391	$4,456,955	
1.6	Biologic Data	$1,502,627	$7,513,135	
1.7	Data Support	$3,776,719	$18,883,595	
2.0	**Minimum Flows and Levels Program**			SWFWMD
2.1	Technical Support	$1,718,986	$8,594,930	
2.2	Establishment	$678,495	$3,392,475	
3.0	**Watershed Management Planning**	$7,456,686	$37,283,430	SWFWMD, Local Cooperators
4.0	**Quality of Water Improvement Program**	$743,025	$3,715,125	SWFWMD
5.0	**Stormwater Improvements: Implementation of Storage and Conveyance BMPs**	$16,927,435	$84,637,175	SWFWMD, USGS
	TOTAL	**$40,842,229**	**$204,211,145**	

1.0 Hydrologic Data Collection

The District has a comprehensive, hydrologic conditions monitoring program that includes the assembly of information on key indicators such as rainfall, surface and groundwater levels and water quality, and stream flows. The program includes data collected by District staff and permit holders, as well as data collected as part of the District's cooperative funding program with the USGS. This data collection allows the District to gauge changes in the health of water resources, monitor trends in conditions, identify and analyze existing or potential resource problems, and develop programs to correct existing problems and prevent future problems from occurring. This data collection also supports District flood control structure operations, water use and environmental resource permitting and compliance, minimum flows and levels (MFL) evaluation and compliance, the Surface Water Improvement and Management (SWIM) program, the 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 808 surface water level gauging sites, and cooperative funding with the USGS for discharge and water-level data collection at 129 river, stream and canal sites. The data is available to the public through the District’s Water Management Information System and through the USGS Florida Water Science Center Web Portal.

1.2 Geohydrologic Data Well Network

The Geohydrologic Data Well Network is a monitor well network that supports various projects throughout the District including the Central Florida Water Initiative (CFWI), Water Resource Assessment Projects, Water Use Caution Areas, recovery strategies, the Springs Team, sea level rise and other salt-water intrusion assessments, and development of alternative water supplies (AWSs). The network includes the Regional Observation and Monitor-well Program which has been the District’s primary means for hydrogeologic data collection since 1974. Data from monitor well sites are used to evaluate seasonal and long-term changes in groundwater levels and quality, as well as the interaction and connectivity between groundwater and surface water bodies. During construction of new monitor well sites, valuable hydrogeologic information is collected including the lithology, aquifer hydraulic characteristics, water quality, and water levels.

1.3 Meteorologic Data

The meteorologic data monitoring program consists of measuring rainfall totals at 171 rain gauges, most of which provide near real-time data. Annual funding is for costs associated with measurement of rainfall, including sensors, maintenance, repair, and replacement of equipment. Funding allows for the operation of one District evapotranspiration (ET) station for reference near Lake Hancock, and for District participation in a cooperative effort between the USGS and all five Florida water management districts (WMDs) to map statewide potential and reference ET using data measured from the Geostationary Operational Environmental 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 380 wells across the District to monitor saltwater intrusion and/or the upwelling of mineralized waters into potable aquifers.

1.5 Groundwater Levels

The District maintains 1,618 monitor wells in the data collection network, including 856 wells that are instrumented with data loggers that record water levels once per hour, and 762 that are measured manually by field technicians once or twice per month.

1.6 Biologic Data

The District monitors ecological conditions as they relate to both potential water use impacts and changes in hydrologic conditions. Funding for biologic data collection includes support for routine monitoring of approximately 150 wetlands and a five-year assessment of over 400 wetlands to document changes in wetland health and assess level of recovery in impacted wetlands. Funding also supports an effort to map the estuarine hard bottom of Tampa Bay, as well as SWIM program efforts for mapping of seagrasses in priority water bodies including Tampa Bay, Sarasota Bay, Charlotte Harbor, and the Springs Coast area.

1.7 Data Support

This item provides administrative and management support for the WQMP, hydrologic and geohydrologic staff support, the District's chemistry laboratory, and the District's LoggerNet data acquisition system.

2.0 Minimum Flows and Levels Program

Minimum Flows and Water Levels (MFLs) are ecologically based, hydrologic standards that are used for permitting and planning decisions concerning how much water may be withdrawn from or near a water body without causing significant harm to water resources or ecology of the area. Chapter 373.042, F.S., requires the state water management districts or the Florida Department of Environmental Protection (FDEP) to establish MFLs for aquifers, surface watercourses, and other surface water bodies to identify the limit or level at which further withdrawals would be significantly harmful. Rivers, streams, estuaries, and springs require minimum flows; while minimum levels are developed for lakes, wetlands, and aquifers. Minimum Flows and Levels (MFLs) are adopted into District rules, Chapter 40D-8, Florida Administrative Code (F.A.C.), and are used in the District's WUP and water supply planning programs.

Reservations are rules that reserve water from use by WUP applicants, as necessary, for the protection of fish and wildlife or public health and safety. Reservations are adopted into District rules, Chapter 40D-2, F.A.C., pursuant to Chapter 272.223, F.S., and are also used for water use permitting and water supply planning.

The District's processes for establishing MFLs and reservations include opportunities for interested stakeholders to review and comment on proposed MFLs or reservations and participate in public meetings. An independent scientific peer review process is used for establishing MFLs for flowing water bodies, MFLs for all water body types that are based on methods that have not previously been subjected to peer review, and for establishing reservations. Stakeholder input and peer review findings are considered by the Governing Board when deciding whether to adopt proposed MFLs and reservations. District monitoring programs provide data for evaluating compliance with the adopted MFLs and reservations, determining the need for MFLs recovery or prevention strategies and assessing the recovery of water bodies where significant harm has occurred.

As of August 2019, the District has preliminarily planned to monitor and assess the status of 210 adopted MFLs, including MFLs for 23 river segments, 10 springs or spring groups, 127 lakes, 41 wetlands, 7 wells in the Northern Tampa Bay Water Use Caution Area (NTBWUCA), and the Upper Floridan aquifer (UFA) in the Most Impacted Area (MIA) of the SWUCA, and in the Dover/Plant City Water Use Caution Area (DPCWUCA). The District is scheduling the establishment or reevaluation of 96 additional MFLs and one reservation through FY2029. The District's annual MFL Priority List and Schedule and Reservations List and Schedule is approved by the Governing Board in October, submitted to FDEP for review in November, and subsequently published in the Consolidated Annual Report. The approved and proposed priority lists and schedules are also posted on the District's Minimum Flows and Levels Documents and Reports webpage at: https://www.swfwmd.state.fl.us/projects/mfl/documents-and-reports

3.0 Watershed Management Planning

The District addresses flooding problems in existing areas by preparing and implementing WMPs in cooperation with local governments. The WMPs define flood conditions, identify flood level of service deficiencies, and evaluate best management practices (BMPs) to address those deficiencies. The WMPs include consideration of the capacity of a watershed to protect, enhance, and restore water quality and natural systems while achieving flood protection. The plans identify effective watershed management strategies and culminate in defining floodplain delineations and constructing selected BMPs.

