TECHNICAL MEMORANDUM

To: Plum Creek Timber Co.
From: Water and Air Research, Inc. and CH2M.
Date: June 17, 2015
Subject: Envision Alachua Sector Plan – Water and Wastewater Data and Analysis

1.0 Introduction

This technical memorandum includes the data and analysis related to planning the water and wastewater facilities for the proposed Envision Alachua Sector Plan (EASP) by Plum Creek in Alachua County. The purpose is to provide the appropriate level of technical information to assist the County in review of the application. The conceptual level of detail presented here is consistent and appropriate for the sector plan process. An outline of information included in this technical memorandum is presented below:

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1.1 Proposed Sector Plan

Envision Alachua is a community planning process that began in 2011 to discuss future economic, environmental and community opportunities in Alachua on lands owned by Plum Creek. Plum Creek lands and the EASP planning area are shown in exhibits 1-1 and 1-2. Envision Alachua is an open dialogue with community leaders representing economic development, business, local government, education, environmental, conservation and residents in Alachua County.

Exhibit 1-1
Proposed Map of the Future Land Use - June 2015
EASP - Water and Wastewater Data and Analysis

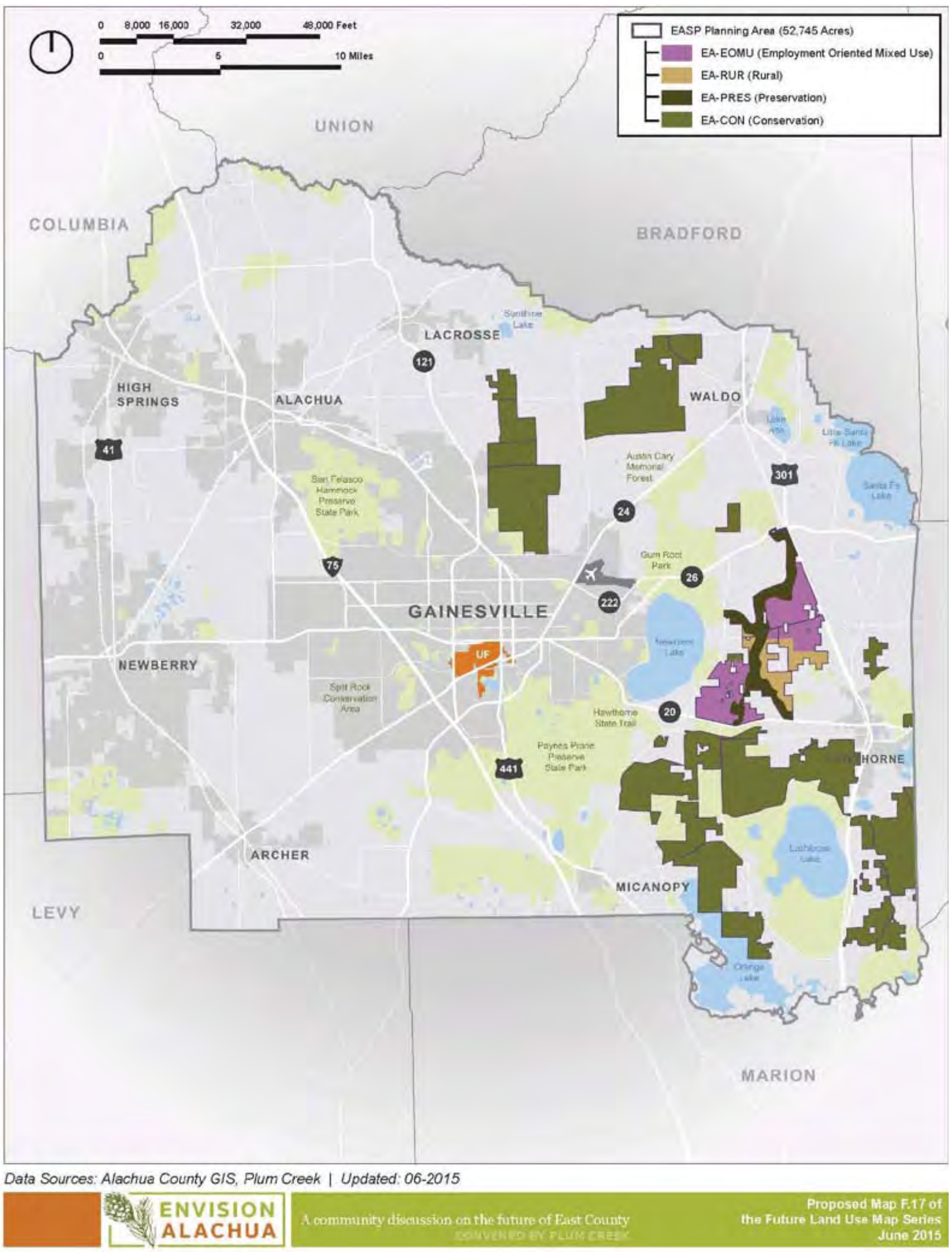
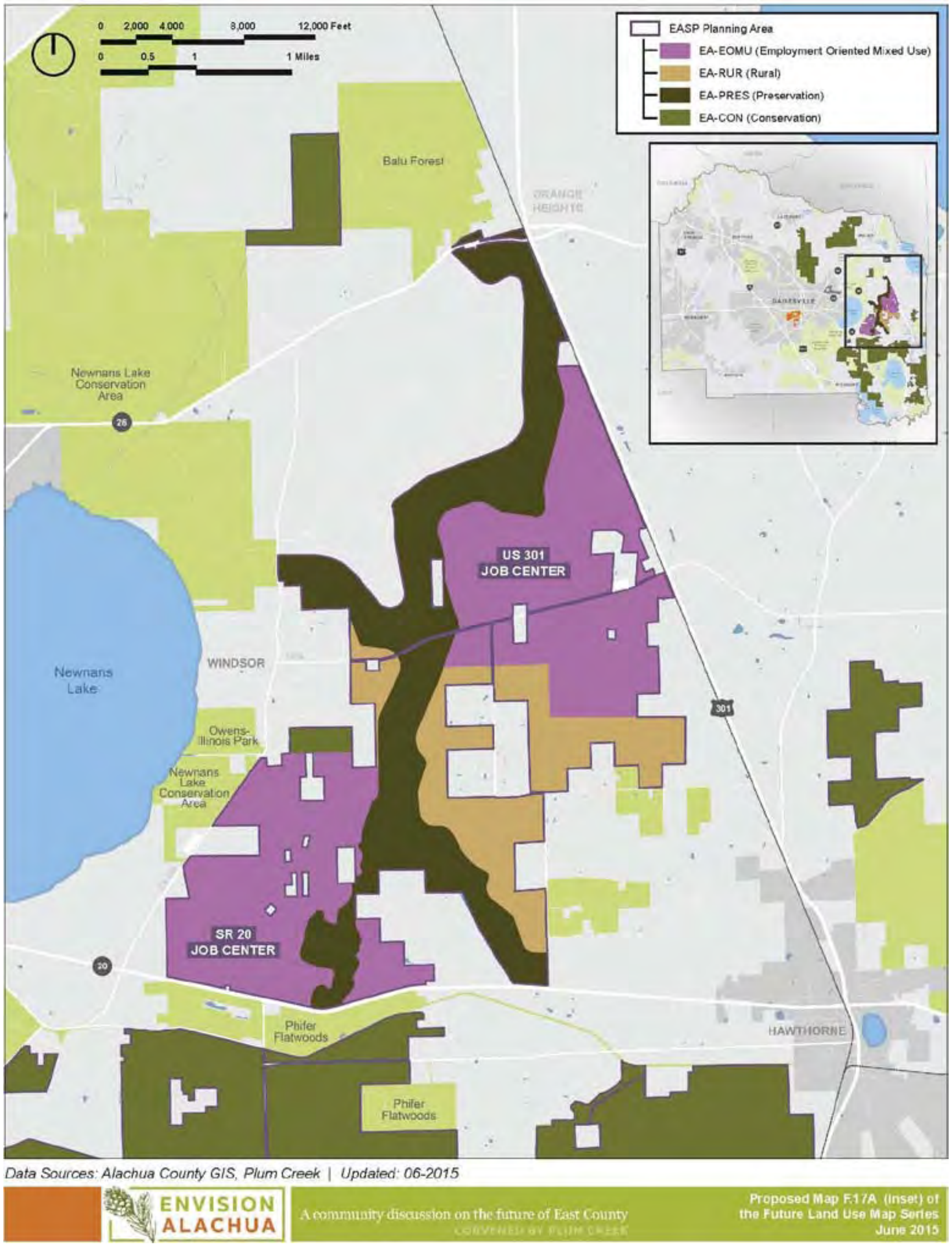


Exhibit 1-2
Proposed Map of the Future Land Use (Inset) - June 2015
EASP - Water and Wastewater Data and Analysis



To ensure broad community involvement, information sharing and opportunities for in-depth conversation, the Envision Alachua process has included a variety of community participation and informational activities. These include guided tours of Plum Creek lands, community workshops, educational forums, case examples, a project website and a Task Force composed of 30 community members. The Envision Alachua Task Force was established to provide input into the visioning process for developing a master plan for Plum creek lands in Alachua County. The Task Force includes community leaders from the economic development, business, local government, education, faith-based, environmental and conservation communities throughout Alachua County. Members have met approximately every quarter since June of 2011 to hear technical presentations that provide background on current and future economic, environmental and community conditions in Alachua County. These presentations provide a baseline for discussion and guidance from the Task Force. The Task Force guiding principles and priorities are: 1) education and community, 2) economic opportunity, and 3) environmental conservation.

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 the 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 eastern Alachua County inclusive of environmental uses and for uses other than timber.

During Phase II of the process, Plum Creek also 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. Also during the Phase II process, 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

1.2 Integrated Water Resources Strategy

Envision Alachua recognizes that it is critical to address the long-term water quality and supply needs for these lands. To accomplish this, Plum Creek is developing a new water ethic standard based on the following principles:

- Conservation First
- Right Water for the Right Use
- Efficiency of Use
- Source Protection and Restoration
- Performance Monitoring over 50 Years

Plum Creek's policy stating that no potable water will be used for residential landscaping (except for home gardens and a limited period when the landscaping is being established) is ground-breaking and is an example of the type of leadership Plum Creek is providing on water management issues. The following are some key policies that will promote long-term sustainability in both the quality and supply of water for these lands.

- The use of large water storage facilities for water harvesting and capture shall be encouraged.
- All Agriculture and Silviculture (forestry) activities shall follow the most recent applicable best management practices.
- Priority use of reclaimed water shall be given to environmental restoration projects and industrial users.
- State-of-the-art system components (e.g., water recycling) shall be incorporated where appropriate and feasible.
- The use of Florida-Friendly plant species shall be required for landscaping, with a preference for native species.

To guide and evaluate the effectiveness of the water management strategy, and also to provide comments on the approach, conservation techniques and potential alternative sources of water, Plum Creek convened a group of professionals with water expertise. The Envision Alachua Water Management Technical Advisory Panel, the majority of members represented by University of Florida professors, was asked the following questions:

- Are the assumptions in the water strategy reasonable?
- Are the results and recommendations in the plan reasonable?
- Do the proposed solutions appropriately address the key issues?
- Are there solutions which have not yet been considered?
- Is there additional data, analysis or research needed?

The group met in mid-March 2014 and discussed these basic questions. Their comments and suggestions provided guidance to Plum Creek in refining and improving the water strategy. The Envision Alachua Water Management Technical Advisory Panel's summary report is included in Appendix I. The Envision Alachua *Approach to Water Supply Solutions* presentation that was shown at the meeting is also included in Appendix I.

The result of both the water technical advisory panel and the water team formed the basis for a new water ethic that shaped the policies of the EASP.

1.3 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 sustainable 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 goals for Plum Creek's planned areas. These principles are reflected in the policies stated above.

- 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 developing the water supply plan, these water principles were applied. Plum Creek recognizes that over the planning period the resources, communities and treatment technologies will continue to improve. The water supply plan and the initial implementation for supply, treatment, storage and reuse must be flexible to adapt to the future. The approach and technologies applied must remain flexible, but these principles remain constant.

Plum Creek will continue to seek input from experts at the St. Johns River Water Management District (SJRWMD), Suwannee River Water Management District (SRWMD), Gainesville Regional Utility, and the Water Institute and Program for Resource Efficient Communities at the University of Florida, to evaluate the best and most sustainable solutions for water needs in eastern Alachua County. Education and outreach to the surrounding communities will be a priority to teach the public about water conservation methods for businesses and residents.

