City of Lake Wales, Florida

DRAFT REPORT

ALTERNATIVE WATER SUPPLY ASSESSMENT

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Table of Contents

Executive Summary

The City of Lake Wales ("City") owns and operates a public, municipal drinking water system obtaining water supply from seven wells completed in the Upper Floridan Aquifer (UFA) – a source used throughout the region considered oversubscribed. The City's well and treatment delivery capacity of 18.6 mgd (million gallons per day) is, however, limited by its Water Use Permit to an average of 3.9 mgd.

Water demand projections as recently as early 2020 indicated no need for additional supply for about the next 20 to 25 years. However, this year the City has experienced a huge increase in the number of proposed residential developments. Currently, 8,044 new housing units are pending action before the City Development Services. If those homes were approved and built, the number of housing units would nearly double the current figure of 9,371 residential services served by the water sysem. An updated projection has indicated an accelerated need for additional supply by 2032.

It is highly unlikely that new withdrawals from the UFA will be allowed, and the City should not plan on that. The direction for new water supplies is with AWS (Alternative Water Supply) sources which, for all practical purposes, means groundwater development in the Lower Floridan Aquifer (LFA). The two most likely alternatives available to the City are either the independent development of a new LFA supply or participation in a regional supply project sponsored by the Polk Regional Water Cooperative (PRWC).

For the independent development of a LFA supply, the City can expect a 5- to 10-year lead time for the planning, testing and permitting followed by design, bidding and construction of the required facilities. Unlike the higher quality UFA water, the LFA will be brackish requiring a much greater degree of treatment.

The PRWC is planning to develop a network of LFA well supplies, treatment facilities and transmission pipelines to provide bulk water supply to be purchased by the participating municipalities. However, this program is very much a work-in-progress substantially lacking in specific information regarding expected costs, allocations, rate determination and other key decision factors. While a regional water supply can offer potential benefits due to economics of scale and preferential treatment by funding agencies, at this point there simply is insufficient information to base a recommendation on whether or not to participate in the PRWC program. Loss of local control is also a consideration.

Given the projected City water supply needs and lead times involved, our recommendation is to proceed with a test well program over the next two years to better plan and conceptualize a City-supply approach. Perhaps by that time, enough information will become available from the PRWC to make an informed decision regarding which alternative will best serve the City's long-term water supply needs.

I. Background

The City of Lake Wales ("City") owns and operates a public, municipal drinking water system serving approximately 22,600 people providing roughly 2.7 mgd (million gallons per day). The current water source is groundwater from the Upper Floridan aquifer which is treated by aeration and chlorination at several water treatment facilities. The City recently acquired the Park Water Company, a separate entity with its own supply, serving about 3,800 people; the Park Water Company is not included in this assessment.

Given a significant, recent acceleration of future expected development, the City's current water supply will undoubtedly need to be expanded. The topics covered by this assessment include an overview of the current water supply and treatment systems; the identification and assessment of alternative water supply sources; and comparative discussion with our conclusions and recommendations.

Current Water Supply and Treatment Systems Overview

The City's current water supply consists of seven wells treated at three water treatment plants (WTPs): the Market Street WTP, the Grove Avenue WTP and the Burns Avenue (High School) WTP described as follows.

Well Yields and Pumping Capacity

The City's wells are high-producing wells completed in the productive and transmissive Upper Floridan Aquifer (UFA). Well data at the three WTPs are shown in Table I-1.

Table I-1: Well and Pump Data

	Well ID	Year Drilled	Depth (ft)	Cased Depth (ft)	Casing Dia (in)	Pump Capacity (gpm)	Pump Hp
WTP #1 Market Street	P1-1	1964	1,020	720	18	1,500	60
	P1-2	1950	1,008	652	18	1,400	50
	P1-4	1982	1,050	620	18	3,000	100
WTP #2 Grove Avenue	P2-1	1960	1,063	745	18	2,000	150
	P2-2	1941	1,063	790	18	2,000	150
WTP #3 Burns Avenue	P3-1	1982	1,050	705	16	1,500	100
	P3-2	1982	1,050	705	16	1,500	100

The total production capacity of the seven wells is 12,900 gpm (gallons per minute) or 18.6 mgd (million gallons per day).

Water Use Permit (WUP) Limits and Conditions

The City's current WUP (Water Use Permit #20 004658.012) was issued by the Southwest Florida Water Management District (SWFWMD) on January 5, 2012. The 20-year permit has an expiration date of January 5, 2032. Average Annual and Peak Monthly Withdrawal Limits on a gallon per day basis are summarized in Tables I-2, I-3, I-4 and I-5. Beside these withdrawal limits, WUC compliance is predicated on maintaining a per capita daily water use rate no greater than 132 gpcd (gallons per capita day).

Table I-2: WUP Total Average Daily Withdrawal Limits for Potable Water Supply (gallons)	
Annual average daily	3,902,600
Greatest month average daily	4,683,100

Table I-3: WUP Individual Well Daily Withdrawal Limits (gallons) at Market Street WTP		
Well ID	**Average Annual**	**Average during Peak Month**
P1-1	30,900	36,500
P1-2	204,700	241,900
P1-4	54,100	63,900
Combined	289,700	342,300

Table I-4: WUP Individual Well Daily Withdrawal Limits (gallons) at Grove Avenue WTP		
Well ID	**Average Annual**	**Average during Peak Month**
P2-1	469,800	555,300
P2-2	469,800	555,400
Combined	939,600	1,110,700

Table I-5: WUP Individual Well Daily Withdrawal Limits (gallons) at Burns Avenue WTP		
Well ID	**Average Annual**	**Average during Peak Month**
P3-1	1,081,200	1,278,100
P3-2	1,081,100	1,278,100
Combined	2,162,300	2,556,200

A review of production data for the last three years (2018-2020) indicates that the greatest average monthly production (3.3 mgd in May 2020) is also well below the permit limit of 4.6 mgd. Figure I-1 shows average monthly production and the WUP permit limit as well as Maximum Daily Demand (MDD) during each month. General engineering practice suggests that the water supply should be able to meet the MDD with the largest source out of service and the City's water supply appears to meet this criteria.

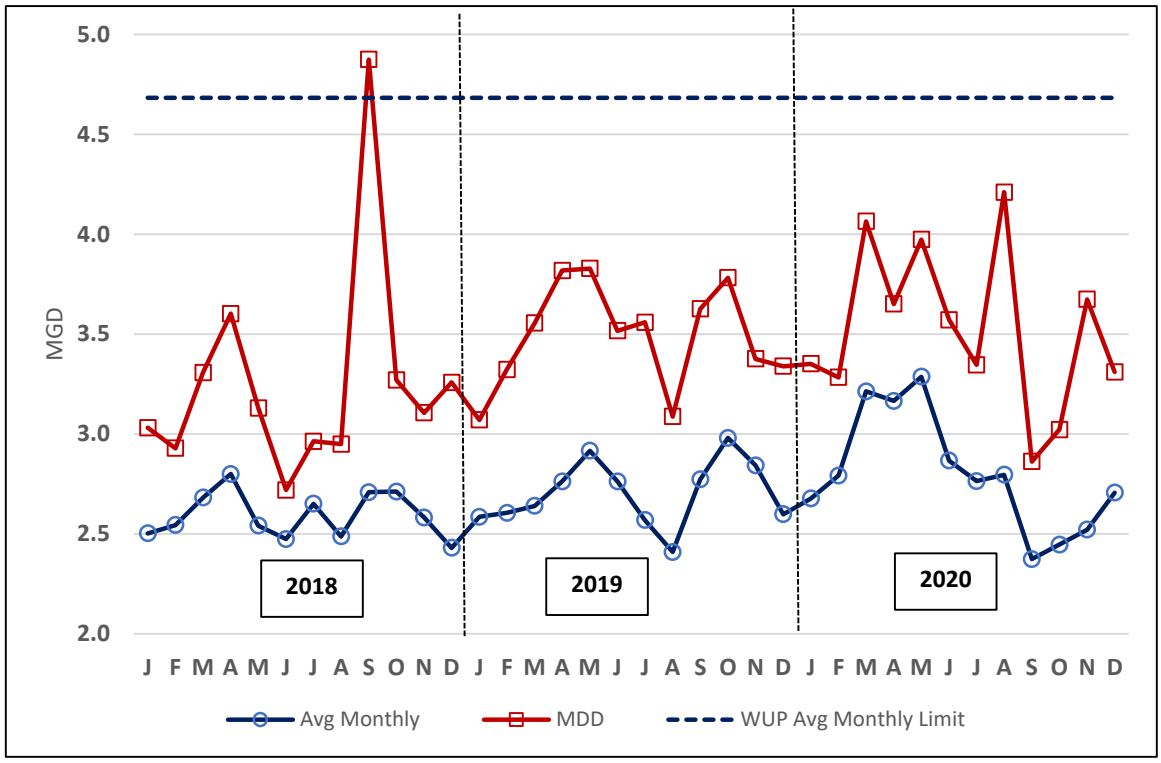

Figure I-1: Average Monthly Water Production, WUP Permit Limit and MDD, 2018-2020

The highest day shown, September 8, 2018, probably represents an unusual event – perhaps a watermain break or fire. However, the increasing trend in both MDD and average monthly production is obvious. This trend is addressed later in this section of the report.