Local governments and the District combine their resources and exchange watershed data to implement the WMPs. Funding for local elements of the WMPs is provided through local governments' capital improvement plans and the District's Cooperative Funding Initiative. Additionally, flood hazard information generated by the WMPs is used by the Federal Emergency Management Agency to revise flood insurance rate maps. This helps better define flood risk and is used extensively for land use planning by local governments and property owners. Since the WMPs may change based on growth and shifting priorities, the District also cooperates with local governments to update the WMPs when necessary, giving decision-makers opportunities throughout the program to determine when and where funds are needed.

4.0 Quality of Water Improvement Program

The Quality of Water Improvement Program (QWIP) was established in 1974 through Section 373.207, F.S., to restore groundwater conditions altered by well drilling activities for domestic supply, agriculture, and other uses. The program's primary goal is to preserve groundwater and surface water resources through proper well abandonment. Plugging abandoned artesian wells eliminates the waste of water at the surface and prevents mineralized groundwater from contaminating surface water bodies. Thousands of wells constructed prior to current well construction standards were often deficient in casing, which interconnected aquifer zones and enabled poor-quality mineralized water to migrate into zones containing potable-quality water.

Plugging wells involves filling the abandoned well with cement or bentonite. Isolation of the aquifers is reestablished, and the mixing of varying water qualities and free flow is stopped. Prior to plugging an abandoned well, geophysical logging is performed to determine the reimbursement amount, the proper plugging method, and to collect groundwater quality and geologic data for inclusion in the District's database. The emphasis of the QWIP is primarily in the SWUCA where the UFA is confined. Historically, the QWIP has proven to be a cost-effective method to prevent waste and contamination of potable ground and surface waters.

5.0 Stormwater Improvements: Implementation of Storage and Conveyance Best Management Practices

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. As stormwater is a primary contributor of water quality degradation in older urban areas, the District seeks opportunities to retrofit or improve these systems to reduce impacts to receiving waters. Fiscal year (FY)2020 funding includes new storage and conveyance projects in the Tampa Bay area, particularly in Hillsborough and Pasco county, as well as several continuing Tampa Bay projects.

Section 2. Water Resource Development Projects

As of FY2020, the District has 20 ongoing projects that meet the definition of water resource development "projects." The projects are listed in Table 7-2, below, along with their funding to date, total costs, participating cooperators, the estimated water quantity to be become available, and the planning region benefitted by the project. The total cost of these projects is approximately \$150 million and a minimum of 78 million gallons per day (mgd) of additional water supply will be produced or conserved.

These projects include feasibility and research projects for new alternative water supply (AWS), Facilitating Agricultural Resource Management Systems (FARMS) projects to improve agricultural water use efficiency, and environmental restoration (ER) 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 FY2019	Total Project Cost (District + Cooperator)	Funding Source	Water to Become Available	Planning Region of Benefit
1) AWS Feasibility Research and Pilot Projects						
1.1	South Hillsborough Aquifer Recharge Program (SHARP) (N287)	$1,382,500	$2,765,000	SWFWMD, Hillsborough County	2 mgd	TBPR
1.2	Bradenton Aquifer Protection Recharge Well (N842)	$1,500,000	$5,050,000	District, City of Bradenton	5 mgd	TBPR
1.3	PRMRWSA Partially Treated Water ASR (N854)	$495,500	$7,755,000	District, PRMRWSA	3 mgd	SPR
1.4	Southern Hillsborough Aquifer Recharge Expansion (SHARE) Phase 1 (N855)	$4,500,000	$9,700,000	District, Hillsborough County	4 mgd	TBPR
1.5	Braden River Utilities ASR Feasibility (N912)	$2,736,250	$5,995,000	District, Braden River Utilities	TBD	SPR
1.6	Hydrogeologic Investigation of Lower Floridan Aquifer in Polk County (P280)	$11,375,000	$12,000,000	SWFWMD	TBD	HPR
1.7	Optical Borehole Imaging Data Collection from LFA Wells (P925)	$100,200	$167,000	District, USGS	NA	HPR
1.8	Sources/Ages of Groundwater in LFA Wells (P926)	$368,300	$555,800	District, USGS	NA	HPR
1.9	City of Venice Reclaimed Water Aquifer Storage Recovery (Q050)	$0	$5,065,000	District, City of Venice	0.17 mgd	SPR
1.10	Direct Aquifer Recharge-North Hillsborough Aquifer Recharge Program Phase 2 (Q064)	$0	$1,500,000	District, Hillsborough County	TBD	TBPR
1.11	Direct Aquifer Recharge-South Hillsborough Aquifer Recharge Program Phase 3 (Q088)	$0	$13,000,000	District, Hillsborough County	6 mgd	TBPR
2) FARMS						
2.1	FARMS Projects	$40,780,456	$71,791,225	SWFWMD, FDACS, State of FL, private farms	29 mgd	All

2.2	Mini-FARMS Program	$616,237	$150,000 (annual)	FDACS, SWFWMD	2 mgd	All
3) ER and MFL Recovery						
3.1	Lower Hillsborough River Recovery Strategy (H400)	$5,464,712	$10,857,462	SWFWMD, City of Tampa	3.1 mgd	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 (H04)	$3,668,040	$700,000	SWFWMD	3.9 mgd	TBPR
3.4	Haines City Reclaimed Water MFL Recharge & Advanced Treatment Feasibility Study (N888)	$225,000	$357,710	SWFWMD, Haines City	0.7 mgd	HPR
3.5	Lake Hancock Lake Level Modification (H008)	$9,989,166	$10,428,490	SWFWMD, State of FL, Federal	TBD	HPR, SPR
3.6	Lake Jackson Watershed Hydrology Investigation (N554)	$260,000	$400,000	SWFWMD, City or Sebring, Highlands County	NA	HPR
3.7	Upper Myakka / Flatford Swamp Hydrologic Restoration and Implementation (H089)	$5,044,012	$31,000,000	SWFWMD	6.0 mgd	SPR, HPR

Note: Tampa Bay Planning Region (TBPR); Southern Planning Region (SPR); Heartland Planning Region (HPR)

1.0 Alternative Water Supply Research, Restoration and Pilot Projects

The following projects are research and/or pilot projects designed to further the development of the innovative AWSs described in the Regional Water Supply Plan (RWSP). Included in these projects are feasibility projects for recharging the UFA with excess reclaimed water and the exploration of Lower Floridan aquifer (LFA) zones as a viable water source for inland utilities. These projects may lead to the development and protection of major sources of water supply in the future.