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.

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. Opportunities to use additional wetlands for the storage of reclaimed water and stormwater within the planned areas will be evaluated. 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.

2.0 Proposed Development Program

Plum Creek is currently planning a long term master plan (LTMP) for its holdings within the County. 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. A range of typical water demands for the development areas were estimated considering maximum water use rates by similar types of development to low end rates considering 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 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 2030 and 2070 based on a 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 planning period. Reasonable solutions for water supply were determined for future development and environmental activities.

3.0 Water Supply and Facilities

3.1 Description of Community

Land use within the planned areas is divided into four categories including conservation, preservation, rural and employment orientated mixed use (EOMU). The proposed land use areas are shown in Exhibit 1-1 and 1-2. Conservation lands will make up much of Plum Creek's planned areas, will preclude development of any kind, will be managed by silviculture and also used to house mitigation. 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. Areas are provided for related research facilities and environmental services in addition to silviculture and other activities. Rural land use includes, rural residential, some limited services supporting the rural areas, green space and recreation areas.

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

3.2 Characteristics and Principles Related to Water Demands

3.2.1 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.

3.2.2 Residential

Water use, particularly indoor use, in single-family residences has been declining in recent years. The Florida Department of Environmental Protection (FDEP) 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.

The use of potable water for residential landscape irrigation will be not be allowed, and Florida-friendly landscaping will be required. 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. These common areas can also be irrigated with reuse water or harvested water to reduce the potable water demand.

3.2.3 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.

Florida-friendly landscaping will be required throughout the Plum Creek urban lands, and no potable water will be used for residential landscape irrigation. 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.

3.3 Forecast Water Demands

Projected water demand estimates were developed for low, average and high water use based on planning needs for the development in 2030 and 2070. These are shown in Exhibit 3-1 and Exhibit 3-2, respectively. The total projected long-term water demand is through 2070, 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 in Alachua County that do not strictly implement water conversation principles. Low water demand reflects communities that implement water conservation principles. All residential water use assumes no potable water will be used for landscape irrigation. 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 Exhibits 3-1 and 3-2.

Exhibit 3-1
EASP Projected Potable Water Demand – 2030
EASP - Water and Wastewater Data and Analysis

Land Use	Unit	Water Use, gal/unit-d Low	Medium	High	Number of Units[a]	Total Usage, mgd Low	Medium	High
Advanced Manufacturing								
General Manufacturing	Square feet	-	-	-	0	0	0	0
Distribution Centers	Square feet	-	-	-	0	0	0	0
R&D, Office Facilities[b]	Square feet	0.03	0.05	0.06	1,300,000	0.037	0.068	0.084
Retail[c]	Square feet	0.02	0.025	0.04	300,000	0.006	0.007	0.011
Residential								
Single Family[d]	Capita	40	78	95	3,375	0.149	0.291	0.355
Multi Family[e]	Capita	35	58	77	1,575	0.043	0.071	0.094
Total Water Demand						0.235	0.437	0.544

[a] Information provided by Plum Creek.

[b] The following is assumed for low, average, and high water demand, respectively: 7 gpcd, 13 gpcd, 16 gpcd *Wastewater Engineering – Treatment, Disposal, and Reuse* (Metcalf & Eddy, Inc. Third Edition, 1991). All water use estimates assume 4,727 employees.

[c] 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 667 employees.

[d] Estimated total usage assumes 2.49 people per household. Low 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. High water use from Envision Alachua Water Consumption Baselines, assumes maximum of non-irrigated residence and 3 people per household.

[e] Estimated total usage assumes 1.75 people per household. Per capita water use from apartment and condo water consumption from Envision Alachua Water Consumption Baselines.

Exhibit 3-2
EASP Projected Potable Water Demand – 2070
EASP - Water and Wastewater Data and Analysis

Land Use	Unit	Water Demand, gal/unit-d Low	Medium	High	Number of Units[a]	Total Demand, mgd Low	Medium	High
Advanced Manufacturing								
General Manufacturing	Square feet	0.172[b]	0.315[c]	0.522[b]	2,500,000	0.43	0.788	1.31
Distribution Centers	Square feet	0.008[d]	0.025[e]	0.051[f]	2,500,000	0.02	0.063	0.128
R&D, Office Facilities[g]	Square feet	0.03	0.05	0.06	5,000,000	0.14	0.26	0.32
Retail[h]	Square feet	0.02	0.025	0.04	1,200,000	0.024	0.03	0.044
Residential								
Single Family[i]	Capita	40	78	95	13,048	0.522	1.01	1.24
Multi Family[j]	Capita	35	58	77	6,055	0.212	0.351	0.466
Total Water Demand						1.35	2.51	3.51

[a] Information provided by Plum Creek.

[b] The following no or little wet-process type industry and domestic wastewater flows are assumed for estimating low and high water demand, respectively: 1,000 gal/ac-d and 8 gpcd, 3,000 gal/ac-d and 25 gpcd *Wastewater Engineering – Treatment, Disposal, and Reuse* (Metcalf & Eddy, Inc., Fourth Edition, 2003). All water demand estimates assume 5,000 employees and wastewater flow accounts for 90% of water flows. It was assumed that the unit industrial wastewater flows from Metcalf & Eddy are for gross manufacturing area; a floor-to-area ratio of 20% was assumed to convert the unit wastewater flow from gross manufacturing area to floor area.

[c] Estimated for general manufacturing using internal CH2M HILL data.

[d] Low unit water demand determined using water use data from multiple distribution centers in Alachua County, FL from May 2014 – April 2015.

[e] Average unit water demand estimated for warehouse type facilities using internal CH2M HILL data.

[f] High unit water demand determined using water use data from multiple distribution centers in Alachua County, FL from May 2014 – April 2015.

[g] The following is assumed for low, average, and high water demand, respectively: 7 gpcd, 13 gpcd, 16 gpcd *Wastewater Engineering – Treatment, Disposal, and Reuse* (Metcalf & Eddy, Inc. Third Edition, 1991). All water use estimates assume 18,182 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 2,667 employees.

[i] Estimated total usage assumes 2.49 people per household. Low 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. High water use from Envision Alachua Water Consumption Baselines, assumes maximum of non-irrigated residence and 3 people per household.

[j] Estimated total usage assumes 1.75 people per household. Per capita water use from apartment and condo water consumption from Envision Alachua Water Consumption Baselines.

3.4 Potential Sources

3.4.1 Surficial Aquifer

The surficial aquifer system in this area of 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.

3.4.2 Intermediate Aquifer

The intermediate aquifer system in this area of 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 dependable 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.

3.4.3 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 commonly believed to be 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.

3.4.4 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.

3.4.5 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, and storage facilities. At a minimum, these facilities will be designed to protect existing waters from degradation and ensure protection in 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.

3.4.6 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 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 quality 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 EASP area will be treated to a minimum of public-access-reuse standards. This will allow the reclaimed water to be used for a variety of needs including industry, rapid infiltration, 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. The beneficial reuse of reclaimed water will give the EOMU areas greater flexibility by allowing for additional industrial opportunities or may be used to assist common spaces, parks and athletic fields.

3.5 Alternative Water Solutions

3.5.1 Alternatives

Identifying and implementing alternative water supply projects is an important component of the 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.

3.5.2 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.

3.5.3 Seawater/Brackish Groundwater

Seawater and brackish groundwater are potential alternative water supplies, but they are 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.

3.5.4 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.

3.5.5 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 potentially reasonable water supply to consider for more detailed hydrogeologic investigations . 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.

3.6 Alachua County Levels of Service Standards

As part of the Alachua County Comprehensive Plan (ACCP), ***basic*** Level of Service (LOS) requirements for planned water supply facilities are included.

The Capital Improvements Element (Policy 1.2.1) identifies three basic ‘categories’ of public facilities for the purposes of establishing levels of service standards in Alachua County: Category A, Category B or Category C public facilities. Potable Water is determined to be a Category B public facility. The proposed plan amendment for the EASP proposes a future land use map amendment that increases the density and intensity of land only within the EA-EOMU future land use category, which has been proposed to function as an urban cluster under the Alachua County Comprehensive Plan (ACCP). The adopted Level of Service (LOS) for Potable Water within an urban cluster is established as follows through ACCP Policy 1.2.3, which states:

“Alachua County shall maintain adopted LOS standards for Category "B" public facilities and shall review planned improvements to these facilities as part of the annual update of the Capital Improvements Program. Procedures shall be included in the development regulations to ensure that adequate facilities to maintain level of service standards will be available concurrent with the impacts of development as defined in Policy 1.3.2 (a-c). Pursuant to Section 163.3167(2), no final development order or permit which contains a specific plan for development, including the densities and intensities of development, shall be approved without a determination that this concurrency requirement will be met.”

The specific LOS Standard for Potable Water is established in Policy 1.2.4 (e):

Potable Water and Sewer LOS Standards (based on Potable Water and Sanitary Sewer Element). The following level of service standards for **potable water** and sanitary sewer service in the unincorporated portion of Alachua County are hereby adopted, and shall be used as the basis for determining the availability of facility capacity, adequate water supply, and the demand generated by a development within the appropriate service area for the providers listed below for purposes of issuing development orders or building permits.

Potable Water	
Raw Water Supply:	Average Daily Flow
Treatment Capacity:	Daily Flow
Pumping and Distribution Capacity:	Peak Hourly Flow
Storage capacity:	One-half of peak day volume in gallons. This requirement may be met by a combination of storage and auxiliary power.
Minimum pressure:	The system shall be designed for a minimum pressure of 40 psig under forecasted peak hourly demands to assure 20 psig under extreme and unforeseen conditions.
Fire demand:	As determined using Insurance Services Organization guidelines
Potable Water:	
Average Day (gross)	147 gallons per capita per day (including residential and non-residential uses)
Peak Day (gross):	200 gallons per capita per day (including residential and non-residential uses)

Each of these standards is met or exceeded, as indicated in the conceptual design described in the following sections of this document. Note, as discussed previously, the per capita per day demand levels calculated and included here are less than the level of service standards for Alachua County. The reasons for this difference are discussed above and include the addition of water conservation principles that prohibit the use of potable water for irrigation.

3.7 Conceptual Design and Phasing

3.7.1 Conceptual Design

Based on the assumed raw water quality, projected demands, and anticipated land use, a conceptual design of the water supply system was developed for the EASP area. The proposed water supply and treatment system process flow diagram (PFD) for the water treatment plant (WTP) facilities is shown in Exhibit 3-3.

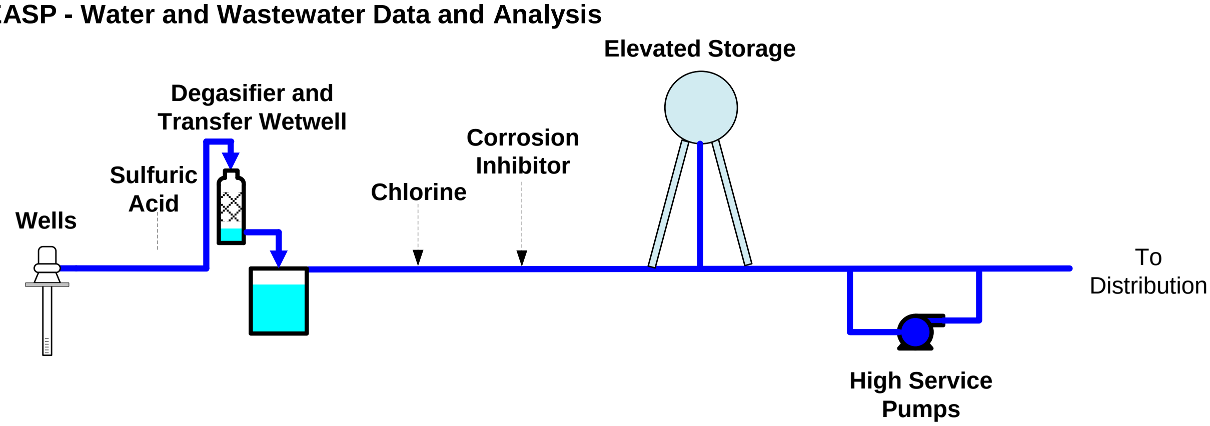
The upper Floridan aquifer (UFA) is proposed as the water supply source. Previous preliminary evaluations of the potential impacts from pumping this groundwater source indicate minimal variance to the existing conditions with pumping levels at less than 3.0 mgd. The medium water use demand estimates for 2030 and 2070 are 0.437 mgd and 2.51 mgd, respectively. Only under the high water use demand conditions for the year 2070 are the estimates above 3.0 mgd, at 3.51 mgd.