The WUP contains a variety of Special Conditions relative to reporting, improving irrigation efficiency, increasing conservation measures, beneficial reuse of reclaimed wastewater and customer billing among other conditions. Of note, a report revisiting the basis for which the current, 20-year permit was issued must be submitted by the City at the half-way point of their current permit term, in this case by January 31, 2022. Based on a review of the conditions for issuance, demand projections and beneficial reuse goals, the WUP may be modified by SWFWMD.

Current Cost of Water Production

The estimated, total current cost of water production is shown in Table I-6. The costs are based on the 2020-21 Adopted Budget. In some cases, the budgeted costs are shared between the water and wastewater systems and simplified allocation assumptions are indicated in the table.

For comparison with the alternatives later in this report, water production includes pumping the water to the ground storage tanks and treating the water but not pumping the treated water into the system. Thus, the estimated water production power cost is reduced by half to include only the well pump cost and not high lift (distribution) pumping.

Table I-6: Estimated Current Cost of Water Production

Expense Category	Estimated Amount	Notes, Assumptions
Labor – Salaries	$ 161,000	4 water plant personnel
Labor – Benefits (60%)	$ 97,000	Average
Contract Services – Laboratory	$ 20,000	Assume 2/3 of budget for water
Power (electricity)	$ 75,000	Assume 2/3 of budget for water, then half
Maintenance & Replacement	$ 33,000	Assume 1/3 of budget for water
Chemicals	$ 20,000	Assume 2/3 of budget for water
Total Estimated Cost of Water Production	$ 406,000	Not including relevant debt service

Based on the past five City annual water supply reports, total expected well withdrawal for 2021 is 1,010 MG (million gallons) or 2.77 mgd resulting in an estimated cost of water production of $0.40/kgal (dollars per thousand gallons). Note that this estimate does not include existing debt service associated with the water production facilities.

Water Withdrawal/Production/Demand Projections

The City obtains water supply from the wells which is treated with aeration and chlorination, stored in ground storage tanks, and then pumped into the distribution system. Over the past 5 years (2016 through 2020) the City has also imported water into the system although that has declined to an insignificant amount. About 1% of the well water withdrawn is lost in the treatment process. For purposes of the projections, water withdrawals are considered equal to the water provided to the system and the terms “Water Withdrawals”, “Water Production” and “Water Demand” are equivalent except as noted in the report.

Five recent years of City annual water supply reports, from 2016 through 2020, were reviewed with the following observations:

- The number of metered, residential DU (dwelling unit) services rose from 7,431 to 7,836 – an increase of 405 over the 5-year period averaging 81 new services per year at a 1.3% annual increase rate
- Residential metered water consumption increased by an average of 1.6% per year - from 1,638,182 gpd to 1,791,835 gpd
- Both the number of people per DU and the per capita water usage remained fairly consistent at 2.41 and 79.6 gpcd, respectively, for an average residential water consumption of 192 gpd per DU
- The number of Commercial/Industrial services increased from 702 to 722 – an average of 4 new services per year
- Commercial/Industrial metered water consumption decreased during that time frame from a peak of 381,581 gpd in 2017 to a low of 338,764 gpd in 2020
- Likewise, average Commercial/Industrial consumption decreased from 537 to 469 gpd per service

During the five-year period 2016 through 2020, residential water consumption accounted for 69% of total water use and industrial/commercial consumption accounted for 15%. Municipal connections used another 3% and other accounted-for uses were 6%.[1] Un-accounted for water during that period (excepting 2019) average 12%. (The total adds up to more than 100% due to rounding.)

The City's water system serves customers within and outside the City limits. Customers outside the City account for about 25% of the service population.[2] Currently, there are no plans for expanding the number of outside services.

The City, like many communities in Florida and the US, is currently experiencing a very active real estate development economic climate. As of March 31, 2021, plans for 8,044 new dwelling units (DUs) have been submitted to and are pending action by the Community Development Department including 4,264 detached single-family homes, 1,500 attached single-family homes and townhomes and 2,280 multi-family homes (see Appendix A). The proposed 8,044 new DU would increase the number of DUs served by the water system by 85%. The number of commercial services is also expected to increase, although at a much slower rate.

The currently pending DUs include a major proposal by WH Corporation accounting for 6,100 DUs that would likely be developed over the next 20 years. The remaining 1944 DUs would likely be built over the next 5 years.

[1] Data from 2019 were not included in the latter two percentages because the reuse pumphouse was upgraded that year dramatically increasing the use of potable water for municipal field irrigation.

[2] The 2020 water service population was reported to be 22,584 people and City Development Services estimates the City population at 17,000 in their February 2021 Comprehensive Plan.

Figure A-1 shows the projected water service population over the next 40 years labeled "HTA" projection. Also shown are other recent projections for comparison. The HTA projection is based on the following parameters:

- The WH Corporation development completed over the next 20 years
- The remaining, pending proposals completed over the next 5 years
- Additional, new dwelling units at the recent, annual rate of 80 DUs
- The recent average of 2.41 people/dwelling unit held constant
- The recent average residential per capita water usage of 79.6 gpcd held constant
- New industrial/commercial services at the recent rate of 4 per year using an average of 495 gpd/service
- Municipal water usage remains constant at the current, apparent rate of 65,000 gpd
- Other, accounted-for water usage at the recent, apparent rate of 75,000 gpd
- Un-accounted for water at 10% of the total demand

A table detailing the projection calculations appear in Appendix B. Graphs of projected service population and projected water demand are shown on Figures I-2 and I-3, respectively.

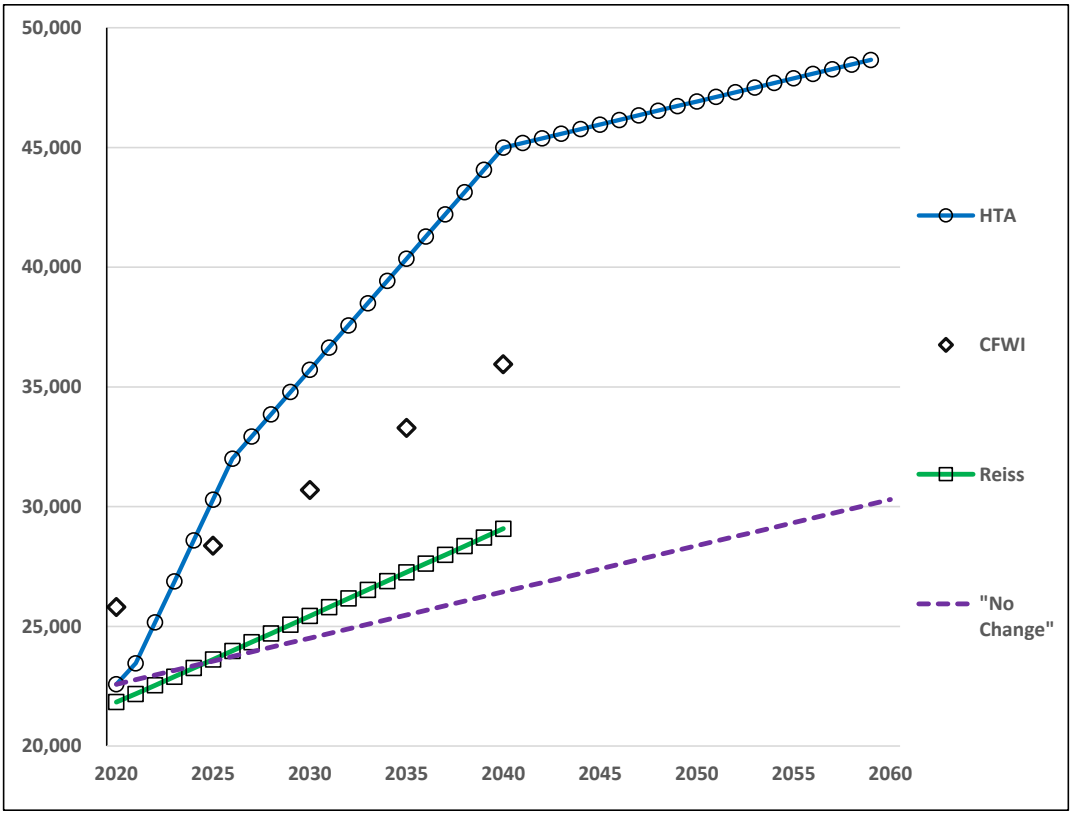

Figure I-2: Comparison of Water Service Population Projections

On Figure I-2, the "HTA" projection is compared with other, recent 20-year projections. The CFWI (Central Florida Water Initiative) projection is from the *2020 Regional Water Supply Plan, Appendix A: Population and Water Demand Projections*. The "Reiss" projection is the "City revised projection" from the *City of Lake Wales, Potable Water Supply Master Plan, Final Report*, dated February 2020. The "No Change" line is a projection of the past 5 years average growth rate as described above. The "HTA" projection represents the impact of the currently proposed developments illustrating the potential change if all 8,044 dwelling units are built.

