Report

Water Supply Data and Analysis Envision Alachua Sector Plan

Prepared for

Plum Creek

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Contents

SECTION 1

Introduction

1.1 Background

Plum Creek is currently planning, at the request of Alachua County, a 50-year, long term master plan (LTMP) for its holdings within the county. The company made a decision to enlist the community into the planning process so it could collectively help shape the future of the county on the lands owned by Plum Creek. In June of 2011, Plum Creek convened and launched Envision Alachua which is a community planning process to discuss future economic, environmental and community opportunities in Alachua County on lands owned by Plum Creek.

Plum Creek is the largest private landowner in Alachua County, with 65,000 acres. Nearly 24,000 of these acres are permanently conserved. The company's holdings are located throughout northern and eastern Alachua County. Plum Creek is considering future uses for its lands that could be aligned with community needs. Working with a 30-member Task Force and the general community, Phase I of the process yielded a community vision, goals and guiding principles to guide Plum Creek's decision-making as it explores potential opportunities for lands in East County inclusive of environmental uses and for uses other than timber.

During Phase II of the process, Plum Creek worked with a Technical Advisory Group, the Task Force and members of the community to determine how to achieve the community's vision and goals that support economic development opportunities, environmental conservation and activities that meet community needs as expressed during the Envision Alachua process.

During Phase II, Plum Creek determined to use the Sector Plan process for its land-use application. The Sector Plan is a comprehensive planning tool that:

- Ensures lands are designated for conservation and economic development
- Plans lands greater than 15,000 acres
- Exceeds the current planning horizon of 20 years

As part of the long term master plan process, infrastructure must be planned and resources must be identified, including the water supply resources needed to serve the future activities, wildlife and people on those lands. With any new development areas being considered, the water supply needs must not adversely impact the existing water resources, the surrounding environment, or the local and regional communities. This supporting data and analysis report for the Long Term Master Plan summarizes the evaluation of water supply for Plum Creek's future development areas in eastern Alachua County and the potential solutions for balancing the resources of those areas with the needs of the environment in all of Plum Creek's planned areas.

The first step in the evaluation was to identify potential water sources and quantify the range of specific water demands for the new planned areas. North Central Florida has multiple groundwater aquifers at different depths with varying degrees of water quality. The Upper Floridan aquifer is a high quality water source that has been used for many years for potable water by public utilities and for agricultural uses by small and large farming operations in the area. Another potential source is the deeper Lower Floridan aquifer which is commonly used in other parts of the state. Other alternative water sources, including reuse and stormwater, were also identified for use within the development for non-potable water demands. Water demands for the development areas were estimated ranging from a maximum typically associated with traditional quantities of water used by similar types of development to a low end using aggressive conservation techniques. Plum Creek's goal for the entire planned areas is to be a model of water stewardship and will include not only conservation methods for industries, agriculture, and residents, but also a fundamental water ethic that fosters wise water use. Identifying the optimum combination of water resources coupled with conservation methods was determined to be the best way to balance water resources in the region and reduce impact to the environment.

Therefore, a preliminary water resource development plan was created to identify the best approach to water supply based on these principles. Ranges of water demand for the Plum Creek development were determined for a 50-year period based on preliminary development planned program. A combination of water sources, treatment, reuse, and conservation methods were selected to balance regional water resources as the water demands change during the maturity of development areas and the environmental uses over the 50-year period. Reasonable solutions for water supply were determined for future development and environmental activities.

SECTION 2

Water Principles

As a guide toward implementation, Plum Creek adopted the communities' water principles to align the water supply plan with the overall vision of the planned areas in eastern Alachua County. The main goal of water-use planning is to address long-term needs for water supply, water quality, and water conservation for future planned areas in Alachua County. To achieve this, an integrated water resource plan was created that would balance water supply, wastewater reclamation and reuse, stormwater, and natural systems to meet the water goal for the planned areas. The five planning principles listed below were identified by the community and serve as the water goal for Plum Creek's planned areas:

- Identify, protect and utilize groundwater recharge areas.
- Develop communities that optimize water conservation and achieve a reduction in water usage.
- Apply Florida-friendly guidelines for landscaping.
- Demonstrate leadership in resource management by promoting and adopting innovative ways to meet water needs.
- Capture, treat, and reuse stormwater to the maximum extent feasible – water will be used more than one time.