The UFA wells are estimated to be constructed to approximately 300 to 400 feet (ft) below land surface. The UFA water will be treated by a basic water treatment plant. Treatment will include degasification for hydrogen sulfide removal. The degasifier system includes degasifier towers, blowers, biological air scrubbers and recirculation pumps. The degasifier tower effluent is conveyed directly into a transfer pump station wetwell. Transfer pumps will be installed in the transfer pump station, and they will convey water to the distribution system.

Sodium hypochlorite and phosphoric acid will be injected downstream of the transfer pump station to provide disinfection and corrosion control, respectively. Chemical doses are preliminary and require further evaluation based on site-specific water quality data. The chlorine and phosphoric acid feed system sizing is based on the maximum daily flow, and chemical storage is sized for 30 days at the average daily flow. Free chlorine residual analyzers will be used for regulating chemical usage. Flow meters and/or chemical tote weight scales will be used for monitoring chemical usage. Further evaluation of the proposed design should be conducted to evaluate 1) chlorination for hydrogen sulfide removal, and 2) the need for corrosion control, if degasification is provided.

High service pumps will be provided to meet fire flow and peak hour demands.

Exhibit 3-3
EASP Water System – General Process Flow Diagram
EASP - Water and Wastewater Data and Analysis

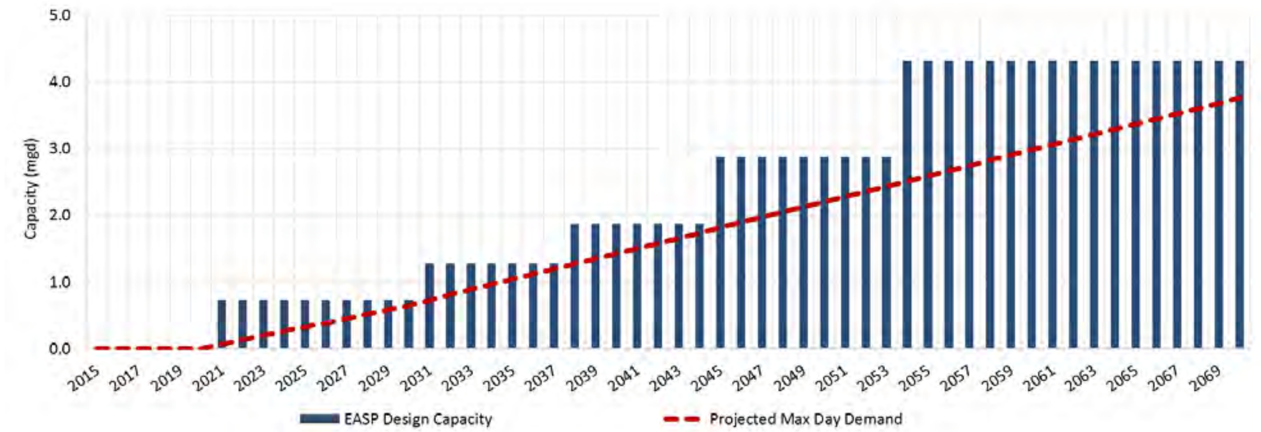


3.7.2 Phasing

Five phases are defined for the 2070 plan for the EASP area.The first phase includes the design and construction of all of the water treatment facilities, with operations beginning in 2021 when the first user is expected.

Projected maximum day demands and water treatment plant design capacity through 2070 for the EASP area are shown in Exhibit 3-4. Yearly water demands are based on the 2030 land use and population estimates, assuming linear growth. The required capacity for the EASP area was estimated based on the projected demands and FDEP rules 62-555.315 and 62-555.320.

Exhibit 3-4
EASP Water Treatment Plant Phasing
EASP - Water and Wastewater Data and Analysis



Note: Maximum day demand is estimated using the medium total water demand and a maximum day factor of 1.5. Linear growth is assumed.

For planning purposes, the potable water system for the EASP area is assumed to provide fire flow protection at a rate of 5.04 mgd (3,500 gpm) for a duration of 4 hours. This is the recommended rate from the American Water Works Association (AWWA) for commercial land use. A peak hour demand factor of 4 is assumed.

Phase 1 is projected from 2021 to 2030 and will include the installation of two 5.04 mgd high service pumps, two 0.792 mgd UFA wells, a degasifier tower (hydrogen sulfide), a transfer wetwell and pumps, and chemical addition. The treatment facilities will be co-located with one of the wells, and a pipeline will convey water from the second well to the treatment plant. The wells will be approximately 1,000 ft apart to minimize drawdown within the UFA. This will provide a firm high service pumping capacity of 5.83 mgd to provide fire flow and potable water for the EASP area. Additionally two 750,000 gallon elevated storage tanks will be installed to provide the required storage for fire flow and peak demands. The descriptions of the facilities to be included in each of the five phases are included in Exhibit 3-5.

Exhibit 3-5
Potable Water Treatment Plant Phasing Descriptions
EASP - Water and Wastewater Data and Analysis

Phase	Year	Facility	Description
1	2021 – 2031	Wells	Two 1.44 mgd upper Floridan Aquifer wells and 1,000 ft conveyance.
		Sulfuric Acid System	Storage includes two 300 gallon totes, sized for a minimum 30 days storage at 0.73 mgd and a dose of 90 mg/L. The feed system includes two metering pumps sized for 0.73 mgd at a dose of 90 mg/L. The storage and feed system are housed in a multiple chemical facility sized for future.
		Degasifier/ Transfer Pump Station	One 1.88 mgd degasifier tower and blower, one biological scrubber and recirculation pump.Transfer wetwell sized for future 13,000 gallons and two 1.88 mgd transfer pumps.
		Chlorine System	Storage includes one 300 gallon tote, sized for a minimum 30 days storage at 0.73 mgd and a dose of 3 mg/L. The feed system includes two metering pumps sized for 0.73 mgd at a dose of 3 mg/L. The storage and feed system are housed in a multiple chemical facility sized for future.
		Corrosion Inhibitor System	Assumes phosphoric acid is used for corrosion control. Storage includes one 55 gallon drum, sized for a minimum 30 days storage at 0.73 mgd and a dose of 3 mg/L. The feed system includes two metering pumps sized for 0.73 mgd at a dose of 3 mg/L. The storage and feed system are housed in a multiple chemical facility sized for future.
		High Service Pumps	Install two 5.04 mgd horizontal centrifugal pumps to meet fire flow requirements.
		Storage	Construct two 750,000 gallon elevated storage tanks.
2	2032 – 2037	Sulfuric Acid System	Two new metering pumps sized for 3.76 mgd at a dose of 90 mg/L. Additional 300 gallon tote.
		Chlorine System	Two new metering pumps sized for 3.76 mgd at a dose of 3 mg/L. Two additional 300 gallon totes.
		Corrosion Inhibitor System	Two new metering pumps sized for 3.76 mgd at a dose of 3 mg/L. Additional 55 gallon drum.
3	2038 – 2044	Wells	One 1.44 mgd upper Floridan Aquifer wells and 1,000 ft conveyance.
		Sulfuric Acid System	Convert storage system from totes to 9ft diameter tank.
4	2045 – 2053	Degasifier/ Transfer Pump Station	One 1.88 mgd degasifier tower and blower, one biological scrubber and recirculation pump. One 1.88 mgd transfer pump.
5	2054 – 2070	Wells	One 1.44 mgd upper Floridan Aquifer wells and 1,000 ft conveyance.
		Storage	Construct one 500,000 gallon elevated storage tank.

Notes: Firm well capacity required is the maximum day demand.

Constructed firm well capacity is the sum of the well capacities with the largest well out of service.

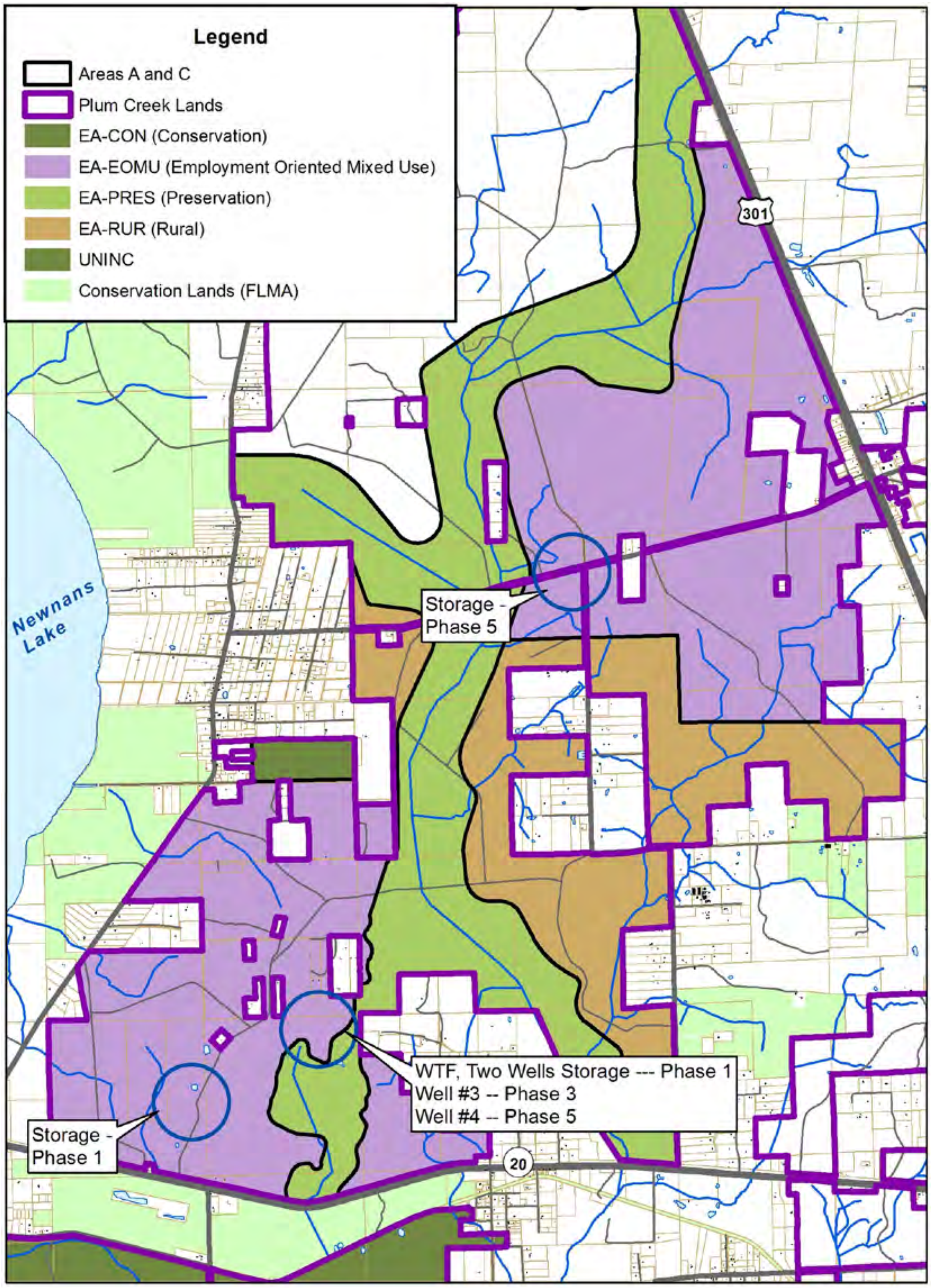
Firm high service pump capacity required is the max day demand plus fire flow demand.

Constructed firm high service pump capacity is the sum of the pump (well and high service) capacities with the largest pump out of service.

Storage required is 25% of the max day demand plus the design fire flow demand.

Exhibit 3-6 shows the potential general location of the future water treatment facility, wells, and storage tanks for the EASP area. The location of the treatment plant and the other facilities is preliminary and may be revised based on anticipated growth patterns, land use designations, potential impacts to the surrounding environment or other reasons. Additional analysis is required to determine the optimum locations for the new wells and elevated storage tanks.

Exhibit 3-6
Preliminary General Area for Potential Location of Future Water Treatment Facilities
EASP - Water and Wastewater Data and Analysis



3.8 Preliminary Cost Estimates

Preliminary construction costs were developed for each phase of the water supply and treatment system through 2070. These costs are shown in Exhibit 3-7. These preliminary estimates do not include costs for the distribution system within the EASP area. The estimated costs were developed using engineering judgment and the CH2M Parametric Cost Estimating System (CPES) tool. CPES is a proprietary, conceptual cost estimate tool that is commonly used at the conceptual stage of a project. All costs are in 2015 dollars.