Although the CFWI apparently overestimated the 2020 service population, the increasing trend rate is similar to the Reiss projection. Both are a modest increase to the recent 5-year trend. However, the HTA projection is significantly greater showing a doubling of the current service population. This may be reflecting the highly unusual societal changes caused by the COVID-19 pandemic – something that could not have been anticipated in 2020.

The service population projections are similarly reflected in the water supply projections shown in Figure I-3 also showing the WUP groundwater withdrawal limit. The sources of the CFWI and "Reiss" projections are the same as noted above.

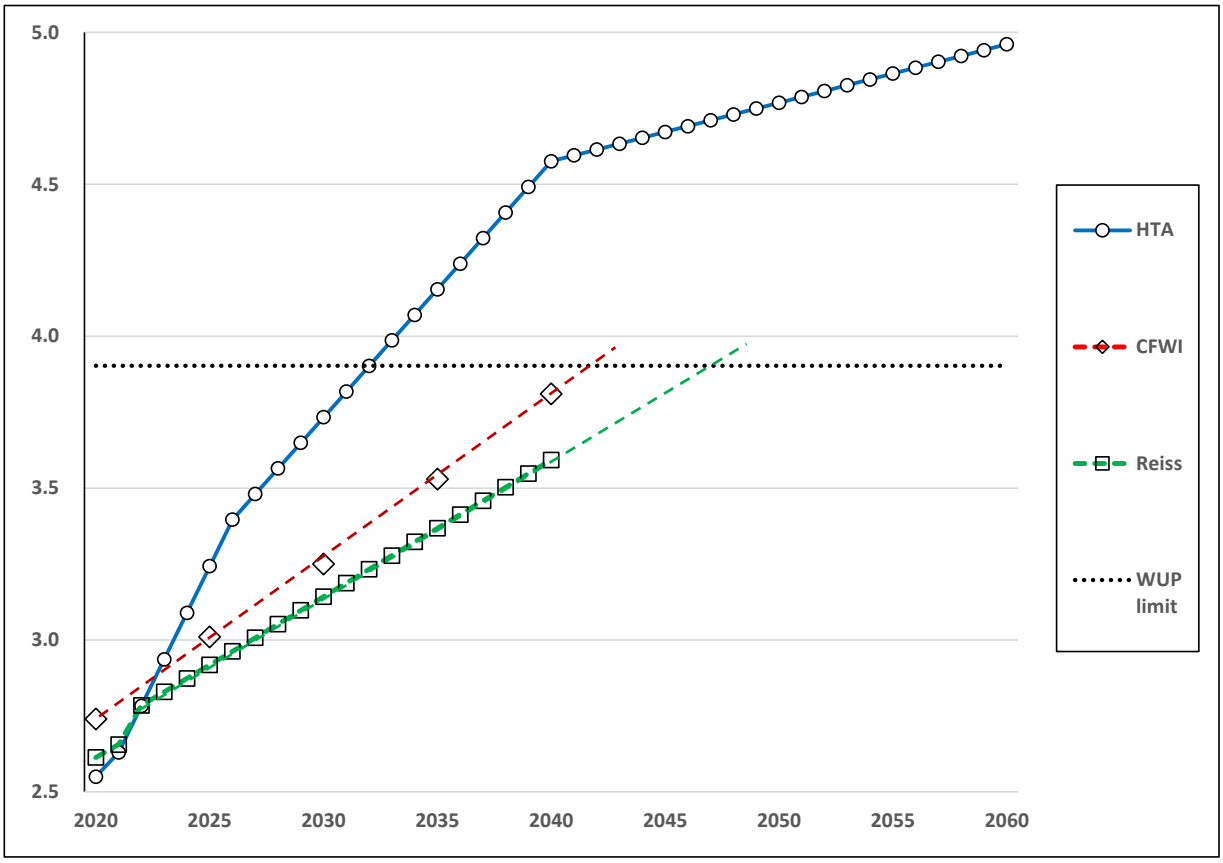

Figure I-3: Annual Average Water Demand Projections (mgd)

Extending the CFWI and Reiss projections would indicate a need for additional water supply beyond the WUP withdrawal limit around 2042 to 2047. However, the current ("HTA") projection indicates that need could occur around 2032 – 10 years earlier than previously projected. This projection indicates the potential need for an additional 0.67 mgd by 2040 and 1.1 mgd by 2060.

As with the projection of water service population, the demand projection can vary with several factors including:

- The timing and how many of the currently proposed 8,044 new dwelling units actually get built,
- Future additional new DUs and industrial/commercial services, and
- Expansion of the water service area outside the City.

Future water demand can also be modulated by increased conservation measures, increased use of recycled wastewater for irrigation and reduction of un-accounted for water – all strategies that fall under the general term "sustainability".

Summary

Clearly the limiting factor for the City's water supply is the WUP groundwater withdrawal limit. The WUP limit of 3.9 mgd is dwarfed by the total well yield and pumping capacity of 18 mgd.

A current surge of proposed residential development projects, presently numbering 8,044 new dwelling units, has dramatically increased prior water service population and water demand projections from a year ago resulting in the following conclusions:

- The water service population may more than double from about 22,500 to 49,000 over the next 20 years
- Water demand may exceed the WUP groundwater withdrawal limit of 3.9 mgd by 2032 – the expiration date of the City's current WUP
- The deficit in water supply is projected to be 0.67 mgd by 2040 and 1.1 mgd by 2060

The development of new water supplies and treatment facilities can easily take five years or more; planning for the additional supplies should begin now.

The current cost of water production including pumping from the wells to the ground storage tanks and chemical treatment is estimated to be $0.40/kgal (1,000 gallons) not including any debt service associated with water production and treatment.

II. Alternative Water Supply Sources

For purposes of this assessment, the term "Alternative Water Supply" is defined to mean brackish groundwater in the Lower Floridan Aquifer (LFA) as further described in this report. It is generally acknowledged that further withdrawals from the current, major source of drinking water in Polk County – the Upper Floridan Aquifer (UFA) – will not be permitted. Other Alternative Water Supply (AWS) sources include wastewater recycle and demand reductions and offsets provided by conservation measures and aquifer recharge. As with additional UFA withdrawals, surface water is not considered a viable AWS option because of environmental impact concerns.

The two main LFA alternatives for Lake Wales are development of new LFA wells and treatment facilities and participation in the Polk Regional Water Cooperative regional supply program.

Regionalization – The Polk Regional Water Cooperative

The Polk Regional Water Cooperative (PRWC) was created in 2016 through an interlocal agreement between Polk County and 15 municipal member governments including Lake Wales. A main PRWC intent is to provide for regional cooperation for water resource development to meet future water demands within Polk County. The PRWC area is shown on Figure II-1 which also shows one alternative for the interconnecting transmission pipelines.

A great deal of planning, engineering and legal activity has occurred, and is continuing to occur, since its inception. The emerging regional plan includes two major LFA supply and treatment facilities, an aquifer recharge and streamflow augmentation project and an interconnecting network of transmission piping with pumping facilities. Much of the program is still in the conceptual planning phase.

<u>Regional Project Concept</u>

In 2017, the PRWC considered five AWS projects and selected three for further development: the Southeast LFA Wellfield Project, the West Polk County LFA Deep Wells Project and the Peace Creek Integration Water Supply Project.[3] These three projects are described below.