While building the water supply plan for the planned areas, Plum Creek will apply these water principles. Plum Creek has identified over 45,000 acres of its lands for conservation in Alachua County that will provide permanent protection to surface water and groundwater resource areas. Once the long term master plan is approved by the County Commission, the lands designated for conservation will immediately lose all development rights. These resource lands will not be developed thereby conserving natural surface water systems and groundwater aquifers. Plum Creek is also committed to water conservation within the planned development areas. Water conservation will be incorporated into the design and construction of all buildings and facilities, into the type of landscaping allowed, the selection of industries and agricultural uses and, potentially, into the community covenants and restrictions and Zoning Master Plans. Plum Creek will use additional wetlands for the storage of reclaimed water and stormwater within the planned areas. These wetlands will not only provide storage to better optimize the use of reclaimed water and stormwater, but can also provide a benefit to the community and surrounding wildlife.

Plum Creek will demonstrate leadership in water resource management by identifying and utilizing a combination of traditional and alternative water resources to provide the optimum balance and provide flexibility for the future. Plum Creek recognizes that over a 50-year planning period the resources, communities and treatment technologies will continue to improve becoming more effective and efficient. The water supply plan and the initial implementation for supply, treatment, storage and reuse must be flexible to adapt to the future.

In addition, Plum Creek will coordinate with surrounding entities including, experts at the University of Florida, St. Johns River Water Management District, Gainesville Regional Utility, the City of Hawthorne, and other local governments, to determine the best and most sustainable solutions for water needs in Alachua County. Education and outreach to people will be a priority to teach the public about water conservation methods for businesses, people and communities. The water goal will be accomplished by carrying out innovative solutions for water supply, groundwater recharge, water quality, and conservation at individual and regional levels.

SECTION 3

Forecasted Water Supply Needs

3.1 Description of Community

Land use within the planned areas is divided into four categories including conservation, employment orientated mixed use (EOMU), agriculture, and rural. Conservation lands will make up the majority of Plum Creek's planned areas, will preclude development of any kind, managed by silviculture and limited agriculture and used to house mitigation, environmental services and benefits. EOMU land use includes economic development via research and development, offices, and advanced manufacturing. EOMU areas will also include residential units, retail space, schools and civic uses, recreation and open spaces. Agriculture land use provides area for related research facilities and environmental services in addition to silviculture and other agricultural activities. Rural land use includes, rural residential, some limited services supporting the rural areas, green space and recreation areas.

EOMU, agricultural and rural areas create demands for potable water, irrigation, and industrial process water. There is a wide range of types of urban and agricultural land use, and water demands can vary greatly depending on the specific type of urban development or agricultural activity.

3.2 Characteristics and Principles Related to Water Demands

3.2.1 Irrigation

Landscaping is an asset to the built environments and communities as a whole. Landscaping can help clean and cool the air, reduce stormwater runoff as well as glare and noise, and beautify communities. However, maintaining healthy conventional residential and urban landscapes requires irrigation which significantly contributes to the overall water demand of a community.

Outdoor water use is subject to the built environment style, the size of the landscaped areas and the type of vegetation planted. Florida-friendly landscaping involves planting vegetation that is native to the area or are amenable to water conversation. Applying Xeriscape practices means implementing specific principles. It is the use of appropriate native and adapted plants, use of mulch, water use zones, and other water conservation practices. These landscaping choices and techniques not only will reduce or eliminate the need for irrigation, but also reduces the need to fertilize the landscapes.

In addition to Florida-friendly, native, and smart-choice landscaping being principle components in the water plan, effective conservation irrigation practices can also reduce water demand and irrigation costs. Various soil moisture-based irrigation systems can be implemented to maximize water use efficiency. Smart controllers and soil moisture sensors can be utilized to prevent the system from running while raining, after a recent rain, or if the moisture content in the soil is sufficient without irrigation. Water efficient irrigation techniques can also reduce nutrient runoff which can occur when too much water is applied.