1.1 South Hillsborough Aquifer Recharge Program (SHARP) (N287)

This is an aquifer recharge pilot testing project that will design, permit, construct and test a 2 mgd reclaimed water UFA recharge well in the MIA of the SWUCA. The project will beneficially use reclaimed water and improve aquifer levels in the MIA to help meet the Salt Water Intrusion Minimum Aquifer Level (SWIMAL) defined in the SWUCA Recovery Strategy.

1.2 Bradenton Aquifer Protection Recharge Well (N842)

The project is for design, permitting, construction, and testing of one recharge well in the Avon Park production zone of the UFA and associated facilities to help prevent nutrient loading to the Manatee River and Tampa Bay and to replenish groundwater in the MIA. The third-party review will provide necessary information to support District funding past the 30 percent design to final design, permitting, and construction.

1.3 PRMRWSA Partially Treated Water ASR (N854)

The project consists of site feasibility testing, 30 percent design, and third-party review of a partially treated water aquifer storage and recovery (ASR) project located at the Pease River Manasota Regional Water Supply Authority (PRMRWSA) ASR facility. Feasibility pilot testing will be implemented using partially treated surface water pumped from Reservoir No. 1 to recharge the UFA at two existing ASR wells and subsequently delivered back to the raw water reservoir system. The third-party review which will provide the necessary information on construction costs and project benefits to support District funding in future years to complete design, permitting, and construction.

1.4 Southern Hillsborough Aquifer Recharge Expansion (SHARE) Phase 1 (N855)

This project is for a third-party review of the County's 30 percent design, completion of design and permitting, and the initiation of construction for Phase 1 of the South Hillsborough Aquifer Recharge Expansion (SHARE) project. Pending third-party review and approval, the project involves construction of 9,500 feet of transmission mains, two reclaimed water recharge wells (2 mgd each), eight monitoring wells, and associated appurtenances. The SHARE project expands upon the county's current recharge project (N287).

1.5 Braden River Utilities ASR Feasibility (N912)

This project will perform a third-party review for reclaimed water ASR feasibility studies at two sites. Pending the review, the project may include the construction of an ASR well at each site, monitoring wells, and partial infrastructure necessary to sufficiently and cost-effectively perform two cycle tests in accordance FDEP permit requirements.

1.6 Hydrogeologic Investigation of LFA in Polk County (P280)

This project explores the LFA in Polk County to assess its viability as an AWS source and to gain a better understanding of the Lower Floridan characteristics and groundwater quality. Three sites have been identified. At each site, if the tests on the initial exploration monitor well drilled are positive, a test production well may be constructed to conduct an aquifer performance test to obtain transmissivity and leakance information and to determine the quality of the formation water. The data gathered from the wells will improve the District's understanding of this potential AWS source, enhance groundwater modeling of the LFA, and determine the practicality of developing the LFA as an AWS source in areas facing future water supply deficits. Data from this project will also add to the geologic inputs in the Districtwide Regulation Model for the LFA to assess potential withdrawal-related impacts to water resources in the District. If the tests prove that the water quality and quantity are suitable, the water may be used by the regional entity established in Polk County as an additional source of public water supply.

1.7 Optical Borehole Imaging Data Collection from LFA Wells (P925)

This project collects optical borehole imaging data from LFA wells in Polk County. This data will aid in understanding the aquifer characteristics and groundwater quality in Polk County. The

USGS is testing and providing the processed data to the District. Currently, nine LFA well sites have been identified for testing.

1.8 Sources/Ages of Groundwater in LFA Wells (P926)

This project collects isotope data from LFA wells from various sites in Polk County. The groundwater analysis will determine the sources and ages of the water from productive zones within the LFA and lower portions of the Upper Floridan aquifer. This data will aid in understanding the LFA characteristics (including flow paths) and groundwater quality in Polk County. The USGS is testing and providing the processed data to the District. Currently, six LFA well sites have been identified for testing.

1.9 City of Venice Reclaimed Water Aquifer Storage Recovery (ASR) (Q050)

This project is for the 30 percent design and third-party review of an ASR system to store and recover at least 25 million gallons per year of reclaimed water on-site at the City's Eastside Water Reclamation Facility, an advanced wastewater treatment plant. If constructed, ASR would let the City store excess reclaimed water in the wet season, to be used in the dry season when demand exceeds plant flow. The City has self-funded a feasibility study for FY2019, which will clarify project requirements, but its planning level study expects two production wells (1 mgd capacity each).

1.10 Direct Aquifer Recharge-North Hillsborough Aquifer Recharge Program Phase 2 (Q064)

This project includes completion of a direct aquifer recharge feasibility study, which includes the construction and testing of three exploratory wells necessary to evaluate recharge locations for the North Hillsborough Aquifer Recharge Program (NHARP). If approved, the study will aid in the determination of the hydrogeological characteristics and water quality of the targeted Avon Park Formation of the UFA and the approximate depth of the base of the underground source of drinking water in the general vicinity of NHARP. 1.11 Direct Aquifer Recharge-South Hillsborough Aquifer Recharge Program Phase 3 (Q088)

This project is for the third-party review of the County's 30 percent design, completion of design, permitting, construction, testing, and Independent Performance Evaluation for SHARP Phase 3. The Phase 3 project, if approved, will design, permit, construct, and test three recharge wells (2 mgd each) and design and construct well heads, appurtenances, monitoring wells, and approximately 4,000 feet of pipelines to connect the recharge wells to existing reclaimed water transmission mains. This project expands upon the County's current recharge projects resulting in six recharge sites anticipated to recharge approximately 14 mgd collectively.

2.0 Facilitating Agricultural Resource Management Systems Projects

The FARMS Program is an agricultural BMP cost-share reimbursement program consisting of many site-specific projects. The FARMS Program is a public/private partnership developed by the District and the Florida Department of Agriculture and Consumer Services (FDACS). The purpose of the FARMS initiative is to provide an incentive to the District's agricultural community to implement agricultural BMPs that will provide resource benefits including water quality improvement, reduced UFA withdrawals, and enhancements to the water resources and ecology.