The Southeast Wellfield project would consist of 15 LFA production wells, 11 miles of raw water transmission mains, a reverse osmosis (RO) WTP (Water Treatment Plant), several concentrate disposal wells, and 73 miles of finished water transmission mains. A 40-year WUP had been previously issued by SFWMD to Polk County Utilities in 2014 at the proposed site for

[3] Phase 2 Implementation Agreement Engineer's Report, prepared for Polk Regional Water Cooperative by Reiss Engineering, Wright-Pierce and Jones-Edmunds, April 30, 2017

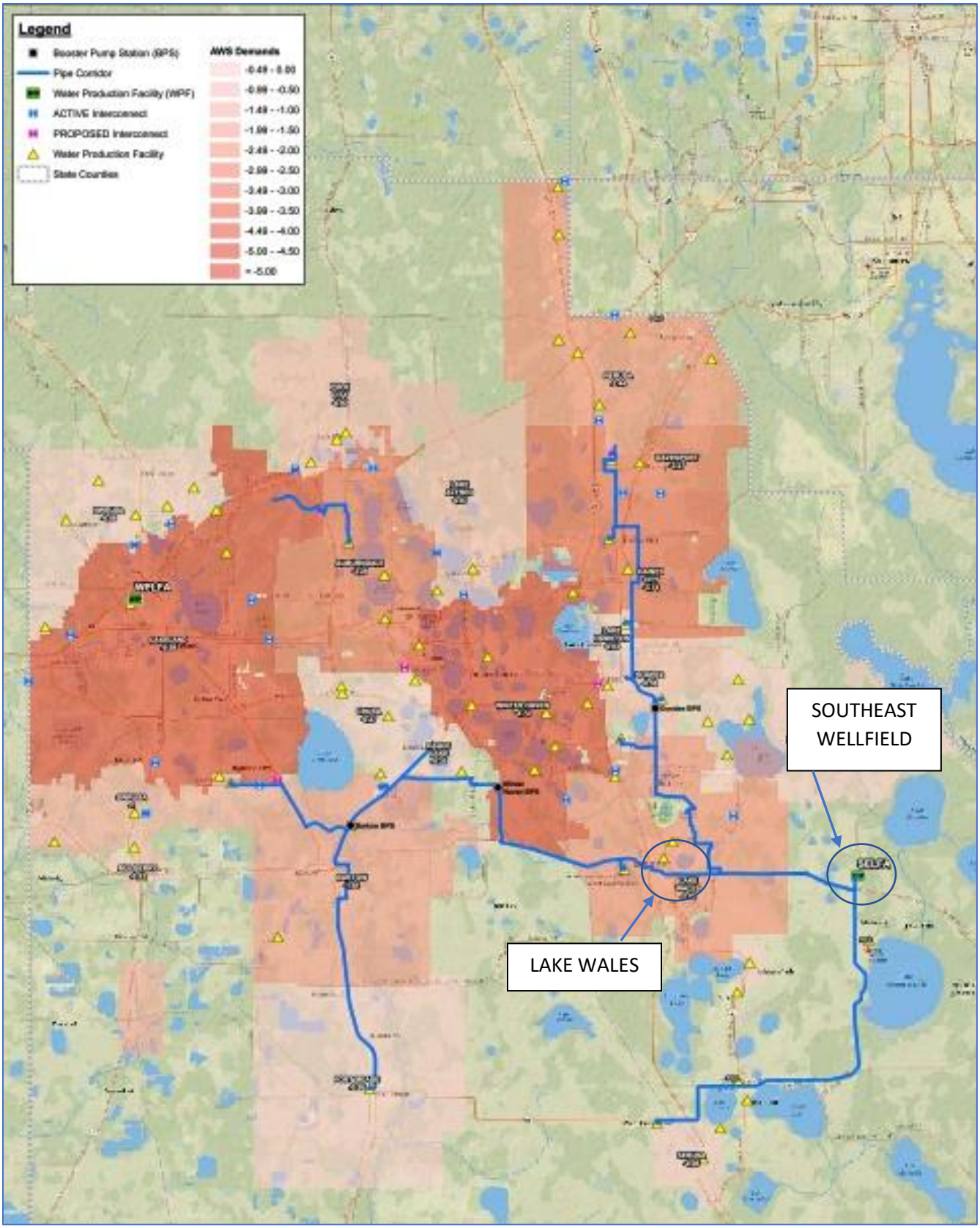

Figure II-1: PRWC Service Area *(Source: PRWC)*

withdrawing up to 37.5 mgd which would be developed in phased steps. The estimated, planning-level project capital cost was $352,385,000. Total annual costs including debt service and O&M (Operations and Maintenance) would be $31,833,000 equating to an estimated cost of production of $3.08/kgal (dollars per thousand gallons).

The West Polk County LFA Deep Wells project would consist of 8 LFA production wells that would produce an estimated yield of 20 mgd. The RO WTP would produce 15 mgd of finished water applying an estimated RO permeate recovery of 75%. 25 miles of finished water transmission mains to project partners and two deep injection wells for the RO concentrate would be included. The estimated, planning-level project capital cost was $166,754,000. Total annual costs including debt service and O&M (Operations and Maintenance) would be $16,488,000 equating to an estimated cost of production of $3.01/kgal.

The goal of the Peace Creek Integrated Water Supply Project is to recover lost water storage at the headwaters of the Peace River by constructing flow control structures and by large-scale wetland restoration. The project would provide recharge to the UFA, enhance river and lake water quality and streamflow, improve wetland habitat, and provide for increased flood protection. The estimated, planning-level project capital cost was $120,885,115 of which $71,137,500 was for land acquisition. Total annual costs including debt service and O&M (Operations and Maintenance) would be $8,119,537. The project would be credited with adding 5 mgd of water supply capacity in the UFA.

Continuing project conceptualization was described in a draft technical memorandum dated March 2019.[4] The recommended alternative included the two proposed LFA wellfields and distribution of the treated drinking water to the member utilities through a combination of transmission pipelines and "water wheeling" through some of the utility distribution systems. The concept would include two or three booster pumping stations. Lake Wales would receive the water from a direct pipeline from the Southeast LFA Wellfield WTP. Cost estimates for some, but not all, of the project components were provided in the draft technical memorandum and the estimated cost of water to Lake Wales was not clear.

Agreements with PRWC

The City's relationship with PRWC seems to be governed by two agreements described as follows.

[4] *Draft Technical Memorandum, Water Transmission Alternative Investigation and Interim Solution* by Team One (Corollo, Wright-Pierce and Hydro Solutions Consulting), March 2019

Interlocal Agreement Relating to the Establishment of the Polk Regional Water Cooperative

The Polk Regional Water Cooperative (PRWC) was established on June 1, 2016 by ratification of the *Interlocal Agreement*. The PRWC structure established by the agreement is briefly summarized as follows:

- The parties to the agreement are 16 municipalities in Polk County (including Lake Wales) as well as the County government. These parties are referred to as *Member Governments*.
- The PRWC is an independent legal entity with broad powers that include regional planning, development and ownership of capital projects, facility operations, acquisition of real property, facility leasing and establishment of rates and charges to the Member Governments, obtaining grants and funding assistance and issuance of debt instruments
- PRWC is overseen by a Board of Directors comprised of one representative from each Member Government
- PRWC is managed by a Director and staff hired by the Board

PRWC potable water supply projects are intended to focus on Alternative Water Supply (AWS) sources. The agreement defines AWS sources to include salt water, brackish surface and groundwater, stormwater aquifer recharge and recharge and augmentation with reclaimed wastewater. No "traditional", meaning UFA supply projects, are anticipated.

The agreement outlines a series of steps by which potential water projects would be identified, evaluated, and selected for development. The funding and development of approved, defined water projects would be covered under separate, future *Implementation Agreements.*

Individual Member Governments are not prohibited from pursuing their own AWS potable water supply projects independent of PRWC. There is a 90-day notification requirement of an intent to do so and the PRWC has at least 90 days to decide whether to include the AWS project as a PRWC project. There is no similar notification requirement to develop a traditional (UFA) potable water supply project.

Southeast Wellfield Implementation Agreement

The first project selected for PRWC development is the Southeast Wellfield. Following procedures established by the Interlocal Agreement, an Implementation Agreement was executed for the Southeast Wellfield dated _____. All the Interlocal Agreement Member Governments are parties to the Implementation Agreement except the City of Frostproof and Village of Highland Park.

The Implementation Agreement includes projected finished water allocations to the parties and information regarding cost allocation. However, the agreement is quite complex and

somewhat vague due to a scarcity of information regarding the project scope and definition, operational scenarios, and expected costs to be incurred by the parties – all of which still need to be further developed and more clearly defined. Possibly for this reason, the agreement allows the parties to be either Project Participants or Project Associates. A Project Associate is a Member Government without project voting rights but also with no financial commitment to the project. Lake Wales has elected Project Associate status under the agreement.

The Implementation Agreement anticipates proceeding with facility design with deliverables, including plans, specifications, and cost estimates, at the 60% and 100% design stages. At the 60% design stage, a Project Participant may withdraw from the project and a Project Associate may join the project both subject to relatively minor costs. However, the cost commitments appear to increase substantially after the 60% design stage (although, again, those costs have not been quantified). In essence, the 60% design stage appears to be a key decision point for either participating in the Southeast Wellfield project or not.

It is emphasized that this Implementation Agreement is only for the wellfield and treatment facility and does not include the transmission pipelines that Lake Wales would need to obtain the water produced.