Exhibit 3-7
Water Supply and Treatment Facilities – Capital Cost Estimates
EASP - Water and Wastewater Data and Analysis

	Year						
Item	2016	2017	2018	2019	2020	2030[a]	2070[b]
Permitting (2.5 percent)		$210,000	$210,000				
Land ($10,000/acre)			$20,000				
Design (15 percent)				$2,500,000			
Administrative (2 percent)				$340,000			
Construction (includes location adjustment)					$16,900,000	$2,500,000	$4,120,000
Total		$210,000	$230,000	$2,840,000	$16,900,000	$2,500,000	$4,120,000

[a] Includes phases 2 through 4. Permitting, design and administrative costs not included for phases 2 through 4.
[b] Includes phase 5. Permitting, design and administrative costs not included for phase 5.

The following construction cost assumptions were incorporated in the water supply and treatment facility estimates:

- The new well is constructed on an undeveloped site
- Overall site work, plant computer system, yard electrical, and yard piping were estimated as a percentage of construction cost
- Contractor markups were estimated as: 10% overhead, 5% profit, 5% for mobilization/bonds/insurance, and 30% for contingency
- A location adjustment factor was included for local conditions in Gainesville, Florida
- Assumed that pile foundations are not required

These cost estimates are considered to be consistent with a Class 5 estimate as defined by the Estimate Classification system of the American Association of the Advancement of Cost Engineering International (AACE International). The estimates were developed without detailed engineering data and are considered approximate. Class 5 estimates are normally expected to be accurate within minus 50 percent to plus 100 percent. A contingency has been included in these cost estimates as a provision for unforeseeable, additional costs within the general bounds of the project scope and for detailed design items that cannot be captured at this level of estimate

4.0 Wastewater Demand and Facilities

4.1 Forecast Wastewater Flows and Loads

Exhibits 4-1 and 4-2 show the estimated wastewater flows and required capacity for wastewater treatment in 2030 and 2070, respectively. Wastewater flows were determined by assuming approximately 90% of the water demand will reach the wastewater treatment system. The 90% capture rate assumes no potable water is used for residential irrigation.

The long-term WWTP capacity is projected to be 2.8 mgd based on a maximum month average daily flow (MMADF) factor of 1.25 times the average daily flow of 2.25 mgd. The MMADF factor of 1.25 is a typical value commonly used in planning. However, policies concerning residential use, industry types, and irrigation can reduce the overall wastewater quantity. But the pollutant load would not change because this is mainly determined by the population served. Load is one of the main factors that determine treatment plant sizing in addition to flow.

Exhibit 4-1
Projected Wastewater Flows for Plum Creek EASP in 2030
EASP - Water and Wastewater Data and Analysis

	Total Wastewater Flow, mgd		
Land Use	Low	Average	High
Advanced Manufacturing			
General Manufacturing	-	-	-
Distribution Centers	-	-	-
R&D, Office Facilities	0.037	0.068	0.084
Retail	0.01	0.01	0.01
Residential			
Single Family	0.12	0.24	0.29
Multi Family	0.05	0.08	0.11
Total Wastewater Flow	0.21	0.38	0.48

Exhibit 4-2
Projected Wastewater Flows for Plum Creek EASP in 2070
EASP - Water and Wastewater Data and Analysis

	Total Wastewater Flow, mgd		
Land Use	Low	Average	High
Advanced Manufacturing			
General Manufacturing	0.39	0.71	1.17
Distribution Centers	0.02	0.06	0.11
R&D, Office Facilities	0.14	0.23	0.27
Retail	0.02	0.03	0.04
Residential			
Single Family	0.47	0.92	1.12
Multi Family	0.19	0.32	0.42
Total Wastewater Flow	1.22	2.25	3.14

Exhibit 4-3 shows assumed loads per person for the development. These loads were based on standard values from Metcalf and Eddy, 2004.

Exhibit 4-4 shows the loads for influent wastewater to the WWTP for 2030 and 2070. The number of people for advanced manufacturing, office, retail and schools load types was determined based on the low range of flow per resident of Plum Creek. The loads for commercial and industrial areas were determined using a 0.2 factor on the load per person by assuming that 33% of the work force lived in the development, and thus, this loading was already accounted for and the remaining workers were only there a portion (30%) of the day.

Exhibit 4-3
Load per Person
EASP - Water and Wastewater Data and Analysis

Influent Parameter	Load per person (lb/d)
CBOD5	0.22
TSS	0.25
TKN	0.04
TP	0.006

Exhibit 4-4
Influent Wastewater Load
EASP - Water and Wastewater Data and Analysis

	Residential	Advanced Manufacturing	Office	Retail	Total Load (lb/d)
Number of People 2030	4,950	0	4,727	667	
$CBOD_5$ (lb/d)	1,089	-	209.0	29.5	1,328
TSS (lb/d)	1,238	-	237.5	33.5	1,509
TKN (lb/d)	198	-	38	5.36	241
TP (lb/d)	29.7		5.7	0.8	36
Number of People 2070	19,103	5,000	18,182	2,667	
$CBOD_5$ (lb/d)	4,203	221.1	804.0	117.9	5,346
TSS (lb/d)	4,776	11.1	913.7	134	6,075
TKN (lb/d)	764.0	0.1	146.2	21.4	972
TP (lb/d)	114.6	0.0	21.9	3.2	146

Note: Loadings for advancing manufacturing, office, and retail included a 0.3 factor per person due to work hours and assumed that 33% were already included as a resident.

4.2 Reuse Demand

Estimated potential outdoor irrigation and reuse demands for the planned areas are shown in Exhibit 4-5 and 4-6 for 2030 and 2070, respectively. Assumptions used to estimate the average range of irrigation needs for community and residential land uses are also shown in these exhibits. Note that the Plum Creek plan requires that the priority for the use of reclaimed water shall be given to environmental restoration projects and industrial users.

Exhibit 4-5
Estimated Irrigation Demands, 2030
EASP - Water and Wastewater Data and Analysis

Land Use Category	*Estimated Irrigated Area (acres)*[a]	*Projected Annual Average Demand (mgd)*[b]	*Assumptions*
Manufacturing	*0*	*0*	----
Distribution	*0*	*0*	----
R&D/Office	*7.5*	*0.012 – 0.015*[c]	*FFL*[e]
Retail	*0*	*0*	----
Multi-Family Residential	*4.2*	*0.006 – 0.009*[c]	*FFL*
Schools	*15.6*	*0.036 – 0.060*[d]	*turfgrass*
Parks	*8.9*	*0.021 – 0.034*[d]	*turfgrass*
Civic	*1.4*	*0.003 – 0.005*[d]	*turfgrass*
Totals:	*37.6*	*0.078 – 0.123*	

[a] *Provided by Plum Creek*

[b] *Demands (million gallons per day) based on typical gross irrigation rates for projected landscaping concept. Maximum daily rates may exceed annual average rates by a factor of ~ 1.5 – 2.5.*

[c] *Based on average gross irrigation rates of 0.4 - 0.5 inch/week (~ 1,547 – 1,934 gals/ac-day) considering research indicating FFL landscapes (which includes turfgrass cover) use approximately 30% to 50% less water than conventional turfgrass landscapes. (References: Boyer, M.J., et al., 2014, Irrigation Conservation of Florida-Friendly Landscaping Based on Water Billing Data, Journal of Irrigation and Drainage Engineering, American Society of Civil Engineers; Haley, M.B., et al, 2007, Residential Irrigation Water Use in Central Florida, Journal of Irrigation and Drainage Engineering, American Society of Civil Engineers.)*

[d] *Based on average gross irrigation rates of 0.6 - 1.0 inch/week (~ 2,321 – 3,868 gals/ac-day) for turfgrass in regional area. (References: Dukes, M.D., et al., 2014, Frequently Asked Questions about Landscape Irrigation for Florida-Friendly Landscaping Ordinances, IFAS Publication ENH1114; Romero, C.C. and M.D. Dukes, 2014, Net Irrigation Requirements for Florida Turfgrass Lawns, Part 3, IFAS Publication AE482; Haley, M.B., et al, 2007, Residential Irrigation Water Use in Central Florida, Journal of Irrigation and Drainage Engineering, American Society of Civil Engineers.)*

[e] *Florida-friendly landscaping*

Exhibit 4-6
Estimated Irrigation Demands, 2070
EASP - Water and Wastewater Data and Analysis

Land Use Category	*Estimated Irrigated Area (acres)*[a]	*Projected Annual Average Demand (mgd)*[b]	*Assumptions*
Manufacturing	*38.3*	*0.059 – 0.074*[c]	*FFL*[e]
Distribution	*19.1*	*0.030 – 0.037*[c]	*FFL*
R&D/Office	*28.7*	*0.044 – 0.056*[c]	*FFL*
Retail	*2.8*	*0.004 – 0.005*[c]	*FFL*
Multi-Family Residential	*15.6*	*0.024 – 0.030*[c]	*FFL*
Schools	*66.0*	*0.153 – 0.255*[d]	*turfgrass*
Parks	*34.8*	*0.081 – 0.135*[d]	*turfgrass*
Civic	*5.9*	*0.014 – 0.023*[d]	*turfgrass*
Totals:	*211.2*	*0.409 – 0.615*	

[a] Provided by Plum Creek
[b] Demands (million gallons per day) based on typical gross irrigation rates for projected landscaping concept. Maximum daily rates may exceed annual average rates by a factor of ~ 1.5 – 2.5.
[c] Based on average gross irrigation rates of 0.4 - 0.5 inch/week (~ 1,547 – 1,934 gals/ac-day) considering research indicating FFL landscapes (which includes turfgrass cover) use approximately 30% to 50% less water than conventional turfgrass landscapes. (References: Boyer, M.J., et al., 2014, Irrigation Conservation of Florida-Friendly Landscaping Based on Water Billing Data, Journal of Irrigation and Drainage Engineering, American Society of Civil Engineers; Haley, M.B., et al, 2007, Residential Irrigation Water Use in Central Florida, Journal of Irrigation and Drainage Engineering, American Society of Civil Engineers.)
[d] Based on average gross irrigation rates of 0.6 - 1.0 inch/week (~ 2,321 – 3,868 gals/ac-day) for turfgrass in regional area. (References: Dukes, M.D., et al., 2014, Frequently Asked Questions about Landscape Irrigation for Florida-Friendly Landscaping Ordinances, IFAS Publication ENH1114; Romero, C.C. and M.D. Dukes, 2014, Net Irrigation Requirements for Florida Turfgrass Lawns, Part 3, IFAS Publication AE482; Haley, M.B., et al, 2007, Residential Irrigation Water Use in Central Florida, Journal of Irrigation and Drainage Engineering, American Society of Civil Engineers.)
[e] Florida-friendly landscaping

4.3 Alachua County Levels of Service Standards

As part of the Alachua County Comprehensive Plan (ACCP), *basic* Level of Service (LOS) requirements for planned sanitary sewer (wastewater) facilities are included.

The Capital Improvements Element (Policy 1.2.1) identifies three basic ‘categories’ of public facilities for the purposes of establishing levels of service standards in Alachua County: Category A, Category B, or Category C public facilities. Sanitary sewer is determined to be a Category B public facility. The proposed plan amendment for the EASP proposes a future land use map amendment that increases the density and intensity of land only within the EA-EOMU future land use category, which has been proposed to function as an urban cluster under the ACCP. The adopted Level of Service (LOS) for Sanitary Sewer within an urban cluster is established as follows through ACCP Policy 1.2.3, which states:

“Alachua County shall maintain adopted LOS standards for Category "B" public facilities and shall review planned improvements to these facilities as part of the annual update of the Capital Improvements Program. Procedures shall be included in the development regulations to ensure that adequate facilities to maintain level of service standards will be available concurrent with the impacts of development as defined in Policy 1.3.2 (a-c). Pursuant to Section 163.3167(2), no final development order or permit which contains a specific plan for development, including the densities and intensities of development, shall be approved without a determination that this concurrency requirement will be met."

The specific LOS Standard for Sanitary Sewer is established in Policy 1.2.4 (e):

Potable Water and Sewer LOS Standards (based on Potable Water and Sanitary Sewer Element). The following level of service standards for potable water and **sanitary sewer (wastewater)** service in the unincorporated portion of Alachua County are hereby adopted, and shall be used as the basis for determining the availability of facility capacity, adequate water supply, and the demand generated by a development within the appropriate service area for the providers listed below for purposes of issuing development orders or building permits.