The FARMS Program has five specific goals: (1) offset 40 mgd of groundwater within the SWUCA; (2) improve surface water quality impacted by mineralized groundwater within the Shell, Prairie, and Joshua Creek (SPJC) watersheds; (3) improve natural systems impacted by excess irrigation and surface water runoff within the Flatford Swamp region of the upper Myakka River watershed; (4) prevent groundwater impacts within the northern areas of the District; and (5) reduce frost-freeze pumpage by 20 percent within the DPCWUCA. These goals are critical in the District's overall strategy to manage water resources.

2.1 FARMS Cost-Share Projects

Facilitating Agricultural Resource Management Systems (FARMS) projects employ many of the agricultural water conservation strategies described in the RWSP to reduce groundwater withdrawals by increasing the water use efficiency of agricultural operations. The projects have the added benefit of reducing agricultural impacts to surface water features. The projects are public/private partnerships where the District provides financial incentives to farmers to increase the water use efficiency of their operations. Each project's performance is tracked to determine its effectiveness toward program goals. Since actual use of permitted quantities is dependent on hydrologic conditions, one of the objectives of FARMS projects is to reduce groundwater use regardless of hydrologic conditions. Facilitating Agricultural Resource Management Systems (FARMS) projects not only offset groundwater use with surface water, but also increases 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.

Table 7-3. *Specific FARMS cost-share projects within the Tampa Bay Planning Region that were funded post-FY2015*

Project Description	District Budget FY2015-2019	Benefit (mgd)	Primary Priority Area
Duggal Farm Amendment	$208,661	0.040	SWUCA
Halls Branch Farm	$200,100	0.082	SWUCA
Mathis Farms - Colson RD	$82,382	0.010	DPCWUCA
Hinton Farms	$218,793	0.058	MIA
Ocean Breeze	$32,064	0.010	MIA
Bonnie Blue Ranch, LLC	$297,610	0.050	MIA
Farmland Reserve	$196,300	0.055	MIA
Brenner Groves, LLC	$258,495	0.013	DPCWUCA
Frogmore Ranch, LLC - Amendment	$114,000	0.032	Springs Coast
Council Growers	$389,971	0.142	MIA
University of Florida GCREC	$65,794	0.023	MIA
Ocean Breeze - Phase 2	$79,030	0.015	MIA
Total	$2,143,200	0.53	

Notes: Projects were selected by funds budgeted in years FY2015 to FY2019, meeting District RWSP definition of "projects under development." The benefit is based on projected offset, with exceptions for observed results on high performing projects.

As of September 2019, there were 208 approved FARMS projects including 51 in the Tampa Bay Planning Region and 21 frost-freeze protection projects in the DPCWUCA. The projects are projected to have a cumulative groundwater offset of 28.48 mgd Districtwide and 2.68 mgd for the projects within the Tampa Bay Planning Region. The projected offset for the frost-freeze protection projects (post-January 2010) within the DPCWUCA is 38.43 mgd per 21-hour 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, DPCWUCA Recovery Strategy, the Shell and Prairie Creek WMP, and the District's Strategic Plan. Much like the FARMS projects, the Mini-FARMS Program implements BMPs on agricultural operations to reduce UFA groundwater use and/or improve water quality conditions throughout the District. The maximum cost-share amount available from Mini-FARMS projects is $5,000 per agricultural operation per year, and the maximum cost-share rate is 75 percent of project costs.

From FY2006 through FY2018, the District's portion of the Mini-FARMS Program has reimbursed 159 water conservation BMP projects. The total cost of the Mini-FARMS projects was $ 856,086 and the District's reimbursement was $ 597,256. The Mini-FARMS Program continues to receive a strong demand from growers within the District, and it is projected that at least $150,000 will be budgeted for projects annually.

2.3 FARMS Irrigation Well Back-Plugging Program.

This program offers financial and technical assistance to well owners within the SWUCA to back-plug irrigation wells that produce highly mineralized groundwater. Back-plugging is a recommended practice to rehabilitate irrigation wells by identifying and restricting the intrusion of highly mineralized groundwater that often occurs from deeper aquifer zones in certain areas of the District. This program is separate from the QWIP, which focuses on proper well abandonment. The program was initiated in 2002 to improve water quality in watershed systems of the SWUCA, and later became an addition to the FARMS Program in 2005. Field investigations indicated that highly mineralized groundwater produced from older or deeper irrigation wells was the most likely source adversely impacting water quality downstream in Punta Gorda's public supply reservoir. Growers experience several advantages from well back-plugging including elevated crop yields from reduced salts in irrigation groundwater, decreases in soil-water requirements and pumping costs, and reduced corrosion and fouling of irrigation equipment.

A total of 85 wells have been back plugged in the SWUCA through FY2018, with 63 of these wells located in the SPJC priority watersheds. Analytical results for all back-plugged wells indicated conductivity, total dissolved solids, 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 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 WMDs, and other entities. Field demonstrations, workshops, and other educational opportunities are provided to growers and their employees. Technical assistance also identifies areas of future educational needs.

3.0 Environmental Restoration and MFL Recovery Projects

As of FY2020, the District has six ongoing environmental restoration and MFL recovery projects that benefit water resources. The Lower Hillsborough River Recovery Strategy, Lower Hillsborough River Pumping Facilities, and the Pump Stations on the Tampa Bypass Canal (TBC) projects are in the Tampa Bay Region. The Lake Hancock Lake Level Modification, the Lake Jackson Watershed Hydrology Investigation, and the Haines City Reclaimed Water MFL Recharge & Advanced Treatment Feasibility Study Projects are in the Heartland region. The Upper Myakka/Flatford Swamp Hydrologic Restoration and Implementation project is in the Southern Planning Region.

3.1 MFL Recovery Lake Hancock Design, Permit, Mitigation to Raise Lake (H008)

The Lake Hancock Lake Level Modification Project is part of the recovery strategy to restore minimum flows to the upper Peace River, which is one of the four goals defined in the SWUCA Recovery Strategy. The project involved raising the control elevation of the existing outflow structure on Lake Hancock in order to slowly release the water during the dry season to help meet the minimum flow requirements in the upper Peace River between Bartow and Zolfo Springs. Increasing the operating level will also help restore wetland function for several hundred acres of contiguous lands to Lake Hancock and provide recharge to the UFA through exposed sinks along the upper Peace River. Construction is complete and the project is currently in the monitoring phase.