One provision pertinent to this assessment is that the delivery pressure to the Project Participants will be a minimum of 30 psi[5]. This pressure would be sufficient to fill a ground storage tank but insufficient to fill an elevated tank or meet distribution system requirements. For this assessment, it is assumed that high lift (distribution) pumping from the ground storage tanks would continue to be required as it is with the well withdrawals.

In the Implementation Agreement, the Southeast Wellfield would initially produce 12.64 mgd of finished drinking water and developed further in phases up to the WUP withdrawal limit of 30 mgd. Lake Wales would receive an "allotment" of 0.73 mgd (5.7753% of the initial production capacity) based on an estimated need in year 2045.[6] More recently, the initial production capacity has been reduced to 5 mgd with an ultimate capacity of 12.5 mgd.

Groundwater Development within the City

As mentioned, the City's current water supply consists of 7 wells completed in one portion of the Floridan Aquifer – the UFA.

<u>The Floridan Aquifer</u>

The Floridan Aquifer is one of the largest, most prolific aquifers in the U.S. spanning an area of about 100,000 square miles throughout Florida and southeastern portions of Alabama, Georgia

[5] Section 11.4 *Water Pressure*, Page 24
[6] Southeast Wellfield Implementation Agreement, page 9.

and South Carolina. In Polk County, and much of central to south Florida, the aquifer is comprised of distinct units separated by lower permeability zones although the occurrence and depths of the units vary considerably.

Based on information contained in a recent USGS publication[7], the Floridan aquifer system near Lake Wales appears to range from a depth of about 300' to 3,200' below grade. A generalized concept of the hydrogeologic stratigraphy is shown in Table II-1.

Table II-1: Conceptual Hydrogeologic Stratigraphy of Floridan Aquifer near Lake Wales

Hydrogeologic Unit	Zone Description	Depth Below Grade (ft)
Upper Floridan Aquifer (UFA)	Uppermost permeable zone	300 - 500
	Ocala-Avon Park lower permeability zone	500 - 700
	Avon Park high permeable zone	700 - 1,350
Lower Floridan Aquifer (LFA)	Middle Avon Park semi-confining unit	1,350 - 1,500
	Lower Avon Park permeable zone	1,500 - 2,000
	Glauconite marker zone	2,000 - 2,200
	Oldsmar permeable zone	2,200 - 2,800
	Lower permeability rock zone	2,800 - 3,200

The Upper Floridan Aquifer (UFA) is the major source of public drinking water in Polk County and much of Florida. It is highly permeable with a generally favorable water quality typically requiring only aeration for removal of dissolved gases (e.g., hydrogen sulfide) and chemical addition for disinfection and, sometimes, corrosion control. The static water level in UFA wells is often about 100 feet below grade and pumping levels are often not much lower due to the high aquifer transmissivity. For these reasons, UFA water is comparatively economical to produce. The City's wells appear to be within the Avon Park high permeability zone cased through the Uppermost permeable zone.

On the other hand, the Lower Floridan Aquifer (LFA) has been little used for public water supply given its greater depth and challenging water quality. LFA water is generally believed to be high in dissolved minerals, also characterized as brackish, exhibited by high concentrations of TDS (Total Dissolved Solids), Conductivity, chlorides, sulfate, hardness, and alkalinity. LFA water can be expected to require significant treatment including desalting, generally using RO (reverse osmosis) membrane filtration, among other treatment processes.

To summarize, the UFA is characterized by large production wells yielding 1,500 gpm or more with a favorable water quality and relatively low cost of production. The UFA has been the

[7] Revised hydrogeologic framework of the Floridan aquifer system in Florida and parts of Georgia, Alabama and South Carolina (ver. 1.1, March 2016): U.S. Geological Survey Professional Paper 1807.

historical source of public drinking water in Polk County. Alternatively, the LFA has been little used, therefore far less information is available regarding expected yield and water quality. However, in comparison with the UFA, the LFA is expected to exhibit lower yielding wells with water requiring a higher level of treatment.

Development of Lower Floridan Aquifer Wells

LFA wells would likely need to be drilled to a depth of at least 1,500 feet and possibly 2,500 feet, cased through the UFA. It may be possible to extend an existing UFA well into the LFA as a cost saving measure – especially given that the current well and pumping capacity greatly exceeds the WUP permit limit.

The City of Davenport, a PRWC Member Government, has proposed developing its own LFA well supply. Their proposal is described as follows. Fortunately for Davenport, located north of Lake Wales, the LFA is shallower at a depth of 1,000 feet making the wells less expensive to drill.

City of Davenport LFA Project

Davenport's current water supply is similar to Lake Wales' with UFA wells treated by cascading trey aeration and chlorination. A recent feasibility study was performed by CPH, Inc., Davenport's consulting engineer[8]. Apparently, Davenport's current water demand is approaching its supply capacity and a new LFA well was included in their 2020 WUP renewal.

CPH reviewed hydrogeological data and the results of two existing LFA wells 2 to 4 miles from Davenport. This information indicated that the LFA is highly variable and unpredictable, but LFA wells can be expected to exhibit lower yields than UFA wells and brackish water quality with elevated TDS (Total Dissolved Solids), elevated pH and perhaps sulfates.

CPH recommended a testing program including extending an existing 6-inch diameter agricultural irrigation well from about 400- to 500-feet to a depth of about 1,000 feet. To develop feasibility cost estimates, CPH assumed that RO (Reverse Osmosis) membrane filtration would be needed to desalt (demineralize) the LFA water and packed-tower aeration with odor control would be needed to remove dissolved gases.

Based on limited information, CPH estimated the total project cost including testing, permitting, design, bidding, and construction at $9,031,300 for a 1,500-gpm well and treatment facility. Annual operating costs were estimated at $588,400 in the initial year.

[8] Alternative Water Supply and Treatment Feasibility Study, Lower Floridan Aquifer (LFA) Well, City of Davenport by CPH, Inc., Orlando FL, March 2021.

Davenport is north of Lake Wales where the LFA is believed to be shallower. Lake Wales' wells are already 1,000 feet deep in the UFA and a LFA well would need to be on the order of 1,500 feet deep or greater.

Conceptual Basis for City of Lake Wales LFA Water Supply

Based on the demand projection in Figure II-2, for conceptual planning purposes, the following LFA water supply program is evaluated:

- The installation of an 1,100-gpm LFA well with an initial installation of 550-gpm of treatment capacity in year 2032
- The addition of another 550-gpm of treatment capacity in year 2038

This program would provide additional finished water supply capacity of 800 gpm requiring 1,100 gpm of raw water supply and treatment capacity assuming a 75% membrane system recovery. The program, presented graphically in Figure B-1, is presented strictly for comparing with the PRWC alternative and will likely change with future demand and permitting conditions.

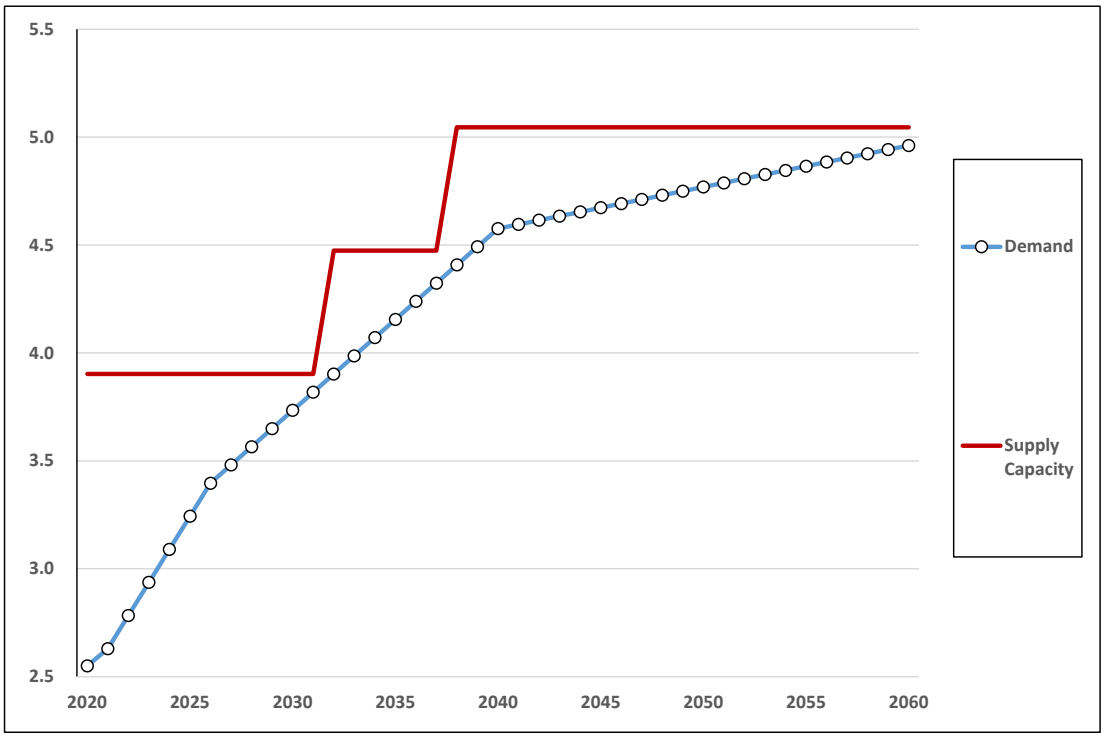

Figure II-1: Projected Demand and Planning Increase in Supply Capacity (mgd)

As a first step, an LFA test well program should be conducted within the next two years. This would include the drilling of a LFA test well, one or more monitoring wells and a pumping test to determine the expected well yield. The "test well" could become the production well. Simultaneously, water quality and treatment testing would be performed to develop preliminary design criteria and costs for the treatment system.