3.2.2 Industrial and Commercial

Industrial water use can vary greatly depending on the type of industry. For example, the chemical production industry can require 10 to almost 400 times more water compared to some food and beverage industries. Industrial water use can be divided into four categories: process water, cooling or heating water, domestic use and irrigation. Maximizing process water use efficiency can have a significant impact on the overall water demand of a wet-process-type industry. Process water often can be reclaimed and reused within an industrial facility. However, best management practices tend to be industry or even facility specific. Restrictions can also be developed to require high water-use industries within the EOMU to implement water recycling technologies.

Cooling towers, boilers and steam systems for cooling and heating are other industrial components that typically consume larger quantities of water. These systems are common in many types of industry regardless of the production process. The water used in these cooling and heating systems can be recycled until the concentration of dissolved solids is high enough to cause scale or corrosion issues. Then the recycled water must be discharged, which is referred to as blowdown, and more water is added to the system. Monitoring and controlling recycle and blowdown are ways to significantly conserve water. Supplying reuse water for cooling towers is another conservation approach.

Additionally, some industries require little to no process water and mainly require domestic type water use and would have demands similar in volume to residential units. The ratio of employees to water use is an important factor when considering types of industry to welcome into the community. Additionally guidelines encouraging low water use can be implemented to attract more low water demand type industries to the community.

A mix of various commercial and institutional water users can be expected in this community. The majority of these users except restaurants and other food industry related users have water demands similar to indoor residential demands. Thus, similar conservation techniques including low-flow fixtures and water efficient appliances in restaurants and cafeterias will be implemented to reduce water demand.

3.2.3 Agricultural

Major crops in Florida include citrus, tomatoes, peppers, watermelons, blueberries, pecans, strawberries and potatoes. Timber is also an important agricultural commodity in parts of Florida. The amount of water a crop needs is affected by climate factors including temperature, humidity, wind-speed and sunshine. The influence of the climate on crop water demand is given by the reference crop evapotranspiration, or K value. For North Florida, turfgrass has a K value between 0.49-0.92; small vegetables have a K value between 0.33-0.83; potatoes have a K value between 0.36-1.37. K values vary by month for any particular location, where larger K values indicate increased water demand. These values are used to compute irrigation needs along with local precipitation levels and soil type.

As mentioned above, irrigation systems and their efficiency can have a large impact on water use efficiency. Microirrigation is the slow, frequent application of water to small areas close to individual plants. Microirrigation is a general term that includes drip irrigation, subsurface drip irrigation and microspray irrigation. These irrigation systems typically emit low flow rates and target water delivery to the plant root zone, maximizing water use efficiency. Requiring the use of efficient irrigation systems and low water use crops can reduce the agricultural water demand of the community. Some crops may be irrigated with reuse water and others may not per FDEP rules regarding reuse applications. Using reclaimed water for crop irrigation where appropriate, is another means of reducing water demand.

3.2.4 Residential

Water use, particularly indoor use, in single-family residences has been declining in recent years. The Florida Department of Environmental Protection Regional Water Supply Planning 2011 Annual Report showed a decline in domestic residential per capita water use from 106 gallons per capita per day (gpcd) to 87 gpcd from 2000 to 2010. An emphasis on water conservation, water use restrictions, increased use of reclaimed water, graduated rates, and Florida-friendly landscaping techniques have all contributed to the decrease in per capita water use in the state. Replacing older fixtures and appliances with high-efficiency fixtures and appliances that are more prevalent in the marketplace, will result in a continued decline of indoor water use. Additionally, plumbing codes are evolving to restrict the use of less efficient, high water use fixtures in new homes and businesses.

Outdoor water use and using potable water for irrigation are areas that will be targeted to reduce water demands. Florida-friendly landscaping, xeriscape practices and a restriction on types of ground cover (sod) will reduce the need for residential irrigation. Water use restrictions and smart water metering can be implemented to help minimize outdoor water use. Rainwater harvesting can be implemented to provide an independent, natural source for residential irrigation. Additionally, communal gardens or common green spaces can be provided within commercial districts, activity centers, and residential neighborhoods to provide a localized area where water use for irrigation can be monitored and controlled.