3.2 MIA Recharge SWIMAL Recovery at Flatford Swamp (H089)

Hydrologic alterations and excess runoff have adversely impacted the Flatford Swamp in the upper Myakka watershed, and quantities of water should be removed from the swamp and surrounding areas to restore hydroperiods close to historic levels. The District has conducted evaluations to explore potential beneficial uses of water. In 2016, evaluations began on an injection recharge option that would use excess flow affecting the swamp to recharge the UFA in the vicinity of the MIA of the SWUCA to slow saltwater intrusion. The recharge system would assist with the SWUCA Recovery Strategy's goal of meeting the SWIMAL to help recover and protect groundwater resources in/near the MIA. The ongoing evaluation includes construction of test recharge wells in the Flatford Swamp and the design and permitting of diversion infrastructure for source water.

3.3 Lower Hillsborough River Recovery Strategy (H400)

The District established revised MFLs for the Lower Hillsborough River in 2007. Because the MFLs were not being met, the District incorporated a recovery strategy for the river into Rule 40D-80.073(8), F.A.C. As part of the recovery strategy, the District entered into a joint funding agreement and additional project-specific agreements with the City of Tampa to assess and implement projects associated with diversion of water from various sources to meet minimum flow requirements in the river.

In accordance with the recovery strategy, the City has diverted water from Sulphur Springs to the base of the Hillsborough River Reservoir Dam, as necessary to support river recovery. In addition, the District and more recently the City have diverted water from the Tampa Bypass Canal to the Hillsborough River Reservoir for subsequent diversion to the lower river. The City assumed responsibility for these diversions from the canal through the reservoir in 2018, with transfers of water from the reservoir to the lower river made using a newly constructed sluice gate in the dam that was cooperatively funded by the District and the City. In 2017, the City, with support from the District, completed the Blue Sink Project, which facilitates diversion of water from Blue Sink to the base of the dam for minimum flow recovery, and use of the sink as a recovery source was initiated in 2018. A project between the District and City associated with investigation of storage or additional supply options was completed in 2018 and identified the proposed Tampa Augmentation Project as a potential source for additional water that may be needed for recovery of the lower river. Permitting, design and permit-required monitoring associated with a project involving potential diversion of water from Morris Bridge Sink for river recovery have also been completed, although project implementation is contingent upon future recovery need assessments.

3.4 Lake Jackson Watershed Hydrology Investigations (N554)

Lake Jackson is a 3,412-acre lake located in the City of Sebring and is one of nine lakes in Highlands County with an established MFL. Residents and local officials have voiced concerns over persistent low water levels potentially related to storm water canal structures, potential flow through the shallow aquifer to the canals, and possible leakage in the lake’s hardpan bottom. This project is a hydrologic investigation, including data collection, to identify the causes of low water level in Lake Jackson and Little Lake Jackson over the last decade and develop cost-effective recovery strategies.

3.5 Haines City Reclaimed Water MFL Recharge and Advanced Treatment Feasibility Study (N888)

This project is for the evaluation of reclaimed water recharge sites, components, and advanced treatment necessary to assist in meeting MFLs on Lake Eva in the “Ridge Lakes” area of the CFWI.

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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 2040 and restore minimum flows and levels (MFLs) to impacted natural systems.

Table 8-1 shows the projected increase in demand for each planning region for the planning period, as described in Chapter 3 of each volume of the Regional Water Supply Plan (RWSP). The table shows that approximately 209.8 million gallons per day (mgd) of new water supply is needed to meet user demands and to restore natural systems.

Table 8-1. *Summary of total projected increases in demand (5-in-10) (mgd) by each planning region from base year 2015 to 2040*

Planning Region	Projected Demand Increase
Heartland	38.9
Northern	50.4
Southern	44.4
Tampa Bay	76.1
Total	**209.8**

Note: Summation differences occur due to decimal rounding

A portion of the total demand shown above will be met by existing permitted quantities; however, new regional infrastructure may be required to deliver permitted quantities to end users, and additional water supply development is necessary to maintain adequate capacity for peak demand periods and continuing growth.

To prepare an estimate of the capital cost for projects needed to meet the portion of demand not yet under development, the District has compiled a list of large-scale water supply development (WSD) projects (Table 8-2). The District anticipates that a large portion of the remaining demand will be met through projects that users will select from the water supply options listed in Chapter 5 of this RWSP.

The amount of funding that will likely be generated through 2040 by the various utility, District, state, and federal funding mechanisms is compared to the capital cost of the potential large-scale projects. This comparison allows an evaluation of funding adequacy for support of projects necessary to meet water demands.

Part A. Statutory Responsibility for Funding

Section 373.705, Florida Statutes (F.S.), describes the responsibilities of the Water Management Districts (WMDs) in regard to funding water supply development and water resource development 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 water resource development (WRD) projects. As discussed in Chapter 7, the District considers its WRD activities to include resource data collection and analysis as well as projects. In terms of WSD, the District has typically funded the development, storage, and transmission of non-traditional sources of water, including reclaimed water and conservation. Potential sources of funding for WSD and WRD projects are addressed below.

Part B. Funding Mechanisms

Section 1. Water Utilities

Water supply development (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 variety of revenue sources such as connection fees, tap fees, impact fees (system development charges), base and minimum charges, and volume charges. Connection and tap fees generally do not contribute to WSD or treatment capital costs. Impact fees are generally devoted to the construction of source development, treatment, and transmission facilities. Base charges generally contribute to fixed customer costs, such as billing and meter replacement. However, a high base charge, or a minimum charge, which covers the cost of the number of gallons of water use, may also contribute to source development, treatment, and transmission construction cost debt service. Volume charges contribute to both source development/treatment/transmission debt service and operation and maintenance (O&M).

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. These entities generally occur in developed areas not served by a government-run utility and generally serve a planned development. Regional water supply authorities, such as Tampa Bay Water (TBW), are also special water supply districts, but do not have retail customers. Facilities are funded through fixed and variable charges to the utilities they supply which are, in the end, paid by the retail customers of the utilities. All the above-mentioned types of utilities and regional water supply authorities have the ability to issue secure construction bonds backed by revenues from fees, rates, and charges.

While some utility revenues will go to pay existing facility debt service, most of that service will be retired in various stages over the next 20 years and debt service for new projects will be added. Projects built late in the 20-year planning period will continue to generate revenues for debt service for many years after the planning period.

Financing through volume-related charges is the most economically efficient means to finance new WSD. Volume charge financing provides consumers and businesses the greatest degree of direct control over water-related costs and a direct incentive to conserve. Such financing increases utility revenue stream variability, but such variability may be reduced through the development of rate stabilization or reserve funds.

If volume charges are utilized to fund higher cost alternative water sources, the impact on ratepayers can be mitigated through existing and innovative rate structures and charges. High-usage rate blocks can be set to reflect the full marginal cost of the next source of supply. Usage by conserving customers can be set at the existing average embedded cost, as they are not driving the need for additional supply development (or below existing cost if a lifeline rate is necessary). If the rate change to implement this pricing is designed to exceed current revenue requirements, the additional revenue can be dedicated to new source development. Such pricing both encourages conservation and reduces the need for steeper increases in future rates.