Sanitary Sewer	
Collection System:	Peak Hourly Flow (2.5 times the average daily flow)
Treatment and Disposal:	Annual average daily flow which allows for anticipated peak hour flow
Sanitary Sewerage: Average Day (gross)	106 gallons per capita per day

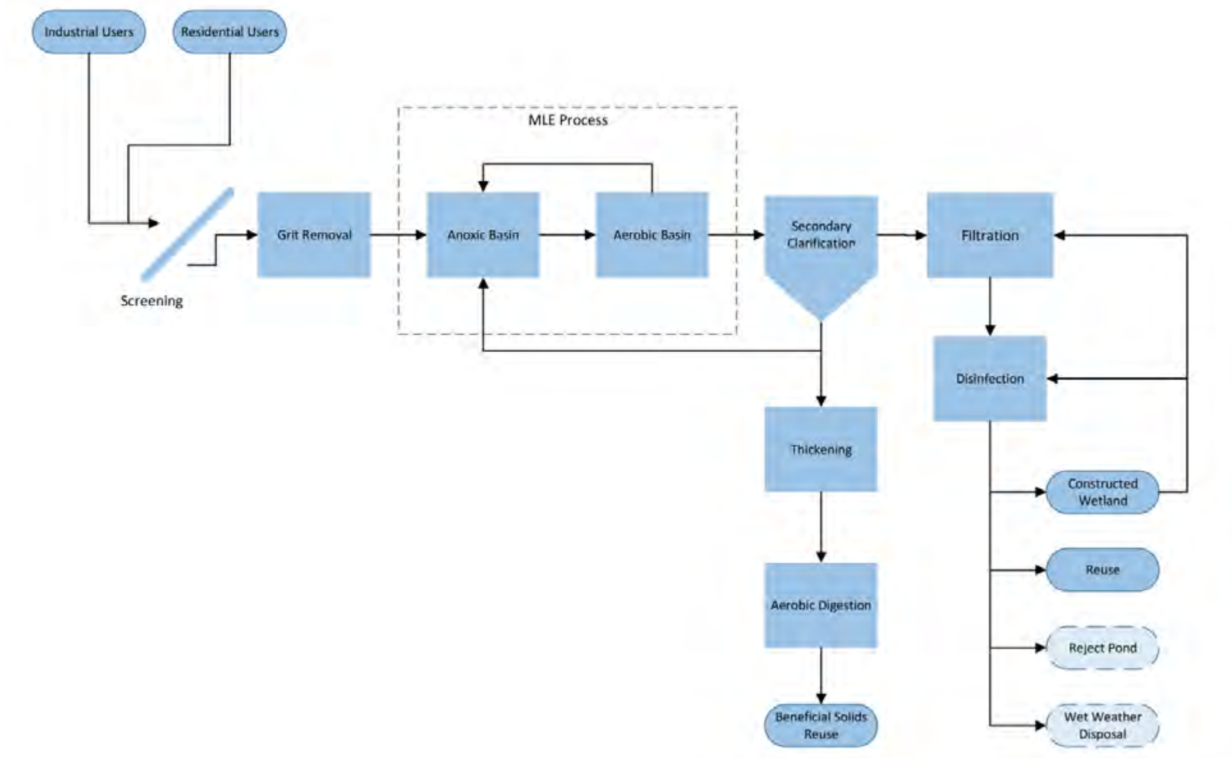
Each of these standards is met or exceeded, as indicated in the conceptual design described in the following sections of this document. Note, as discussed previously, that the per capita per day demand levels calculated and included here are less than the level of service standards for Alachua County. The reasons for this difference are discussed above and include the addition of water conservation principles that prohibit the use of potable water for irrigation.

4.4 Conceptual Design and Phasing

4.4.1 Conceptual Design

A conceptual design of the wastewater treatment facility was created for a basis of the phasing process, equipment and cost estimate. The conceptual design is based on a facility designed to produce effluent that meets Public Access Reuse standards and can be provided to the community for beneficial reuse (for example, irrigation, industrial). A process flow diagram (PFD) of the proposed wastewater treatment and reuse system is shown in Exhibit 4-7.

Exhibit 4-7
Wastewater Treatment Process Flow Diagram
EASP - Water and Wastewater Data and Analysis



Wastewater will enter the treatment plant and flow through a screening and grit removal system to remove large debris and grit material. The screened and degritted wastewater will then proceed to secondary treatment, beginning with biological reactors configured as the Modified Ludzak-Ettinger (MLE) process. The MLE process consists of an anoxic zone followed by an aeration zone, with a recycle flow from the aeration zone to the anoxic zone. The anoxic zone and recycle flow of the MLE process provides nitrogen removal. Wastewater then flows to secondary clarification for solids-liquid separation. The liquid effluent from the secondary clarifiers proceeds to filtration, followed by a high-level disinfection system, in order to meet public access reuse standards. Effluent can be sent directly into the reuse system or be stored in a constructed wetland and utilized for reuse at a later time when reuse demands are high. Effluent that does not meet Public Access Reuse Standards will be sent to a reject pond. Water from the reject pond will be pumped back to the headworks for treatment. During wet weather events, effluent will be discharged to a permitted natural wetland.

The constructed wetland will consist of approximately 38 acres at buildout in 2070. The wetland will contain a 25 acre deep central marsh with a 7 day water storage period. The storage cycle water depth will be a maximum of 3 ft during wet-weather periods and a maximum water depth of 1 ft during dry weather periods. Typical average depths are expected to be shallow and average 0.5 ft. The deep central marsh will be surrounded by approximately 13 acres of shallow marsh. The system will be constructed in increments to match the phased construction of the reclaimed water supply. During phase 1, approximately 5 acres of wetlands will be constructed. This is to ensure that there is sufficient water to maintain a minimum level of hydration during dry seasons while retaining enough capacity during wet-weather periods. The constructed wetland will have park amenities, including boardwalks, overlooks, and trails for the public to utilize.

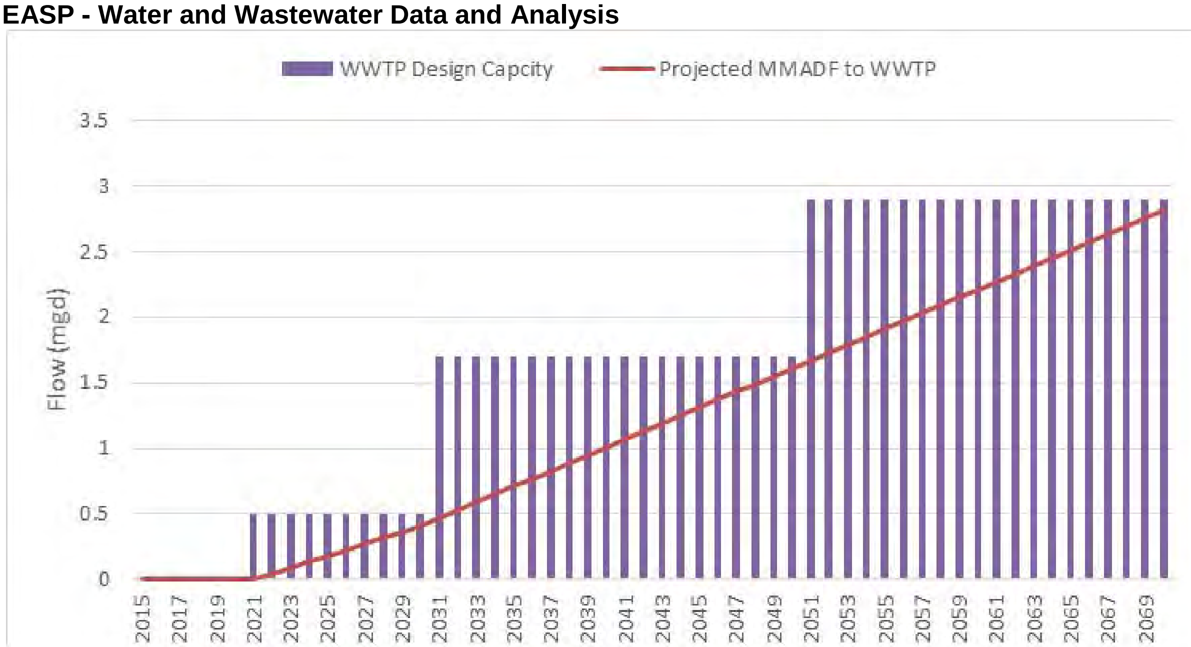
Settled solids from the secondary clarifiers will either be returned back to the anoxic zone or wasted to be thickened prior to aerobic digestion. After thickening, biosolids will be further treated in aerobic digesters to meet Class B Standards to allow beneficial reuse for agricultural purposes.

In order to meet Public Access Reuse Standards, Class I reliability and redundancy requirements must be met. In order to meet these requirements major process equipment must have a back-up component that can handle the peak flow or a percentage of the peak flow.

4.4.2 Phasing

Exhibit 4-8 shows the projected flow and phasing of the WWTP for the community, assuming average calculated values used. The 2070 planning period was divided into three phases for WWTP development. Phases were determined assuming linear growth between now and 2030 and between 2030 and 2070. The next phase would be implemented 1 year before the projected MMADF will exceed the previous treatment plant capacity. The WWTP is assumed to begin operation in 2021. The first phase has a duration of ten years and the second and third phases have a duration of twenty years each. Flow will be collected and transported to one central WWTP located in Area A.

Exhibit 4-8
Wastewater Treatment Plant Phasing
EASP - Water and Wastewater Data and Analysis



[a] Annual average daily flow and maximum month average daily flow corresponds to the last year in the design phase.

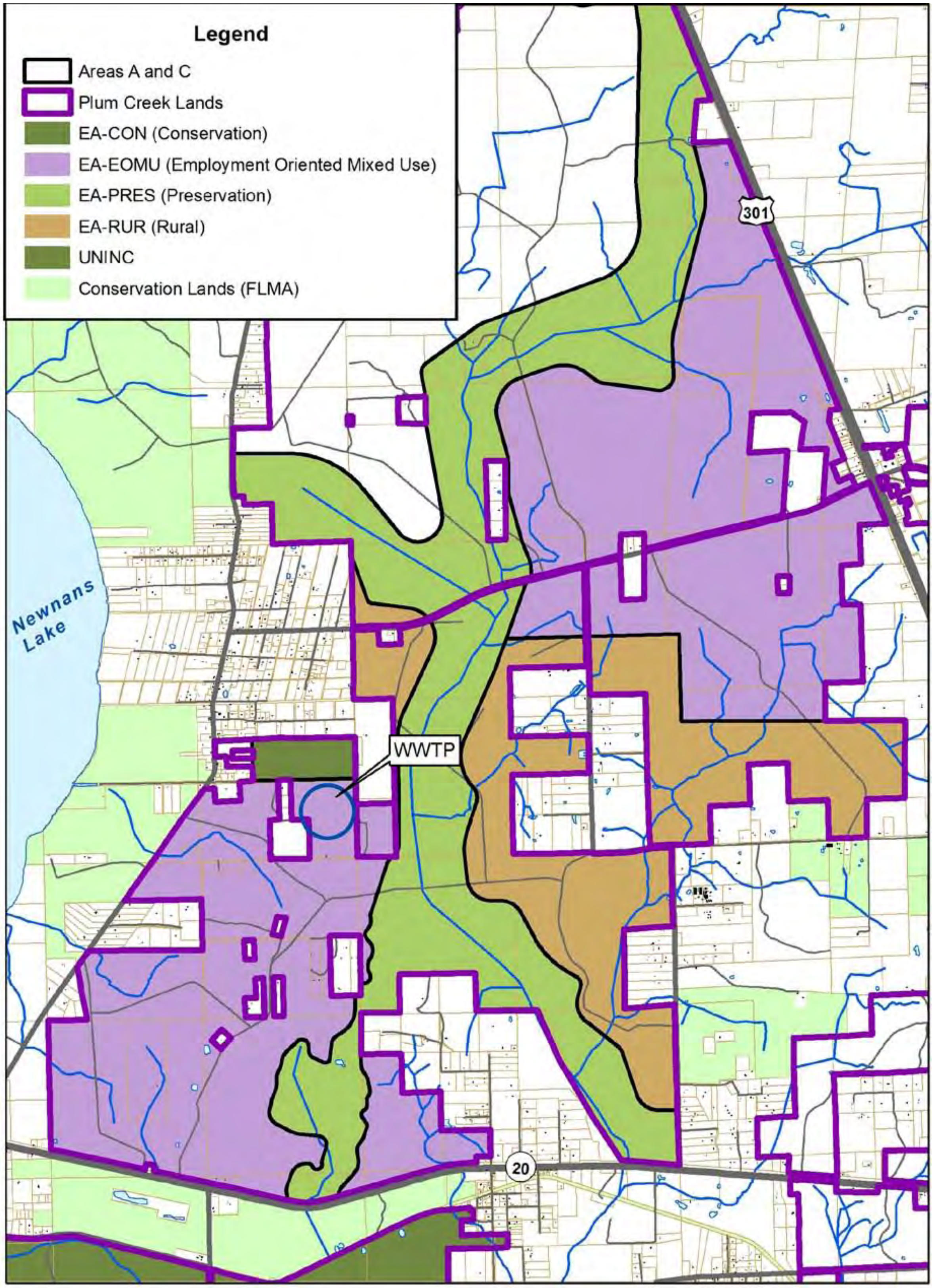
[b] Wastewater treatment plant design flow is based on the maximum month daily flow projections. Flow values rounded up.