3.3 Forecast Fifty-Year Water Demand

Projected water demand estimates were developed for low, average and high water use as shown in Exhibit 3-1. The total projected water demand is for the fifty year plan, based on projected land use and corresponding ranges of water use. The high water demand estimate reflects water usage that is typical of existing communities that do not strictly implement water conversation principles. Low residential water use assumes no potable water will be used for irrigation and other conservation techniques will be implemented. Advanced manufacturing water use values are based on typical usage for no or little wet-process-type industries. Recreation and open space irrigation is not included in the total estimated water demand, as reclaimed water will be used for this type of irrigation. Additional assumptions are detailed in the footnotes of Exhibit 3-1.

Exhibit 3-2 shows the estimated fifty year wastewater flows and required capacity for wastewater treatment. Wastewater flows were determined by assuming 90% of the water demand will reach the wastewater treatment system. For high flow, the residential wastewater flow was determined using 75% of water demand. High residential flow assumed a lower percentage than the low and average because irrigation was assumed to be a larger portion of the high water demands therefore irrigation water was not included in the wastewater flow projections.

Estimated irrigation demands for the planned areas are shown in Exhibit 3-3. Assumptions used to estimate the average range of irrigation needs for agricultural, community and residential land uses are also shown in Exhibit 3-3. There is a significant difference between the average wastewater flow which correlates to available reclaimed water and the average irrigation demand. Thus, supplemental water for irrigation or restrictions on the use of reclaimed water for irrigation may be required. Also, certain crops cannot be irrigated with reclaimed water requiring the use of alternatives sources.

EXHIBIT 3-1
Projected Potable Water Demand

		Water Use, gal/unit-d				Total Usage, mgd		
Land Use	**Unit**	**Low**	**Medium**	**High**	**Number of Units**	**Low**	**Medium**	**High**
Advanced Manufacturing[e]	Acres	1,208	1,848	3,636	918[f]	1.1	1.7	3.3
R&D, Office Facilities[g]	Square feet	0.02	0.04	0.05	6,000,000[f]	0.14	0.26	0.32
Retail[h]	Square feet	0.018	0.02	0.03	1,000,000[f]	0.018	0.022	0.033
Residential[a]	Capita	40	78	130	31,500[a]	1.26	2.45	4.1
Schools[b]								
Elementary[c]	Student	10	15	20	1,670	0.017	0.025	0.033
Middle[d]	Student	10	20	30	840	0.008	0.017	0.025
High[d]	Student	10	20	30	1,176	0.012	0.024	0.035
Total Water Demand						**2.56**	**4.50**	**7.88**

[a] Assumes 3 people per household. Low and high water use is from *Wastewater Engineering – Treatment, Disposal, and Reuse* (Metcalf & Eddy, Inc., Third Edition, 1991). Average water use is based on an average wastewater flow of 70 gpcd and 90% capture of water flows.
[b] Number of students assumes all 10,500 housing units are single family. Alachua County student generation calculation form (School Board of Alachua County 2009 – 2010 Five year District Facilities Plan) used to estimate the number of students.
[c] Assumes school with cafeteria *Wastewater Engineering – Treatment, Disposal, and Reuse* (Metcalf & Eddy, Inc., Third Edition, 1991).
[d] Assumes school with cafeteria, gym and showers *Wastewater Engineering – Treatment, Disposal, and Reuse* (Metcalf & Eddy, Inc., Third Edition, 1991).
[e] The following industry and domestic flows are assumed for low, average and high water use, respectively: 1,000 gal/ac-d and 8 gpcd, 1,500 gal/ac-d and 15 gpcd, 3,000 gal/ac-d and 25 gpcd *Wastewater Engineering – Treatment, Disposal, and Reuse* (Metcalf & Eddy, Inc., Fourth Edition, 2003). All water use estimates assume 10,000 employees and wastewater flow accounts for 90% of water flows.
[f] Information provided by Plum Creek. Advanced manufacturing acres based on 8 million sq ft and a20% floor-area-ratio.
[g] The following is assumed for low, average and high water use, respectively: 7 gpcd, 13 gpcd, 16 gpcd *Wastewater Engineering – Treatment, Disposal, and Reuse* (Metcalf & Eddy, Inc., Third Edition, 1991). All water use estimates assume 18,000 employees.
[h] The following is assumed for low, average and high water use, respectively: 8 gpcd, 10 gpcd, 15 gpcd *Wastewater Engineering – Treatment, Disposal, and Reuse* (Metcalf & Eddy, Inc., Third Edition, 1991). All water use estimates assume 2,000 employees.