Conservation incentivized by block rate structures, in combination with collecting project revenues in advance of construction, can distribute price increases more evenly over time and buffer price fluctuations inherent in common water-pricing practices. This allows customers to adjust water

use practices and technology over time. Indexing of prices is another means of distributing price increases over time. If changes to water rates are revenue-neutral, additional conservation can still occur, as the difference between average and marginal price blocks for larger water users increases. There are a number of additional means available to mitigate the impact of higher cost sources to customers. Many of these are addressed in the American Water Works Association's publications Avoiding Rate Shock: Making the Case for Water Rates (AWWA, 2004) and Thinking Outside the Bill: A Utility Manager's Guide to Assisting Low-Income Water Customers (AWWA, 2014).

Section 2. Water Management District

The District's Governing Board provides significant financial assistance for conservation, planning, and alternative water supply (AWS) 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 Facilitating Agricultural Resource Management Systems (FARMS) Program, and Florida Department of Environment Protection (FDEP) funding for the Springs Initiative.

1.0 Cooperative Funding Initiative

The primary funding mechanism is the District's CFI, which includes funding for major regional water supply and WRD projects and localized projects throughout the District's 16-county jurisdiction. The Governing Board, through its regional sub-committees, jointly participates with local governments and other entities to ensure proper development, use, and protection of the regional water resources of the District. The CFI is a matching grant program and projects of mutual benefit are generally funded 50 percent by the District and 50 percent by the public or private cooperators. Any state and federal funds received for the projects are applied directly against the project costs, with both parties benefitting equally. The CFI has been highly successful; since 1988, this program has resulted in a combined investment (District and cooperators) of approximately $3.3 billion for a variety of water projects addressing the District's four areas of responsibility: (1) water supply, (2) natural systems, (3) flood protection, and (4) water quality. From fiscal year (FY)2016 through FY2020, the District's adopted budget included an average of $56.8 million in ad valorem tax dollars for the CFI program, of which $30 million (53 percent) was for WRD and water supply development assistance.

2.0 District Initiatives

Projects funded through the District Initiatives program are of great importance or a regional priority. The District can increase its percentage match and, in some cases, provide total funding for the project. Examples of these initiatives include: (1) the Quality of Water Improvement Program to plug deteriorated, free-flowing wells that waste water and cause inter-aquifer contamination, (2) the Utilities Services Group to conserve water by assisting utilities in controlling their water loss, (3) data collection and analysis to support major District initiatives such as the MFL program, (4) the FARMS program and other various agricultural research projects designed to increase the water-use efficiency of agricultural operations, (5) WRD investigations and MFL Recovery projects which may not have local cooperators, and (6) the Water Incentives Supporting Efficiency (WISE) program launched in 2019 offers cost-share funding for a wide variety of water conservation projects (max of $20 thousand per project) to a wide variety of non-agricultural entities. From FY2016 through FY2020, the District's adopted budget included an average of $24.5 million in ad valorem tax dollars for District Initiatives, of which $9 million was for WRD and WSD assistance.

The average total commitment from FY2016 through FY2020 for CFI and District Initiatives was approximately $81.3 million. The continued level of investment for these programs depends on various economic conditions, resource demands, and the District's financial resources. However, the District believes 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 FDEP Springs Initiative is a special legislative appropriation that has provided revenue for protection and restoration of major springs systems. The District has allocated Springs Initiative funding to implement projects to restore aquatic habitats, to reduce groundwater withdrawals and nutrient loading within first-magnitude springsheds, and to improve the water quality and quantity of spring discharges. Projects include the reestablishment of aquatic and shoreline vegetation near spring vents, construction of infrastructure necessary to convey wastewater currently treated in septic systems or package plants to a centralized wastewater treatment facility which may increase reclaimed water production and implementation of other best management practices within springshed basins.

The first year of the appropriation was FY2014, when the District received $1.35 million from the FDEP to allocate for springs restoration. To date, the District has been allocated over $55.2 million in Springs Restoration funding from the FDEP, including $19.25 million for FY2020, of which $7 million will be budgeted in future years. The projects receiving Springs Initiative funding have been located primarily in the Northern Planning Region, where the majority of first and second magnitude springs within the District are located.

2.0 Water Protection and Sustainability Program

Large areas of Florida do not have sufficient traditional water resources to meet the future needs of the state's growing population and the needs of the environment, agriculture and industry. The state's Water Protection and Sustainability Program Trust Fund (WPSPTF) was created in the 2005 legislative session through Senate Bill 444 to accelerate the development of alternative water sources and later recreated in Chapter 373, F.S., as part of the 2009 legislative session. Legislation focused on encouraging cooperation in the development of alternative water supplies and improving the linkage between local governments' land use plans and water management districts' regional water supply plans. The program provides matching funds to the District for AWS development assistance. From FY2006 through FY2009, the District received a total of $53.75 million in legislative allocations through the program for WSD projects. Annual WPSPTF funding resumed in FY2020 with $250,000 allocated to the District.

Program funds are applied toward a maximum of 20 percent of eligible project construction costs. In addition, the Legislature established a goal for each WMD to annually contribute funding equal to 100 percent of the state funding for AWS development assistance, which the District has exceeded annually. The legislation also requires that a minimum of 80 percent of the WPSPTF funding must be related to projects identified in a district water supply plan. The District's RWSP is utilized in the identification of the majority of WPSPTF-eligible projects.

Projects are evaluated for funding based on consideration of the 12 factors described in Subsections 373.707(8)(f) and (g), F.S., and additional District evaluation factors as appropriate. If the Legislature continues to fund the state's Water Protection and Sustainability Program, it could serve as a significant source of matching funds to assist in the development AWSs and regional supply infrastructure in the region.

3.0 The Florida Forever Program

The Florida Forever Act, as originally passed by the Florida Legislature in 1999, established the 10-year $3 billion statewide Florida Forever Program. The Program was extended by the Legislature during the 2008 legislative session, allowing the Program to continue for 10 more years at $300 million annually

Since 1999, the District has allocated $95 million ($81.6 million for land acquisition and $13.4 million for water body restoration) of Florida Forever funding Districtwide in support of WRD. A "water resource development project" eligible for funding is defined in Section 259.105, F.S. (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 Program

Operating under Chapter 40D-26, Florida Administrative Code (F.A.C.), the FARMS Program, through the District, utilizes additional state funding when available. Since the inception of the program, the District has received $6.4 million in state appropriations and $1.3 million from the Florida Department of Agriculture and Consumer Services (FDACS). No funding was provided by the state from FY2016 through FY2020.