At least 5 years should be expected to permit, design, and build well and treatment facilities, so that effort should begin not later than 2026. Like the Davenport project, expected treatment would include:

- Degasification with packed-tower aeration and odor control
- Filter pretreatment with automatic backwashing cartridge filters
- Membrane filtration with reverse osmosis (RO)
- Final chemical treatment including chlorination and potentially carbonate addition and/or other type of stabilization and corrosion control

Membrane filtration is a separation process meaning, in its simplest form, a raw water stream in and two streams out: a "clean" drinking water stream (permeate) and a waste stream (concentrate) containing the constituents removed. As mentioned, an expected recovery of the RO is 75% means that for every 100 gallons of raw groundwater influent, 75 gallons of clean drinking water and 25 gallons of concentrate would be produced. If the proposed LFA well were pumped 24 hours at 1,100 gpm, about 300 gpm (0.43 mgd) of concentrate waste stream would be produced for disposal either by deep well injection or to the wastewater treatment plant (subject to available capacity, potential effects on the treatment process, and any NPDES permit limitation).

The concentrate volume could potentially be reduced by adding a secondary, recovery RO system. Assuming a lower recovery of 40% treating the more concentrated solution, an additional 0.17 mgd of drinking water would be recovered and the resulting waste stream would be reduced to 0.26 mgd. The feasibility of secondary recovery would need to be confirmed through bench- or pilot-scale treatment testing.

Estimated Cost of Water Production for City LFA Supply

The following estimate is based on the City developing a 1,100-gpm well and treatment system producing 800 gpm of drinking water and a 300 gpm concentrate stream for disposal. The estimated capital cost of the project including engineering and construction, in current dollars is slightly below $9,000,000 in 2021 dollars as detailed in Appendix C, Table C-1 and summarized in Table II-2.

Table II-2: Estimated Capital Cost of City LFA Supply	
Item	**Estimated Cost**
LFA Well Construction	$ 2,680,000
Water Treatment Plant	$ 4,371,000
Ground Storage Tank Improvements	$ 80,000
SubTotal: Estimated Construction Cost	$ 7,131,000
Engineering	$ 1,854,000
Total: Estimated Capital Cost	$ 8,985,000

The estimated annual cost of water production is $2.79/kgal as shown in Table II-3 under the following set of assumptions:

- Continuous 24-hour operation producing 240,480,000 gallons per year
- Annual debt service based on a 20-year bond at 2.0% p.a. interest rate
- On-site operator 8 hours/day, 365 days/year
- Discharge of the concentrate waste stream to the City WWTF
- Fully funded by the City with no outside funding assistance
- 20-year membrane replacement schedule
- Costs are in current (2021) dollars

Table II-3: Estimated City LFA Cost of Water Production	
Item	**Estimated Cost**
O&M-Labor	$ 112,100
O&M-Power	$ 276,100
O&M-Chemicals	$ 60,000
O&M-Contract Services-Laboratory	$ 20,000
O&M-Membrane Replacement Allowance	$ 26,800
O&M-Other Maintenance & Replacement	$ 100,000
SubTotal: Estimated Annual O&M	$ 595,000
Estimated Debt Service	$ 576,400
Total: Estimated Annual Water Production Cost	$ 1,171,400
Volume of Drinking Water Produced	420,480 kgal
Estimated Cost of Water Production ($/kgal)	$2.79/kgal

As mentioned, the estimated water production cost shown in Table II-3 includes no outside funding assistance. However, several current funding assistance programs could apply. Figure B-2 shows the impacts of various levels of participation (grants or loan principal forgiveness) to lower the project capital cost. As can be seen, a reduction in the net capital cost to the City of up to 50% could reduce the City's estimated cost of water production to $2.07/kgal.

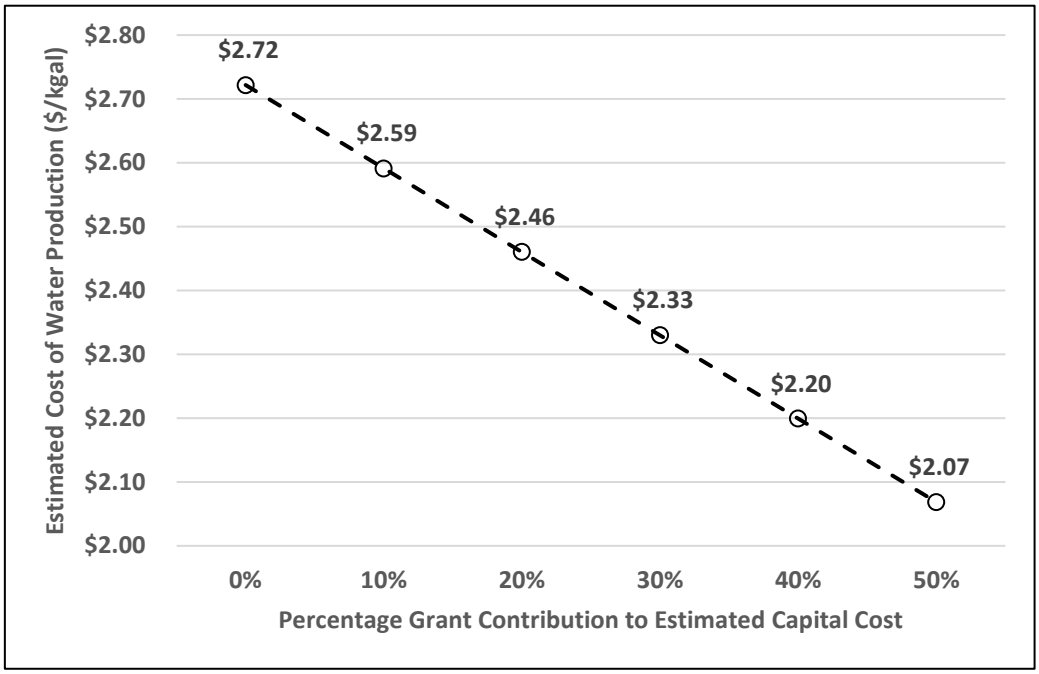

Figure II-2: Impact of Outside Funding Assistance on Estimated Cost of Water Production

It is reasonable to expect that the City could receive outside funding under various programs described as follows. As with any outside funding program, these are competitive programs subject to selection criteria and availability of funds.

SWFWMD's Cooperative Funding Initiative (CFI) program

This is a cooperative grant-funding program best described in a recent SWFWMD Governing Board Policy publication dated 8/27/2019. In brief, the policy encourages the development of AWS but gives extra weight to regional projects serving multiple jurisdictions. (SWFWMD is providing significant CFI funding to the PRWC.) However, individual AWS projects by PRWC Member Governments apparently can be considered for funding with the cost of water production being an important factor.

WIFIA (The Water Infrastructure Finance and Innovation Act)

WIFIA operates as a federal bank providing highly flexible, customizable term loans to municipalities for infrastructure projects with low, fixed interest rate of 1% to 2% with loan repayment terms of up to 35 years. Project costs for small communities (population of 25,000

or less) must be at least $5 million. The WIFIA loan can finance up to 49% of eligible project costs.

Florida Drinking Water State Revolving Fund (DWSRF)

The Florida DWSRF, administered by the Department of Environmental Protection (DEP) provides low interest loans to municipalities for planning, designing, and constructing public drinking water facilities. The DWSRF program also includes interest rate reductions and loan principal forgiveness for economically disadvantaged communities. The DEP web site currently indicates a basic DWSRF loan interest rate of 1.36% and a Florida Median Household Income (SMHI) of $55,600. The amount of principal forgiveness for eligible, disadvantaged systems serving 10,000 people or more is 20%.

These are the three main funding programs that could significantly reduce the capital project cost of a LFA water supply for Lake Wales.