EXHIBIT 3-2
Projected Wastewater Flows

		Flow, gal/unit-d			Number of Units	Total Wastewater Flow, mgd		
Land Use	**Unit**	**Low**	**Medium**	**High**		**Low**	**Medium**	**High**
Advanced Manufacturing	Acres	1,087	1,663	3,272	918	1.00	1.53	3.00
R&D, Office Facilities	Sq ft	0.021	0.039	0.048	6,000,000	0.13	0.23	0.29
Retail	Sq ft	0.016	0.02	0.03	1,000,000	0.02	0.02	0.03
Residential	Capita	36 [a]	70 [a]	98 [b]	31,500	1.13	2.21	3.09
Schools								
Elementary	Students	9	13.5	18	1,670	0.02	0.02	0.03
Middle	Students	9	18	27	840	0.01	0.02	0.02
High	Students	9	18	27	1,176	0.01	0.02	0.03
Total Wastewater Flow						**2.31**	**4.04**	**6.49**

[a] Low and average residential wastewater flow was determined using 90% of water demand.
[b] High residential wastewater flow was determined using 75% of water demand.

EXHIBIT 3-3
Estimated Irrigation Demands

Reuse Type	Acres	Annual Average Demand (mgd) [a]	Assumptions
Agriculture	840	3.1 – 4.8	Dependent on crop planted (range based on small crops and potatoes), sprinkler system, 3 month planting period
Residential	1050	3.6	Turfgrass, sprinkler system, 30% of residential land is irrigable[b]
Parks, Common Areas	350	1.2	Turfgrass, sprinkler system, 10% of residential land is irrigable
Total Irrigation Demand		**7.9 – 9.6**	

[a] Irrigation demands determined by modified Blaney-Criddle method
[b] Overall residential area based on 10,500 units and gross density of 3 units per acre

SECTION 4

Potential Water Supply Sources

4.1 Wastewater Reuse

The reuse of wastewater for beneficial purposes is a priority in the state of Florida and has been for many years. The focus and commitment on reusing wastewater by the Florida Department of Environmental Protection (FDEP) and the hundreds of wastewater utilities producing reclaimed water have made Florida a national leader in this respect. The Florida Administrative Code (F.A.C.) outlined multiple means for beneficial reuse of wastewater including industrial, restricted use agricultural, rapid infiltration, and irrigation of public access use areas. Reuse of reclaimed water for public access reuse requires high level disinfection, which then allows reclaimed water to be used for irrigating private residences, parks, and other public spaces such as schools. The production and distribution of public-access-reuse, quality-reclaimed water is the most common type of reuse within the state of Florida, due to irrigation demands and the standard of water needed to meet this demand.

Based on the reasons above and the water demands listed in the previous section, all wastewater treated within the Plum Creek planned EOMU areas will be treated to a minimum of public-access-reuse standards, be it new onsite facilities or by nearby existing utilities (for example, City of Hawthorne). This will allow the reclaimed water to be used for a variety of needs including industry, rapid infiltration, certain agricultural uses, and irrigation of public areas when needed. The storage and distribution system will be developed to maximize the amount of reclaimed water available to potential users during low and peak demand periods. Storage of excess reclaimed water during wet weather will take place in part in constructed wetlands within communities. These wetlands will be sited and constructed as passive recreational parks to provide additional benefits to the public and wildlife. In addition these wetlands will help optimize reclaimed water storage, reuse, and natural treatment recharge through the use of passive infiltration basins planted with wetland plants. During extended wet weather periods Plum Creek will use existing natural wetlands or recharge areas onsite. This further extends the ability to reuse and benefit the area water supply system.

Additional sources of reclaimed water were investigated; however the largest producer of reclaimed water within the area, Gainesville Regional Utilities, currently reuses 100% of its plant effluent as reclaimed water from its closest treatment facility. Coordinating wastewater treatment and the reuse of reclaimed water with the City of Hawthorne—particularly within planned EOMU areas in that vicinity—could be mutually beneficial and increase the capacity of overall reuse system. (This coordinated partnership also meets the community's vision to benefit existing areas and municipalities, as the 50-year plan articulates.)