5.0 West-Central Florida Water Restoration Action Plan

The Water Restoration Action Plan (WRAP) is an implementation plan for components of the Southern Water Use Caution Area (SWUCA) recovery strategy adopted by the District. The document outlines the District's strategy for ensuring that adequate water supplies are available to meet growing demands, while at the same time protecting and restoring the water and related natural resources of the SWUCA. The WRAP prescribes measures to implement the recovery strategy and quantifies the funds necessary, making it easier for the District to seek funding for the initiative from state and federal sources. In 2009, the Legislature officially recognized the WRAP through Senate Bill 2080, creating Section 373.0363, F.S., as the District's regional environmental restoration and water resource sustainability program for the SWUCA. In FY2009, the District received $15 million in funding for the WRAP, however, no new funding has been provided via state appropriation since that time.

Section 4. Federal Funding

In 1994, the District began an initiative to seek federal matching funds for water projects. Since that time, the Office of the Governor, the FDEP, other WMDs, and local government and regional water supply authority sponsors have joined with the District to secure federal funding. Through a cooperative effort with members of Florida's Congressional Delegation, the federal initiative has grown substantially. In 1999, the effort was expanded to seek funding for the development of alternative source projects and, in 2001, the state of Florida and the WMDs expanded a list of projects in order to seek all available resources to develop an environmentally sustainable water supply strategy that would meet the demands of growth throughout the state. The projects include the use of AWS technologies, as well as stormwater retention and filtering and wastewater treatment. Each WMD certifies that the projects submitted for funding are regional in scope and that matching funds are available either from the District's budget or from a local government sponsor.

Within the District, Federal matching funds from this initiative helped fund the construction of the Peace River Manasota Regional Water Supply Authority (PRMRWSA) reservoir and plant expansion. Funding for Tampa Bay Water's C.W. Bill Young Regional Reservoir came from individual project grant allocations through the State and Tribal Assistance Grants (STAG) program. However, Congress has not funded any individual project STAG grants for several years, so future funding for individual projects through this mechanism is uncertain. Congressional authorization through the Water Resources Development Act aids in the efforts to secure funding for the Peace 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 FDEP, the U.S. Army Corps of Engineers, and the members of the Florida Congressional Delegation to secure federal funding.

1.0 U.S. Department of Agriculture Natural Resources Conservation Service programs

The Natural Resources Conservation Service's (NRCS) Environmental Quality Incentives Program (EQIP) provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands. The program provides assistance to farmers and ranchers to comply with federal, state, and tribal environmental laws that encourage environmental enhancement. The program is achieved through the implementation of a conservation plan that includes structural, vegetative, and land management practices. The program is carried out primarily in priority areas where significant resource concerns exist. Agricultural water supply and nutrient management through detention/retention or tailwater recovery ponds can be pursued through this program.

In addition to EQIP, the FARMS Program has partnered with NRCS through the Agriculture Water Enhancement Program (AWEP) and the Florida West Coast Resource Conservation and Development Council (RC&D) to bring additional NRCS cost-share funding to the SWUCA. The AWEP was created by the 2008 Farm Bill with similar goals as the EQIP program, including conserving and/or improving the quality of ground and surface water. The RC&D is a nonprofit organization that promotes sustainable agriculture and local community food systems in Hillsborough, Manatee, Pinellas, and Sarasota counties.

The District's FARMS Program works cooperatively with the NRCS EQIP, AWEP, and RC&D programs on both financial and technical levels, and dual cost-share projects have been coordinated whenever possible. By an agreement between the District, FDACS, and the NRCS, the maximum funding for using both FARMS and EQIP is 75 percent of total project cost. As of FY2019, 41 FARMS projects Districtwide have involved some level of dual cost-share with EQIP, AWEP, and/or the RC&D, with several additional cooperative projects expected in the near future. On a technical level, agency interaction includes using the NRCS mobile irrigation lab to investigate using FARMS cost-share for improvements to overall irrigation system efficiency, using NRCS engineering designs for regulatory agricultural exemptions whenever possible, and coordinating cost-share on specific project related infrastructure. For example, FARMS may assist with an alternative source of irrigation water and EQIP assists with an upgrade to an irrigation delivery system. The relationship is mutually beneficial, extends cost-share dollars, and provides more technical assistance to participants in both programs.

Section 5. Public-Private Partnerships and Private Investment

As traditional water sources reach their capacity, alternative sources must be developed that involve specialized technical expertise and risky financial investments. The development of such technologies may be beyond the ability and level of tolerance of many water utilities. A range of public/private partnership options are available to provide this expertise and shift the financial risk. These options range from all-public to all-private ownership, design, construction, and facility operation. Investment and competition among private firms desiring to fund, build, or operate WSD projects could reduce project costs, potentially resulting in lower customer charges.

In addition to investor-owned public supply utilities, private risk sharing could be undertaken by three distinct forms of water supply entities: (1) public-private partnerships consisting of public utilities or regional water supply authorities contracting with private entities to design, build, or operate facilities; (2) cooperative institutions such as irrigation districts contracting with private entities; and (3) private entities, which could identify a customer base and become a water supplier to one or more water use types.

1.0 Public-Private Utility Partnerships

Two advantages of public-private partnerships are 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, TBW undertook a public-private partnership with Veolia Water, formerly USFilter, to design, build, and operate its surface water treatment plant that has been in operation since 2002. Veolia assumed all risks for cost, schedule, plant design and construction, equipment supply, startup services, and facility performance through (O&M). The cost savings over the life cycle of the contract is expected to be significant.

Public-private partnerships are becoming more common as water technology and regulation becomes increasingly complex. Increasing numbers of regulated pollutants and new higher-risk technologies drive privatization of some public water supply responsibilities. Partnerships work best where risks are beyond public sector tolerance, a project is new and standalone, construction and long-term operation are combined, there are clearly defined performance specifications, and there are clearly defined payment obligations (Kulakowski, 2005). Small utilities may not have the resources or project sizes sufficient to attract private interest but may participate through multi-utility agreements or through a regional water supply entity. A significant benefit of cooperation in larger projects is the economies of scale common in the water supply industry.