Water Conservation

To be completed

Reclaimed Water

The City produces reclaimed wastewater at the Sam P. Robinson treatment facility. Reclaimed wastewater is used for vegetation irrigation (golf course, residential and other public access areas), agricultural and spray irrigation and for aquifer recharge using rapid infiltration basins (RIBs). As shown on Table II-4, amount of reclaimed water produced over the past 3 years used for aquifer recharge averaged 0.569 mgd amounting to about half (49%) of the total production.

Table II-4: Aquifer Recharge with Reclaimed Wastewater		
Year	**Total Reuse Flow Production (mgd)**	**Aquifer Recharge Portion (mgd)**
2018	1.102	0.636
2019	1.186	0.503
2020	1.209	0.567
Average	1.166	0.569

Using recycled water to recharge an aquifer falls under the definition of Indirect Potable Reuse (IPR). With IPR, the highly treated wastewater is discharged into a reservoir or aquifer and a residence time within the environmental transpires before the water is withdrawn for drinking water.

Referencing Table II-1, the wastewater discharged to the City's RIBs would infiltrate into the surficial aquifer. Depending on the extent that vertical, downward leakage occurs from the surficial aquifer into the Avon Park zone, at least a portion of this flow may be indirectly recharging the City's wells.

III. Discussion, Conclusions and Recommendations

With the recent surge in proposed residential development, the horizon for additional water supply need has apparently accelerated by at least 10 years. Although the City's installed water supply and treatment capacity is about 18.6 mgd, withdrawals are limited by the City's Water Use Permit (WUP). The current demand projection indicates that the WUP withdrawal limit of 3.9 mgd will be exceeded by 2032 – coincidentally the year the current WUP expires. The long-term (40-year) projection indicates a need for an additional 0.67 mgd by 2040 and 1.1 mgd by 2060 – assuming the current WUP permit limits are not reduced.

Current water policies of the State of Florida and the SWFWMD reflect the belief and understanding that the Upper Floridan Aquifer (which includes the City's current well supply) is oversubscribed and that no additional UFA withdrawals will be allowed. For planning purposes, future additional supplies will derive from AWS (Alternative Water Supply) sources. The most feasible AWS available to the City is groundwater from the Lower Floridan Aquifer (LFA). And the two potentially feasible LFA sources available to the City are either the independent development of a new LFA supply or participation in the PRWC regional supply project.

There is nothing currently written that would prohibit the City from developing its own LFA supply and treatment project. Unlike the UFA which requires little treatment, the LFA is expected to exhibit brackish quality requiring a relatively high degree of treatment with desalting using RO (reverse osmosis) membrane filtration and probably a more efficient method of degassing using active aeration with odor control rather than the passive aeration currently employed for the UFA water.

For these reasons, the cost of water produced from the LFA is estimated to increase from about $0.40/kgal (thousand gallons) for UFA well water to between $2.07 to $2.72/kgal for LFA well water depending on the amount of outside funding obtained for the project. While that is a significant increase, water revenue will likewise increase from the large, expected expansion of the water service population. It is our understanding that the SWFWMD would expect the LFA wells to meet the base demand supplemented by the UFA wells to meet the remaining demand.

While a detailed financial analysis is beyond the scope of this assessment, based on the current average residential water usage and water rate schedule for a City residential water service, additional revenue from new residential services is estimated to be $2.08 million in year 2040 and $2.44 million in 2060.

The steps for developing a new LFA water supply project would begin with an initial test well program to confirm the yield, water quality and level and type of required treatment. That would be followed by planning, permitting, and applying for funding assistance and then the typical process of designing, bidding, and constructing the facilities. The entire process could

take 5 to 10 years. For planning purposes, a test well program followed by project planning, permitting, and funding application could cost $1 million. The capital cost of designing, bidding, and constructing the facilities including the production well is estimated to be $9 million in current (2021) dollars. If the "test" well also becomes the production well, the well cost would transfer from the construction phase to the test well program.

The PRWC regionalization program is the LFA alternative for future City water supply. The PRWC will be a bulk water supplier to the participating municipalities. However, this program is very much a work-in-progress with many critical questions remaining unanswered including:

- How many municipalities will choose to participate and who will they be?
- How much will water cost the participating municipalities?
- How will future water rates be determined?
- How much water will each participant be allocated?
- Will the water received by the participants need additional treatment for water quality compatibility?
- What is the time frame for full program roll-out?

A regional water supply can offer the potential benefit of lower costs due to economies of scale and preferential treatment by outside funding agencies (e.g., SWFWMD) who often encourage regional approaches. However, at this point, there is insufficient information on which to base a decision whether or not to participate in the PRWC program.

The lack of relevant information is compounded by the loss of local control and the limited ability to influence PRWC decisions. With the Interlocal Agreement, Lake Wales, as a Member Government, has a seat on the Board of Directors but certainly could be outvoted by a majority of the other Directors.

Presently, there is no basis at this point for us to develop an estimate of the cost of water to the City from the PRWC project to compare with the estimated cost of water production of a City-developed LFA project. So, no recommendation can be provided relative to the PRWC alternative until the questions noted above can be answered.

Given the projected City water supply needs and a lead time for developing a LFA supply and treatment project of perhaps 5 to 10 years, our current recommendation is to proceed with a test well program over the next two years to better plan and conceptualize a City-supply approach. Perhaps by that time, enough information will become available from the PRWC to make an informed decision regarding which alternative will best serve the City over the foreseeable future.

APPENDIX A: PENDING RESIDENTIAL PROJECTS AS OF 3/21/2021

Source: City of Lake Wales, Development Services

- Bundy – 142 Single-Family (SF)
- K&M – 63 SF
- Belle Lago – 80 SF
- Buck Moore Development (Southern Homes, east side) – 46 SF
- Buck Moore Subdivision (west side) – 80 SF
- 80 Acres – 349 SF
- Leoma's Landing – 336 SF
- Robin's Run – 144 SF
- Robin's Walk – 33 SF
- Parc at Lake Wales – 480 Multi-Family (MF)
- Scenic Bluff Phase 2 – 55 SF
- Preserve at Oakwood – 7 SF
- Whispering Ridge Phase 2 – 129 SF

Total: 1,464 SF

480 MF

TOTAL: 1,944

- WH Corp
    - 2800 Single Family Detached
    - 550 Single Family Attached
        - 950 Townhomes
        - 1800 Multi-family