The beneficial reuse of reclaimed water will give the EOMU areas greater flexibility by allowing for additional industrial or agricultural opportunities or may be used to assist common spaces, parks and athletic fields.

4.2 Stormwater

Stormwater management is an important component of any new development, regardless of its size. Within the Plum Creek planned areas, stormwater management will consist of collection, conveyance, treatment and storage facilities. At a minimum, these facilities will be designed to protect existing waters from degradation and ensure protection the planned areas. In addition, as part of the stormwater management plan Plum Creek will look for opportunities to store and reuse stormwater. This may be in conjunction with reclaimed water or by using separate storage and distribution systems. The nature of stormwater, as it comes in sporadic events and often in high volumes, makes it more difficult to store and reuse. Furthermore, irrigation water demand is lower during times when stormwater is plentiful. Therefore, the opportunities to store and reuse stormwater may be at a local or community scale as opposed to the entire planned area; these would include the use of cisterns and other water harvesting methods by individual commercial parcels and commercial districts and by residential parcels and districts.

4.3 Surficial Aquifer

The surficial aquifer system in Florida includes any otherwise undefined aquifers that are present just below the land surface. This aquifer system is generally unconfined, consisting of sand deposits, and is typically less than 50 feet thick. The groundwater in this aquifer recharges from rainfall and typically flows toward the coast or streams where it can discharge as baseflow. There is also potential for water from the surficial aquifer to recharge deeper aquifers.

Because the surficial aquifer is recharged by rainfall, the long-term capacity and reliability of this system is unknown. Additionally, lower quality water can be expected due to the supply being under the influence of surface water.

4.4 Intermediate Aquifer

The intermediate aquifer system in Florida lies between the surficial and Floridan aquifer systems. The intermediate aquifer is generally a semi-confined to confined system and typically consists of limestone and dolostone deposits. In most places, water percolates down from the surficial aquifer system to recharge the intermediate aquifer.

The long-term ability to use the intermediate aquifer as a main water supply is questionable. However, the water quality is generally good due to natural filtration as water percolates down from the surficial aquifer through typically low permeability semi-confining units.

4.5 Upper Floridan Aquifer

The Floridan aquifer is found throughout Florida, extending into the southern portions of Alabama, Georgia and South Carolina. The Floridan aquifer is a highly productive system. The Floridan aquifer system has been divided into Upper and Lower aquifers which are separated by a unit of lower permeability. The Upper Floridan is a major water supply source in north and central Florida.

The Upper Floridan aquifer typically produces good quality water, but high demand can impact flows and levels in nearby surface waters. There is also potential to impact the quality of water in the Upper Floridan aquifer from excessive pumping, which can cause surface water influence from nearby recharge areas, migration of potentially poorer water quality from deeper zones in the Floridan aquifer, or salt-water intrusion close to coastal areas.

4.6 Lower Floridan Aquifer

The Lower Floridan aquifer lies below the Upper Floridan and a semi-permeable unit. The quality of water from the Lower Floridan aquifer in this area is not well established because test and production wells in this aquifer are not common. Withdrawing from the Lower Floridan aquifer can potentially produce lower quality water due to upwelling of deeper, lower quality water. However, withdrawing from the Lower Floridan would likely have less impact to other users and surface water flows and levels compared to the Upper Floridan aquifer.

SECTION 5

Alternative Water Solutions

5.1 Alternatives

Identifying and implementing alternative water supply projects is an important component of the St. Johns River Water Management District (SJRWMD) Regional Water Supply Plan to help meet future water demands. Groundwater, primarily water from the Upper Floridan aquifer, is the main source of water supply in the SJRWMD. However, over pumping groundwater can have adverse environmental impacts both on a local and regional scale, including degrading groundwater quality and impacting surface water flows and levels. Thus, the SJRWMD encourages utilities and local governments to incorporate alternative water supplies into their current practices.

There are a variety of alternative water supplies in addition to the Lower Florida aquifer, reuse or reclaimed water, and stormwater discussed previously, including surface water, lower quality groundwater, and sea water. However, feasibility of these alternatives can vary depending upon location, cost and public perception.