2.0 Cooperatives

Cooperatives are arrangements where multiple self-supplied water users pool their resources to construct water facilities that they could not technically or economically undertake on their own. They also share the risks. Such private or public/private cooperative institutions are more common where lengthy transmission systems are required, such as in the western U.S. where surface water is distributed to water districts and for irrigation. Water is usually obtained from a supplier at a cost and then distributed among members by the water district. Members cooperatively fund the construction of transmission and distribution facilities. As groundwater resources become increasingly limited and reclaimed water systems expand, the same type of economic forces that created irrigation and water districts in the west could develop in portions of Florida. Cooperatives may also shift financial risk by entering into design, build, and operate arrangements with contractors. One example of this structure is the Polk Regional Water Cooperative (PRWC), formed in 2016 to address the development and provision of alternative water sources to its member local governments. Other forms of cooperative institutions in Florida, such as drainage districts and grower cooperatives, have effectively reduced competition and litigation over resources (OPPAGA, 1999).

3.0 Private Supply Investment (Aside from Investor-Owned Public Supply)

Private Supply Investment is where investors identify an unserved customer base and develop water facilities to meet those needs. This type of investment may facilitate the development of alternative water supplies. Such private financial investment occurs where firm regulatory limits are in place to protect water resources and related environmental features, and further development of traditional sources are not allowable. Although the purpose of the regulatory measures is resource protection, they indirectly create a customer base for alternative source developers.

Part C. Amount of Funding Anticipated to be Generated or Made Available Through District and State Funding Programs and Cooperators

Section 1. Projection of Potentially Available Funding

Below is a summary of projected resources that could be generated by the District and state funding programs for water resource development and WSD projects. An explanation follows as to how the funding amounts are derived.

1.0 Cooperative Funding Initiative

With the Governing Board's direction for a continued investment in vital projects to protect the region's water resource needs, the District's most recent long-range funding plan estimated $1.33 billion in ad valorem tax dollars would be allocated for the CFI from 2021 through 2040. Assuming these funds are used for projects that would be matched by a partner on an equal cost-share basis, this would collectively result in $2.66 billion generated through this program. If the funding allocation summary of the program remains consistent with the previous five years, approximately $1.41 billion (53 percent) could potentially be utilized for water source development and WSD assistance. However, the allocation of resources is typically driven by new requests submitted through the CFI program each year, which could significantly influence this funding projection, as the Governing Board may direct more funding for the District's other areas of responsibility (i.e., flood protection, water quality, and natural systems). It is important to note that funding does not include state or federal funds, which the District and its partners continue to seek.

2.0 District Initiatives

Also consistent with the District's most recent long-range funding plan, an estimated $579 million in ad valorem tax dollars would be allocated for District Initiatives from 2021 through 2040. If the funding allocation of the program remains consistent with the previous five years, approximately $214 million (37 percent) could potentially be utilized for water source development and WSD assistance. However, the allocation of resources is typically driven by strategic priorities which could significantly influence this funding projection, as the Governing Board may direct more funding for the District's other areas of responsibility (i.e., flood protection, water quality, and natural systems). It is important to note that funding does not include state, federal, or local funds, which the District continues to seek.

3.0 Springs Initiative

The amount of future state funding for the Springs Initiative cannot be determined at this time. Any funding allocated to this District will be used for projects for the protection and restoration of major springs systems, including projects to reduce groundwater withdrawals and improve stormwater systems.

4.0 Water Protection and Sustainability Trust Fund

The amount of future state funding for this program cannot be determined at this time. As economic conditions improve and the state resumes funding, any funding allocated for this District will be used as matching funds for the development of alternative water supply (AWS) projects.

5.0 Florida Forever Trust Fund

The amount of future state funding for the Florida Forever Trust Fund cannot be determined at this time. Any funding allocated for this District will be used for land acquisition, including land in support of WRD.

If funding allocations remain consistent with the previous five years, approximately $1.62 billion could potentially be generated or made available to fund CFI and District Initiative projects necessary to meet the water supply demand through 2040 and to restore MFLs for impacted natural systems. This figure may be conservative, since it is not possible to determine the amount of funding that may be available in the future from the federal government and state legislative appropriations.

Section 2. Evaluation of Project Costs to Meet Projected Demand

Of the 209.8 mgd of projected Districtwide demand increases during the 2015–2040 planning period to meet the demand for all users and to restore MFLs for impacted natural systems, it is estimated that 46 mgd, or 22 percent of the demand, has either been met or will be met by reclaimed water and conservation projects that are under development. The total District share of cost for the projects currently under development including regional transmission, ASR, and brackish groundwater treatment systems is $490 million.

To develop an estimate of the capital cost of projects necessary to meet demand, the District compiled a list of large-scale WSD projects proposed for development within the 2040 planning timeframe. These projects, proposed by the PRMRWSA, TBW, and PRWC, could produce up to 105 mgd of water supply. The estimated costs and quantity of water they will produce are listed in Table 8-2. The categories shown each contain several projects that could be chosen for development to meet future needs. Many of these are AWS projects would be eligible for co-funding by the District. The table shows the estimated total cost of the 100 to 105 mgd of water supply that will be produced by these projects is up to $1.57 billion.

Tampa Bay Water's (TBW) Long-Term Master Water Plan 2018 contains several AWS projects, many of which would be eligible for co-funding by the District. The TBW priority projects range from 10 to 25 mgd in capacity with capital cost estimates of between $408 and $429 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 AWS 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 AWS and conservation projects chosen by users. The potential water supply project options are discussed in Chapter 5 for each planning region.

Table 8-2. *Proposed large-scale water supply and water resource development projects by 2040 (millions of $)*

Project	Entity to Implement	Quantities (mgd)	Capital Costs
Peace River Facility Surface Water System Expansion and Regional Reservoir	PRMRWSA	15	$208
Regional Loop System and ASR Projects	PRMRWSA	10	$189
Flatford Swamp Hydrologic Restoration	TBD	10	$44-96
Southeast Wellfield and West Polk County Lower Aquifer Deep Wells	PRWC	45	$650
Big Bend Desalination	TBW	10-12.5	$244
Enhanced Surface Water Expansion from Alafia River	TBW	10-12.5	$88
New Regional Feed Line to Balm Area	TBW	N/A	$76-97
Subtotal Southern Planning Region		**35**	**$441-493**
Subtotal Heartland Planning Region		**45**	**$650**
Subtotal Tampa Bay Planning Region		**20-25**	**$408-429**
Total – Districtwide		**100-105**	**$1,499-1,572**

Section 3. Evaluation of Potential Available Funding to Assist with the Cost of Meeting Projected Demand

The conservative estimate of $2.66 billion in cooperator and District financial resources that will be generated through 2040 for funding is sufficient to meet the projected $1.50 to $1.57 billion total cost of the large-scale projects listed in Table 8-2. State and federal funding sources may also assist with any remaining and/or high-end costs for future AWS 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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