TOTAL - 6100 units

GRAND TOTAL = 8,044 units

APPENDIX B: SERVICE POPULATION AND WATER DEMAND 40-YEAR PROJECTION

	Residential Projection					Industrial/Commercial Projection						
	Known New DUs Pending as of 3/31/21	Additional Future DUs	Total Number of DUs	Service Population at 2.41 persons/DU	Residential Usage at 79.6 gpcd	New Ind/Comm Services	Ind/Comm Metered Connections	Ind/Comm Usage at 495 gpd/service	Municipal Usage at 65,000 gpd	Other Accounted-for Usage gpd	Subtotal gpd	Total With UAF at 10%
2020			9,371	22,584	1,797,695		722	357,390	65,000	75,000	2,295,085	2,550,095
2021	324	40	9,735	23,461	1,867,523	4	726	359,370	65,000	75,000	2,366,893	2,629,882
2022	629	80	10,444	25,170	2,003,535	4	730	361,350	65,000	75,000	2,504,885	2,783,206
2023	629	80	11,153	26,879	2,139,547	4	734	363,330	65,000	75,000	2,642,877	2,936,530
2024	629	80	11,862	28,587	2,275,559	4	738	365,310	65,000	75,000	2,780,869	3,089,854
2025	629	80	12,571	30,296	2,411,570	4	742	367,290	65,000	75,000	2,918,860	3,243,178
2026	629	80	13,280	32,005	2,547,582	4	746	369,270	65,000	75,000	3,056,852	3,396,502
2027	305	80	13,665	32,933	2,621,439	4	750	371,250	65,000	75,000	3,132,689	3,480,765
2028	305	80	14,050	33,861	2,695,296	4	754	373,230	65,000	75,000	3,208,526	3,565,029
2029	305	80	14,435	34,788	2,769,153	4	758	375,210	65,000	75,000	3,284,363	3,649,292
2030	305	80	14,820	35,716	2,843,010	4	762	377,190	65,000	75,000	3,360,200	3,733,555
2031	305	80	15,205	36,644	2,916,866	4	766	379,170	65,000	75,000	3,436,036	3,817,818
2032	305	80	15,590	37,572	2,990,723	4	770	381,150	65,000	75,000	3,511,873	3,902,081
2033	305	80	15,975	38,500	3,064,580	4	774	383,130	65,000	75,000	3,587,710	3,986,345
2034	305	80	16,360	39,428	3,138,437	4	778	385,110	65,000	75,000	3,663,547	4,070,608
2035	305	80	16,745	40,355	3,212,294	4	782	387,090	65,000	75,000	3,739,384	4,154,871
2036	305	80	17,130	41,283	3,286,151	4	786	389,070	65,000	75,000	3,815,221	4,239,134
2037	305	80	17,515	42,211	3,360,008	4	790	391,050	65,000	75,000	3,891,058	4,323,397
2038	305	80	17,900	43,139	3,433,864	4	794	393,030	65,000	75,000	3,966,894	4,407,660
2039	305	80	18,285	44,067	3,507,721	4	798	395,010	65,000	75,000	4,042,731	4,491,924
2040	305	80	18,670	44,995	3,581,578	4	802	396,990	65,000	75,000	4,118,568	4,576,187
2041		80	18,750	45,188	3,596,925	4	806	398,970	65,000	75,000	4,135,895	4,595,439
2042		80	18,830	45,380	3,612,272	4	810	400,950	65,000	75,000	4,153,222	4,614,691
2043		80	18,910	45,573	3,627,619	4	814	402,930	65,000	75,000	4,170,549	4,633,943
2044		80	18,990	45,766	3,642,966	4	818	404,910	65,000	75,000	4,187,876	4,653,195
2045		80	19,070	45,959	3,658,313	4	822	406,890	65,000	75,000	4,205,203	4,672,447
2046		80	19,150	46,152	3,673,659	4	826	408,870	65,000	75,000	4,222,529	4,691,699
2047		80	19,230	46,344	3,689,006	4	830	410,850	65,000	75,000	4,239,856	4,710,951
2048		80	19,310	46,537	3,704,353	4	834	412,830	65,000	75,000	4,257,183	4,730,204
2049		80	19,390	46,730	3,719,700	4	838	414,810	65,000	75,000	4,274,510	4,749,456
2050		80	19,470	46,923	3,735,047	4	842	416,790	65,000	75,000	4,291,837	4,768,708
2051		80	19,550	47,116	3,750,394	4	846	418,770	65,000	75,000	4,309,164	4,787,960
2052		80	19,630	47,308	3,765,741	4	850	420,750	65,000	75,000	4,326,491	4,807,212
2053		80	19,710	47,501	3,781,088	4	854	422,730	65,000	75,000	4,343,818	4,826,464
2054		80	19,790	47,694	3,796,434	4	858	424,710	65,000	75,000	4,361,144	4,845,716
2055		80	19,870	47,887	3,811,781	4	862	426,690	65,000	75,000	4,378,471	4,864,968
2056		80	19,950	48,080	3,827,128	4	866	428,670	65,000	75,000	4,395,798	4,884,220
2057		80	20,030	48,272	3,842,475	4	870	430,650	65,000	75,000	4,413,125	4,903,472
2058		80	20,110	48,465	3,857,822	4	874	432,630	65,000	75,000	4,430,452	4,922,724
2059		80	20,190	48,658	3,873,169	4	878	434,610	65,000	75,000	4,447,779	4,941,976
2060		80	20,270	48,851	3,888,516	4	882	436,590	65,000	75,000	4,465,106	4,961,229

APPENDIX C: COST ESTIMATE FOR A 1,100-gpm LFA CITY SUPPLY

This estimate is for a future, 1,100-gpm LFA well and treatment system as described in the report and presented in Tables C-1 and C-2. All costs are presented as current (2021) costs. No outside funding assistance is included (see report discussion and for further information). This analysis is based on continuous plant operation producing 800 gpm (1.15) mgd of drinking water and 300 gpm (0.432 mgd) of concentrate waste stream daily.

O&M Assumptions

1. 8-hour/day operator presence, 365 days/year at $24/hr salary
2. Well pump power: 1,100 gpm at 150' TDH, 72% efficiency, power cost = $0.12/kw-hr
3. RO system power: 300 psi operating pressure, power cost = $0.12/kw-hr
4. Concentrate pump system: 300 gpm at 30' TDH, 72% efficiency, power cost = $0.12/kw-hr
5. Membrane replacement cost (sinking fund) assuming 1/3 of initial RO installation cost is the membranes and 20-year membrane life

Debt Service Assumption

1. 20-year bond at 2.0% p.a. interest rate
2. Based on the capital cost estimate in Table C-2

Table C-1: Estimated Cost of Water Produced

Labor - Salaries	$	70,100	
Labor - Benefits (60%)	$	42,000	
Power	$	276,100	
Chemicals	$	60,000	
Contract Services - Laboratory	$	20,000	
Membrane Replacement Allowance	$	26,800	
Other Maintenance and Replacement	$	100,000	
Total Estimated O&M	$	595,000	
Debt Service	$	576,400	
Total Estimated Cost of Production	**$**	**1,171,400**	
Water Production at Continuous Operation		**420,480**	**kgal**
Estimated Cost of Production	**$**	**2.79**	**per kgal**

Table C-2: Capital Cost Estimate

Assumptions

1. Construct an 1,800-foot deep LFA well by extending an existing UFA well
2. Construct a 45' x 80' masonry treatment building (3,600 sf)
3. Provide 1,100-gpm treatment capacity producing 800-gpm of drinking water and 300-gpm of concentrate waste stream
4. Concentrate waste stream to WWTF
5. Improvements to a ground storage tank is included

Category	Description	Unit	Estimated Quantity	Unit Cost	Total
LFA Production Well	Well construction	L.S.	1	$ 2,000,000	$ 2,000,000
	Site Preparation	ACRE	1	$ 15,000	$ 15,000
	Dewatering Allowance	L.S.	1	$ 5,000	$ 5,000
Civil Site Work	Earthwork	L.S.	1	$ 35,000	$ 35,000
	Fence	L.F.	300	$ 60	$ 18,000
	Precast concrete storage tanks	EA.	3	$ 16,000	$ 48,000
	Bituminous Pavement	TON	60	$ 80	$ 4,800
	Yard Piping	L.S.	1	$ 25,000	$ 25,000
Concrete - Building	Slab, foundation walls, footings, etc.	L.S.	1	$ 78,000	$ 78,000
Concrete - Biofilter	Slab, walls, etc.	L.S.	1	$ 35,000	$ 35,000
Masonry	Interior, Exterior CMU Walls	L.S.	1	$ 80,000	$ 80,000
Miscellaneous metals	Grating, steel framing, etc.	L.S.	1	$ 40,000	$ 40,000
Carpentry	Misc Carpentry	L.S.	1	$ 12,000	$ 12,000
Waterproofing, Insulation	Wall, roof	L.S.	1	$ 40,000	$ 40,000
Flashing & Sheet Metal	Flashing, etc.	L.S.	1	$ 8,000	$ 8,000
Doors & Windows	Passage, double, OH Doors, roof hatch, windows	L.S.	1	$ 33,000	$ 33,000
Painting	Exterior, interior walls; piping	L.S.	1	$ 22,000	$ 22,000
Interior Finishes, etc.	Gypsum wallboard, ceilings, floor tile, furniture	L.S.	1	$ 15,000	$ 15,000
Plumbing	Plumbing	L.S.	1	$ 40,000	$ 40,000
HVAC	AHU, fans, ductwork, louvers, vents	L.S.	1	$ 35,000	$ 78,000
	Pumps				
	Submersible well pump	L.S.	1	$ 30,000	$ 30,000
	RO Feed Pumps - vertical turbine	EA.	2	$ 30,000	$ 60,000
	Concentrate pumps - vertical turbine	EA.	2	$ 30,000	$ 60,000
	RO Membrane Ffltration system	EA.	1	$ 1,200,000	$ 1,200,000
Equipment	Packed-tower degassification system	EA.	2	$ 250,000	$ 500,000
	Odor Control biofilter media, parts	EA.	1	$ 100,000	$ 100,000
	Cartridge filtration system	EA.	2	$ 60,000	$ 120,000
	Process piping	L.S.	1	$ 60,000	$ 60,000
	Chemical feed and storage system	L.S.	3	$ 20,000	$ 60,000
	Laboratory Equipment	L.S.	1	$ 10,000	$ 10,000
	Online analyzers	EA.	3	$ 3,400	$ 10,200
Electrical	Power Distribution, conduit, wire, generator	L.S.	1	$ 320,000	$ 320,000
Instrumentation & Control	Instruments, SCADA work station, software, teleme	L.S.	1	$ 100,000	$ 100,000
Ground storage tank	Modifications, improvements allowance	L.S.	1	$ 60,000	$ 60,000
SUBTOTAL					$ 5,322,000
General Conditions, O&P				14%	$ 745,000
Construction contingency				20%	$ 1,064,000
	TOTAL ESTIMATED CONSTRUCTION COST				$ 7,131,000
Engineering				26%	$ 1,854,000
	TOTAL ESTIMATED CAPITAL COST				$ 8,985,000