Phase 1 is projected from 2021 to 2030 and will encompass all wastewater flows from Area A and C being sent to a newly constructed WWTP with a capacity of 0.50 mgd. Phase 2 is projected from 2031 to 2050 and will include a 1.2 mgd expansion of the WWTP to a total capacity of 1.7 mgd. Phase 3 is projected from 2051 to 2070 and will include a 1.2 mgd expansion of the WWTP to a total capacity of 2.9 mgd. The expansion will be designed and constructed with Class 1 reliability requirements in order to meet public access reuse standards. The descriptions of the facilities to be included in each of the three phases are included in Exhibit 4-9.

Exhibit 4-9
Wastewater Treatment Plant Phasing Descriptions
EASP - Water and Wastewater Data and Analysis

Phase	Year	Facility	Description
1	2021 – 2030	Headworks	Build-out capacity headworks facility will be constructed during Phase 1. Screens will be installed during Phase 1.
		Secondary Treatment	Biological reactors and secondary clarifiers will be constructed to meet Phase 1 capacity with Class 1 reliability requirements. The blower building will be constructed to build-out capacity with room for additional blowers to be installed in later phases.
		Filters	Filters will be constructed to meet Phase 1 capacity with Class 1 reliability requirements.
		Disinfection	Chlorine contact basins will be constructed to meet Phase 1 capacity with Class 1 reliability requirements. Chemical feed facility will be constructed for build-out capacity with room to add additional storage tanks/totes and pumps.
		Solids Disposal	Vendor thickening and haul. Storage tanks constructed to be able to aerobically treat solids to Class B standards to handle Phase 2 flows.
		Reuse System	Pump station will be constructed to build-out capacity with room for additional pumps to be installed in later phases. Reuse main distribution lines will be constructed during Phase 1. Wetland system to be constructed and established in phases consistent with flow availability; first phase = 8 acres.
2	2031 – 2050	Secondary Treatment	Additional biological reactors and secondary clarifiers will be constructed to meet Phase 2 capacity with Class 1 reliability requirements. Blowers will be added to the blower building to meet aeration requirements for Phase 2.
		Filters	Additional filters will be constructed to meet Phase 4 capacity with Class 1 reliability requirements.
		Disinfection	Additional chlorine contact basins will be constructed to meet Phase 2 capacity with Class 1 reliability requirements. Chemical feed pumps will be added for disinfection requirements.
		Solids Disposal	Thickener and chemical storage and feed system will be installed to handle Phase 2 flows with room for additional equipment in the future.
		Reuse System	First phase of wetland system constructed (15 acres).
3	2051 – 2070	Secondary Treatment	Additional biological reactors and secondary clarifiers will be constructed to meet Phase 3 capacity with Class 1 reliability requirements. Blowers will beadded to the blower building to meet aeration requirements for Phase 3.
		Filters	Additional filters will be constructed to meet Phase 3 capacity with Class 1 reliability requirements.
		Disinfection	Additional chlorine contact basins will be constructed to meet Phase 3 capacity with Class 1 reliability requirements. Chemical feed pumps will be added for disinfection requirements .
		Solids Disposal	Storage tanks constructed to be able to aerobically treat ssolids to Class B standards to handle Phase 4 flows. One aadditional thickener will be added to the thickening building.
		Reuse System	Wetland system second phase area = 15 acres; wetland area total (Ph. 2 and 3) = 30 acres.

Exhibit 4-10.
Preliminary General Area for Potential Location of Future Wastewater Treatment Facility
EASP Water and Wastewater Data and Analysis



4.5 Preliminary Cost Estimates

Preliminary construction costs were developed for each phase of the wastewater treatment system through 2070. These costs are shown in exhibit 4-11.These preliminary estimates do not include costs for distribution and collection systems. Costs were developed using engineering judgment and the CH2M Parametric Cost Estimating System (CPES) tool. CPES is a proprietary, conceptual cost estimate tool that is commonly used at the conceptual stage of a project. All costs are in 2015 dollars.

Exhibit 4-11
Wastewater Treatment Facilities – Capital Cost Estimates
EASP - Water and Wastewater Data and Analysis

Item	2016	2017	2018	2019	2020	2030	2070
Constructed Wastewater Treatment Plant					$24,900,000	$12,900,00	$9,600,000
Wetland						$5,000,00	$5,000,000
Subtotal					$24,900,000	$17,900,00	$14,600.000
Permitting (2.5%)		$1,025,000	$1,025,000				
Design (15%)				$6,150,000			
Land ($10,000/acre)			$50,000				
Administration (2%)				$820,000			
Total		$1,025,000	$1,525,000	$6,970,000	$24,900,000	$17,900,00	$14,600,000

The following construction cost assumptions were incorporated in the wastewater treatment estimates:

- The WWTP is constructed on an undeveloped site
- Backup power generators were assumed to run the plant critical loads
- Structure wall thicknesses were estimated using typical guidelines based on depth of water within the structure
- Overall site work, plant computer system, yard electrical, and yard piping were estimated as a typical percentage of construction cost
- Contractor markups were estimated as: 10% overhead, 5% profit, 5% for mobilization/bonds/insurance, and 30% for contingency
- A location adjustment factor was included for local conditions in Gainesville, Florida
- Pile foundations are not required
- Operations and maintenance building size were assumed

The cost estimate is considered to be consistent with a Class 5 estimate as defined by the Estimate Classification system of the American Association of the Advancement of Cost Engineering International (AACE International). The estimates were developed without detailed engineering data and are considered approximate. Class 5 estimates are normally expected to be accurate within minus 50 percent to plus 100 percent. A contingency has been included in these cost estimates as a provision for unforeseeable, additional costs within the general bounds of the project scope and for detailed design items that cannot be captured at this level of estimate.

Appendix I – Meeting Presentation and Water Management Technical Advisory Panel Report

Envision Alachua
Approach to Water Supply Solutions

Water in North Central Florida

Source: Groundwater (Floridan Aquifer)

Uses:
40% Agriculture
30% inside homes, buildings
30% lawn irrigation

Regulate:
County Code inside homes, buildings
Water Management Districts
- Consumptive Use Permits: wells for utilities, ag
- Restrict lawn watering (1/week)
- Prepare Regional Supply Plans

FL Department of Environmental Protection
- Natural Systems Needs: Springs, Rivers

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Water: Political and Regulatory Context

- Water/Springs Protection #1 Issue of 2014 FL Legislature, New regulations in 2015 assured
- FDEP Setting Minimum Flow Levels for Springs, Rivers
- Regional Water Supply Plans now recognizing that increased conservation is the only long term solution
    - No increases in pumping quantities permitted for city utilities
    - Permitted time frames reduced to 5 years
    - Increased restrictions on lawn irrigation
    - Increased regulation/BMPs on agriculture
- Cities and Counties (utility companies) must solve
    - Reduce consumption by existing users
    - *First reduce consumption by any new growth not already approved*

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Envision Alachua Water Strategy

- Commit to water conservation actions that would surely be required for county/state approval of 50 years of new growth (Sector Plan law requires that water needs of approved land uses be included in Regional Water Supply Plan)
- Plan up front to achieve new water ethic in community design over 50 years
- Innovate by integrating supply, treatment, stormwater, wastewater, natural systems
- Lead – set standard for other future development and for existing development – local and Statewide

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Envision Alachua Task Force
Vision, Goals and Planning Principles

Goal D

WATER

Address long-term needs for water supply, water quality and water conservation

Planning Principles

- **D1** Identify and protect water recharge areas
- **D2** Develop communities that optimize water conservation and achieve a 50 percent or greater reduction in water usage based on current usage
- **D3** Apply Florida-friendly guidelines for landscaping
- **D4** Demonstrate leadership in resource management by promoting and adopting innovative ways to meet water needs
- **D5** Capture, treat and reuse storm water to the maximum extent feasible

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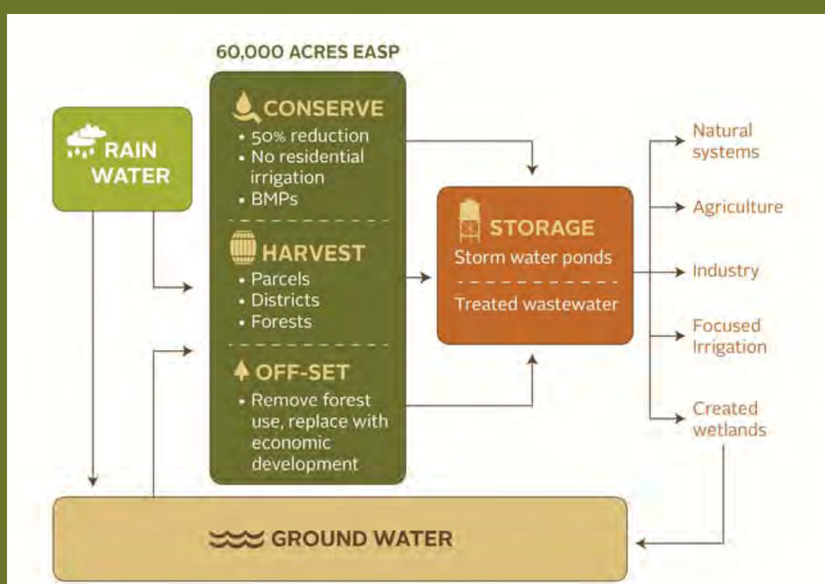
Water Management Concept



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Water Advisors

- Glenn Acomb, FASLA, Department of Landscape Architecture, University of Florida
- Treavor Boyer, Ph.D., Environmental Engineering Sciences, University of Florida
- Mark W. Clark, Ph.D., Soil and Water Science Department, University of Florida
- Wendy D. Graham, Ph.D., Director, University of Florida Water Institute
- Pierce Jones, Ph.D., Director, Program for Resource Efficient Communities, University of Florida
- Robert L. Knight, Ph.D., Howard T. Odum Florida Springs Institute
- Joseli Macedo, Ph.D., AICP, Department of Urban and Regional Planning, University of Florida

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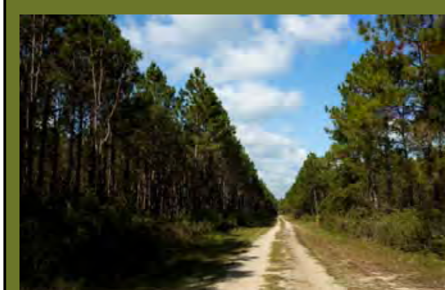
Water Resources and Supply



All Agriculture and Silviculture activities shall follow the most recent applicable best management practices.

Note:

- Removes one home per five acre land use on 25,000+ acres – no wells, septic tanks.
- Removes intense agriculture from 23,000+ acres.

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Water Resources and Supply

The use of Florida-Friendly plant species shall be required for landscaping within the EA-EOMU, with a preference for native species.

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Water Resources and Supply

Residential lots shall not be irrigated with potable water except for a limited period during the initial establishment of landscaping.