5.1.1 Indirect and Direct Potable Reuse

Indirect potable reuse is a water solution that requires wastewater to be highly treated and discharged directly into surface or groundwater sources that are used for water supply. This approach requires an environmental buffer (for example, a water body or aquifer) between the treated wastewater effluent and the drinking water withdrawal. Direct potable reuse is a water solution that requires highly treated wastewater to be blended with the municipal water supply system. Potable reuse eliminates the need for an additional pipeline to be constructed for conveying recycled water. Indirect and direct potable reuse are alternatives that meet the need for additional water supply when other resources are not readily available. However, indirect and direct potable reuse can have strong public opposition and must meet the most stringent treatment and monitoring to protect against adverse health effects.

5.1.2 Surface Water

Reservoirs or naturally occurring surface water bodies can be used to provide storage of stormwater and augment reclaimed water and potable water supplies. Surface water typically requires more extensive treatment processes compared to groundwater which can add complexity to an existing treatment system utilizing groundwater as a source. Moreover for a surface water to be a reliable source, it should be located nearby to minimize conveyance costs. A reservoir can be created to store surface water, but rainfall and stormwater drainage into the reservoir needs to be consistent to generate a reliable source. Withdrawing surface water needs to be planned and monitored closely so that flows and levels of downstream surface waters are not negatively impacted.

5.1.3 Seawater/Brackish Groundwater

Seawater and brackish groundwater are potential alternative water supplies, but they not readily available in this area. Both of these sources require advanced treatment by desalination or reverse osmosis to remove elevated concentrations of minerals and salts. Desalination and other membrane processes can be more costly due to energy requirements and disposal of residuals (i.e., membrane concentrate) can be difficult particularly in inland areas. Typically, desalination plants are co-located with electric generating facilities due to the energy needs for the desalination process. Deep injection wells are commonly used for concentrate disposal, however not all locations are amenable to this disposal method. Evaporation to dry salt, and discharge to wastewater treatment plants, the ocean or other surface waters are other common disposal methods. However, the high concentration of salts in desalination and reverse osmosis concentrates can limit the methods of discharge and therefore the feasibility of these water sources.

5.2 Reasonable Solutions

The alternative water supplies discussed above are not feasible in all regions of Florida. In this region of Florida, the Lower Floridan aquifer is an alternative and reasonable water supply. A higher level of treatment may be required compared to the Upper Floridan aquifer, but more water quality data is needed to better define treatment requirements. If a membrane treatment process is needed to treat water from the Lower Floridan, deep injection of residual concentrate may not be a feasible option in this area. Thus, developing an integrated solution that beneficially uses the residual concentrate through blending with reclaimed water or wetlands treatment is essential.

SECTION 6

Summary and Conclusions

Plum Creek's 50-year long term master plan in eastern Alachua County will consist of multiple land uses including conservation, agriculture, employment oriented mixed use and rural. A thoughtful, sustainable, and balanced water supply plan is critical in order for the planned areas to succeed in bringing economic opportunities, protecting the environment while bringing benefits to the area without negatively impacting the existing resources. Therefore, Plum Creek developed a set of water principles that include: focusing on aggressive conservation measures, education, outreach and cooperation with the community and creating an integrated plan between all water supplies and resources with the flexibility to adapt to the growing needs and new technologies as they become available.

Creating a water supply plan that incorporated these integrated water resource principles began by determining a range of potential water demands for these land areas. The high end water demand was based on historical data from typical communities, while the low end water demand assumed a thorough water conservation plan. As identified in its water principles, Plum Creek recognizes that any water supply plan must include water conservation in all aspects of the built environment including land uses, infrastructure, construction techniques and technologies, as well as the types of industries and agricultural activities that ultimately become a reality within the timeframe of the plan.

Along with conservation, Plum Creek identified a variety of traditional and alternative water supply resources to evaluate for use within the planned areas. Some alternative water supplies, such as traditional indirect potable reuse or the use of highly brackish water, are utilized in other parts of the country where water alternative water supply options are very limited. However, some alternative water supplies such as the Lower Floridan aquifer, and reclaimed water from wastewater treatment and stormwater were identified as appropriate solutions for this 50-year plan and will be included to complete the water balance in the water supply plan moving forward.