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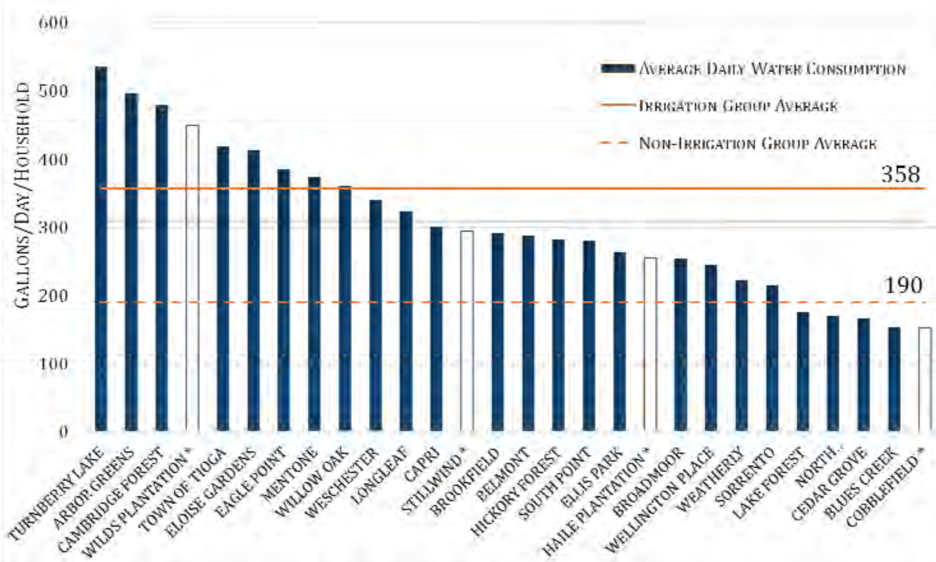
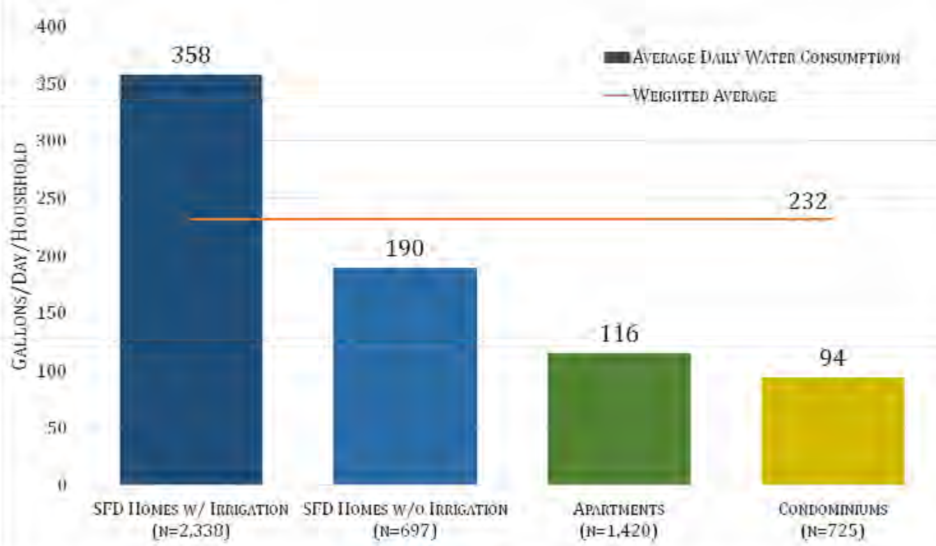
Residential Water Consumption Baselines

Single Family Detached (SFD)

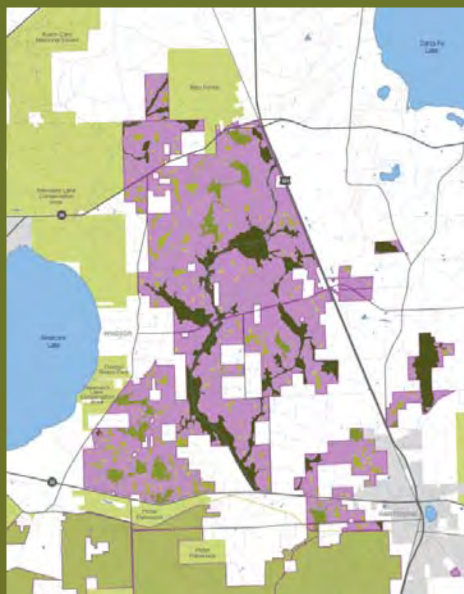


Residential Water Consumption Baselines

Dwelling Unit Types Comparison



Water Resources and Supply



Priority use of reclaimed water shall be given to environmental restoration projects, industrial users and agricultural users.

Reclaimed water shall not be provided to residential lots

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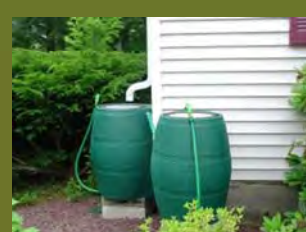
DSAP Stormwater Policy

The use of Low Impact Development techniques are allowed and encouraged.

- Vegetated swales
- Bioretention, rain gardens
- Shade trees
- Permeable pavements
- Narrow street widths
- Eliminate curb, gutter
- Shared driveways, parking
- Rainwater harvesting
- Rooftop runoff
- Education on maintenance



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SUMMARY

- Propose and commit to water use restrictions, and to integrated water system, that would surely be required for 50 year land use approval
    - Our own terms that are achievable, not reacting to proposed regulation that may not be
    - Build supporters in local and state leaders and environmental and science communities
- Show leadership in accomplishing the statewide water solution for future generations
- Set standard to be applied immediately to all new development in county and north central Florida, then State

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Envision Alachua
Approach to Water Supply Solutions

REPORT OF THE ENVISION ALACHUA WATER MANAGEMENT TECHNICAL ADVISORY PANEL

Prepared by Sam Poole, Steve Seibert and MIG, Inc.

Overview

On Friday, March 14, 2014, Plum Creek convened the Envision Alachua Water Management Technical Advisory Panel (Panel). The purpose of the panel was to provide advice and direction on the water, stormwater and waste water management strategies in the Envision Alachua Long Term Master Plan. Panelists were asked to review background materials in advance of the meeting, including:

- Envision Alachua Vision and Goals for Environmental Conservation and Water and Envision Alachua Sector Plan (EASP) Comprehensive Plan Amendment application;
- Integrated Water Resource Management System;
- EASP proposed water policies;
- EASP Water Supply Data and Analysis report; and
- Integrated Water Resource Alternatives Analysis prepared by CH2M Hill.

Plum Creek convened the panel for the purpose of getting feedback from a variety of water and land use planning experts on the water management strategy for the proposed Long Term Master Plan (LTMP). Plum Creek intends to use this information to improve its application and increase its ability to achieve the goals and planning principles described in the Vision document prepared in 2012 with input from the Envision Alachua Task Force. The information and insights from this panel will also inform the preparation of the Detail Specific Area Plans (DSAP) in that phase of the Envision Alachua process.

The following participants were present:

Panelists

Glenn Acomb, FASLA, Department of Landscape Architecture, University of Florida

Treavor Boyer, Ph.D., Environmental Engineering Sciences, University of Florida

Mark W. Clark, Ph.D., Soil and Water Science Department, University of Florida

Wendy D. Graham, Ph.D., University of Florida Water Institute

Robert L. Knight, Ph.D., Howard T. Odum Florida Springs Institute, President, Wetlands Solutions, Inc.

Joseli Macedo, Ph.D., AICP, Department of Urban and Regional Planning, University of Florida

Other Participants and Presenters

Sam Poole, Berger Singerman

Steve Seibert, The Seibert Law Firm

Rob Olszewski, Plum Creek

Jeff Lehnen, CH2M Hill

Greg Galpin, Plum Creek

Pierce Jones, Ph.D., Institute of Food and Agricultural Sciences, University of Florida

Bryan McDonald, CH2M Hill

Tim Jackson, Plum Creek

Daniel Iacofano, Ph.D., MIG, Inc.

Joan Chaplick, MIG, Inc.

Summary of Panel's Key Comments

1. Plum Creek's integrated water management plan prepared as part of a community-based 50-year master plan for its Alachua County lands is a significant advancement over conventional land planning and development practices in Florida. The integrated water management plan is intended to achieve a substantial reduction in per capita consumption of water relative to development presently allowed on the property and should become a new model for water conservation statewide.
2. Reducing per capita consumption by half is good, but Plum Creek has an opportunity to set even higher standards for cost-effective solutions for reducing water consumption, treating wastewater, and managing stormwater, and for resource protection, that should be considered in the next phase of the planning process. Planning and designing systems for a 50-year planning horizon should allow incorporation of evolving water strategies and technologies without jeopardizing the success of the vision – balance "outside the box" thinking with the practical marketplace.
3. Plum Creek should evaluate reducing reliance on the Floridan Aquifer and look to additional conservation strategies, to wastewater reuse, to rainfall and to the shallow aquifer as substantial water supply sources.
4. Plum Creek should design water and wastewater systems with maximum flexibility to accommodate evolutions in technology, particularly in waste source separation and reuse, over the 50-year Envision Alachua planning horizon.

5. Plum Creek should enhance water planning and management strategies by describing how the particular nature of the flatwoods ecosystem with its drainage characteristics and phosphatic soils will influence land development strategies and techniques, from building and infrastructure design and construction to community landscaping and agricultural crop selection.
6. Plum Creek should feature the integrated design of communities, workplaces and agriculture as a critical component of creating the cultural reinforcement of the objectives for limiting the consumption of water and energy and an ethic of sustainable use of resources, with a preference for local resources.
7. Plum Creek should describe the governance structure that will insure the vision established in the Envision Alachua process will be implemented over time as land ownership and governments change.
8. Preparing water budgets and nutrient budgets for "as-is" conditions, for development under current land development regulations, and for development in accord with the Envision Alachua plan is needed to understand the effectiveness of the integrated water plan and to inform the selection and design of water systems and related land planning decisions.

Summary of Responses to Five Questions

1. *Are the assumptions in the integrated water resource management system plan reasonable?* The panel addressed a number of assumptions in the water strategy
   a. The per capita water use is squishy – need a better, clearly stated benchmark to measure 50% reduction against. Including the high consumption number is not a good benchmark.
   b. May not be reasonable to assume water supply capacity in Floridan Aquifer; that aquifer may already be over utilized
   c. Separation between upper & lower Floridan Aquifer is spatially variable and discontinuous to the point that treating upper & lower as two sources may not be accurate.
   d. Appearance of native landscaping in dry periods may make it difficult to keep residents from using potable water for irrigation; need to consider water pricing and cultural strategies to manage desires of some residents to grow foliage that requires irrigation.
   e. The different chemistries between Floridan Aquifer water & surface water may cause treated wastewater from a Floridan Aquifer source potable system to have undesirable effects when discharged to surface systems.
   f. Rainfall and surficial aquifer may be feasible sources of potable water.
   g. Upgrading the City of Hawthorne wastewater plant and building new large capacity plants may not be the best long-term solutions. Distributed wastewater treatment systems may be more cost-effective if pumping cost are considered and may be easier than large plants to adapt to new technology such as source separation.
   h. Using water to transport waste streams to large treatment facilities may change as competition for water for human and natural system uses becomes more intense. The technology of wastewater treatment systems may be radically impacted by advances in source separation in domestic and industrial/workplace generators.
   i. Assumptions in the current draft of the water strategies are not clear on whether the specific characteristics of pine flatwoods have played a role in shaping design of buildings & infrastructure for exposure of phosphatic native soils and for selection of

crop types that are adapted to flatwoods or will require drainage or other management techniques.

j. Not clear from materials what assumptions have been made about climate change.
k. Water management plan appears to conventionally "demand-driven" rather than "supply-side" or "local-capacity" driven.

2. *Are the results and recommendations in the plan reasonable?*
   a. Plum Creek's response to community requests for a jobs-based development strategy is laudable, but the jobs-based focus increases the challenge of setting a new standard for reduced water use, particularly if the agricultural crops selected for production will need irrigation and /or drainage.
   b. Reducing water use by 50% is good, but the size of Plum Creek's holdings may make it possible to do better by the water resources without making the proposed development unfeasible. The plan could be even more aggressive in reducing consumption and treatment of water.
   c. The methodology of ranking water strategies produced reasonable results but was subjective and the ranking system does not produce enough gradation in outcomes. Need to re-examine with the benefit of water and nutrient budgets and see if outcomes change.
   d. The land use patterns are generalized at this point, but will be determinative in achieving a low-impact lifestyle by residents, including water use, transportation, energy use, waste generation. Land use patterns established by Plum Creek in the next phase DSAP could make a strong statement about residents' lifestyles.
   e. Assessing the reasonableness of selected water strategies would be assisted by broader analysis of energy needs of alternatives, particularly over the 50-year planning period. Reliance on more dispersed waste treatment systems might prove more cost-effective.
   f. The recommendations have "wiggle room" that may be necessary given the 50-year horizon and the need for the vision to be economically successful, but establishing stronger commitments ("no potable water will be used for irrigation") would be a better water management approach.

3. *Do the proposed solutions appropriately address the key issues?*
   a. Including ag-based jobs in the community is good - would be helpful to describe the nature of agricultural use of the property. Some crops may require more water if focused on high-value market crops like blueberries or crops that require drainage, compared to native silviculture. Crops for consumption on site could help end the "7000-mile salad."
   b. The proposed water strategies for limiting water use and reusing wastewater will certainly reduce per capita consumption, but it might be possible to do even better.
   c. Stormwater management is addressed well, but might be more aggressively considered as both a water supply source and a potential for recharging the Floridan Aquifer per the wells in Lake Alice on UF campus.
   d. Treated wastewater will have a nutrient load that limits discharge to natural wetlands or aquifers. Panel would like to see more details on the strategies for nutrient management, including water & nutrient budgets, to evaluate proposed solutions.
   e. Legacy phosphorus in and nutrient loading to Lochloosa and Orange Lakes is high. Consider opportunities to create a net reduction in nutrients reaching these lakes.

4. *Are there solutions which have not yet been considered?*
   a. Using rainfall and the shallow aquifer as significant sources to meet potable water needs.
   b. Separating wastes at their source before they enter the water treatment stream may be more cost-effective. This applies to water used in manufacturing as well as domestic applications.
   c. Consider a more dispersed wastewater treatment system that requires less energy for pumping and provides more flexibility to adapt to new technologies and strategies.
   d. Do not overlook pricing of water as a way to manage consumption.
   e. Partition stormwater by source. Consider alternative approaches to storage of water, such as in cypress wetlands where there is low ET, in lakes that provide recreation opportunities, and in the Floridan Aquifer via wells such as UF does with Lake Alice.
   f. Consider the particular water conditions and soils of flatwoods when planning agricultural uses.
   g. Consider a supply-side analysis that attempts to establish the "hydrologic carrying capacity" of the property so that no additional adverse impacts to water availability or water quality are produced as a result of development.

5. *Are there additional data, analysis or research needed?*
   a. A series of three water budgets comparing current conditions, development based on current land development regulations and likely future development patterns, and development based on the Envision Alachua plan is needed in order to better evaluate the management strategies.
   b. A nutrient budget under the same three scenarios as "a."
   c. Analysis of how much household water actually needs to be potable would be useful information.
   d. Cross-section drawings of the hydrogeology and maps of the hydrography for the Plum Creek properties should be developed.
   e. Better information is needed to allow the qualitative ratings for the various alternatives to be more discerning of advantages and disadvantages to allow more gradation among the alternatives.

Issue-Organized Summary of Comments and Questions

Below is a summary of the key questions, opinions, recommendations, and data needs that were identified by the panelists, organized by topic.

Baseline Data is Critical

Panelists expressed a need for baseline data that would help determine what Plum Creek's goals were based on and if they were being achieved. For example, one of the principles references a 50% reduction in water use. Plum Creek should clarify what data it will use to establish the baseline and how its progress toward this principle will be calculated. Baselines that could be helpful include:

- Baseline for current usage (identify the uses it is based on)

- Baseline for what's allowed under County Comprehensive Plan
- Baseline for uses proposed in LTMP

It was also suggested that similar baselines and metrics be developed to help better understand the needs of agricultural and commercial usage.

Water Budget

Panelists suggested a water budget for the project. It was also suggested that Plum Creek show a scenario with a more aggressive water use reduction and the urban form that achieves it. It was also suggested they show a conventional alternative in comparison with this aggressive "shoot for the moon" reduction alternative. These scenarios could then be used to help evaluate alternatives and identify the related metrics. There is a desire by some panelists to establish a water budget that gets us closer to a limited withdrawal of groundwater or even a net reduction in groundwater use for the Envision Alachua plan.

It was suggested that Plum Creek show the Union Street Station example referenced by Dr. Pierce Jones and its related water use and compare it with the "shoot for the moon" urban form scenario that uses less water - to help determine what is optimal. The comparison and a related graphic would be very useful. This might be completed as a student project.

It was suggested that Plum Creek include in the project information background a map that shows where the recharge areas and surface outflows are.

Net Reduction in Water Use

The comments on the water budget led to a discussion about the Envision Alachua project achieving an overall net reduction in groundwater use - since "that's what we need to do." Dr. Bob Knight noted that Plum Creek's proposal is coming as a time when the resources of the Floridan aquifer are very stressed. Dr. Knight stated the project has the ability to change water management in North Florida, and Plum Creek has enough land to make a difference. He advocated that Plum Creek consider setting a new standard of an overall net reduction of Floridan aquifer groundwater use of up to 50%. Dr. Knight offered an example of this standard; if the Envision Alachua Project must utilize an average of 5 MGD of groundwater, then the project goal should be to offset that use by taking 5+2.5 or 7.5 MGD off-line on other properties. He suggested that a feasible water conservation approach to reducing net groundwater use would be converting irrigated agricultural land into non-irrigated forestry. Dr, Knight suggested as an alternative to meeting needs with groundwater that Envision Alachua try to not use any Floridan Aquifer groundwater at all, meeting needs through surface water and rainfall.

Water Sources

Panelists commented on the need to address the differences between water from various sources. Not all water is the same; when water is withdrawn from the aquifer and discharged to the surface, surface water system chemistry is affected.

Dr. Wendy Graham noted that taking water out of the Floridan aquifer and returning it to surface streams and wetlands may have undesired consequences due to differences in created in hydroperiods and water quality. She believes that when groundwater is withdrawn as a source, it should be treated to high quality and returned to the aquifer.

Nutrients and Nutrient Load

Panelist noted that since the water management strategy includes a focus on water reuse, it should also include a focus on nutrient load in treated wastewater. Reclaimed water used for irrigation has a nutrient load of nitrogen and phosphorus that needs to be considered in a nutrient budget to protect natural systems.

Water Distribution and Storage

There were questions as to whether Plum Creek was using new or existing facilities for distribution and collection. The graphics in the presentation showed one large facility. A consideration of energy use should be prominent in the analysis. Plum Creek should take an approach that minimizes potable water and wastewater pumping since it uses so much energy. Energy costs are likely to increase in the future and the location of water facilities will be a substantial component of energy needs. A decentralized approach may work better since it is more energy efficient. One approach is where everyone collects rainwater and deals with their own wastewater. Another approach is a neighborhood-based system where pumping is minimal because water doesn't have to travel far.

Dr. Knight described the difficulties of using natural wetlands for water storage. The current regulations have high standards which require reclaimed wastewater to be thoroughly treated before discharge to natural wetlands. He commented that some of the natural wetlands in the region are already affected by excessive groundwater use. For example, the natural wetlands at Orange Lake have been unnaturally dry due to regional lowering of the aquifer levels. This is also common to many of the region's lakes. Redirecting used or reclaimed water to wetlands can be done, but must be approached carefully. The water storage capacity of these wetlands is great and there is a high potential for net ecological benefit.

It was recommended that stormwater be approached the same way—likely to be beneficial at a smaller scale. The preferred natural wetlands for storage are cypress systems due to their reduced rate of evapotranspiration. If there are available cypress wetlands, then that might be a better place to store water.

Wastewater Management

Dr. Treavor Boyer suggested that Plum Creek take a look at how much potable water is needed for waste management; conventional wastewater systems have a small volume of waste dictating a significant volume of wastewater. He explained that domestic wastewater is driven by the nitrogen in urine, which generates 1% of flow and 90% of nitrogen in the system. He suggested considering dual systems for both separating sources and distributing reuse water. He urged applying the "right water for right use" principle to wastewater and considering ways to capture nitrogen and phosphorus through decentralized or satellite water treatment, especially for wastewater. Dr. Boyer noted that the 50-year timeframe allows this thinking to be a reality.

Water Supply Data Sources

Dr. Knight had specific comments about some of the data sources and how they were used. He questioned including the high end of the range for water usage in calculations as a conflict with Plum Creek's commitment to a new water ethic. Plum Creek responded that the report was done before all the policies were finalized and they are now working to determining what the water usage will be with all the policies in place.

Dr. Knight also questioned the accuracy of the data used in the water supply analysis. He believes the Floridan Aquifer system is over-permitted and over-used and disagrees with the thinking that there is any additional capacity. He further stated that:

- Current pumping is about 2.4 billion gallons per day, with existing permits for 4.6 billion gallons per day.
- Lowered Floridan aquifer levels are putting stress on surface water systems throughout North Florida, including Silver Springs.
- Existing maps indicate that some or all of the Envision Alachua area is located in the springshed of Silver Springs.
- Silver Springs' average flows are already reduced more than 30% due to regional groundwater pumping.
- The St. Johns River Water Management District is establishing minimum flows and levels for Silver Springs that indicate there is less than 2 MGD available for permitting, but analyses conducted by the Florida Springs Institute indicate that Silver Springs is well past the point of significant harm and that there is no capacity for additional groundwater uses.

Dr. Knight also stated that the Floridan is a single aquifer, with strong hydrologic connections between the upper and lower portions of the aquifer. While they are separated in some areas by a confining layer, there is variable presence/absence and permeability of that confining layer, and therefore the upper and lower parts of the Floridan aquifer are hydraulically connected. If water is pumped from the Lower Floridan aquifer, water from the Upper Floridan Aquifer will leak down to replenish the void. As such, he believes the lower aquifer should not be considered as an alternative source of water.

Irrigation Policy

Panelists agree that the policy to restrict the use of potable water for irrigation will achieve significant results. However, it was noted that we also know from pilot projects and some limited research that when you restrict irrigation, some people will still find a way to irrigate. Many people will not accept the appearance of native landscape year-round and will use potable water to support landscape they find more appealing. Landscape choices are programmed in our culture and it may take the same types of efforts that were used to inform people about the dangers of smoking. Taxes that increased the cost of cigarettes and a strong educational effort have led to a significant decrease in the number of people who smoke in the US. This same approach may need to be applied to water usage on a broader scale to achieve the reductions in use that are desired in the county and throughout the state.

Weighting Criteria for Alternatives

There were several questions about how the options were evaluated using the weighted criteria. The reply was that it was based on open discussion with the water team over the course of three workshops. Panelists commented that the use of high, medium and low ratings for the evaluative criteria resulted in minimal differences between several options, making choices too close to call in some cases. They recommended that the analysis of how each alternative met the criteria be more explicit and more fine-grained in scoring so the differences between alternative would be clearer and greater separation of alternatives might emerge.

Performance Monitoring

Panelists agreed that the commitment to monitoring using quantitative metrics was very important, along with adapting to what we learn from the information. It was recommended that performance measures and monitoring efforts, including energy efficiency, water use, and water quality be enhanced to provide feedback to the water management planning and development over the project planning period. There is potential to have this project serve as a laboratory so that progress can be measured and needed adaptations identified. That would be a huge win.

Reclaimed Water

It was noted that there is a discrepancy between the amount of reclaimed water available and that needed for irrigation. This was not addressed fully in the report. If we use reclaimed water for residential, will there be enough for the other uses or can we not direct the use of reclaimed water toward agriculture uses?

Agriculture

Panelists expressed a range of opinions on agriculture, including silviculture. There were some supportive comments for continuing the use of the lands for silviculture since water use for trees is relatively low compared to the potential use of other crops. Another observed that growing trees does nothing to meet local food needs and there is a growing interest in and demand for locally grown food. One panelist summed it up with the comment that "we can't continue eating 7,000 mile salads." Tim Jackson noted that community participants in Envision Alachua made agriculture an important feature of the plan as a strategy to provide jobs for existing skilled workers, as well as a desire to provide locally grown produce.

There was discussion about the need to consider what to grow that is sustainable and compatible, and the need to consider both water and nutrients in the analysis.

Future Development under Present Land Development Regulations and the Comprehensive Plan.

Dr. Knight stated that for existing residents of the rural lands in Eastern and Northern Alachua County a land development pattern of one house on a minimum of five acres with wells and septic tanks was not considered to be as potentially harmful as an "urban and industrial/commercial center." He expressed a personal preference for development of the Envision Alachua lands under current zoning (one unit per 5 acres) over more compact urban centers with permanently conserved open space.

Future Residents

There were questions about who will live in the Envision Alachua communities and the relationship between the design of compact mixed use planned communities and the type of residents this lifestyle would appeal to. There were also questions about the market realities of a project with this many innovative features focused on water conservation.

Use of Flatwoods

Several panel members observed that developers in Florida have a propensity for horizontal development and moved it into different ecosystems as if this is a good thing, and that developers prefer a horizontal versus a vertical footprint. It was recommended that we test different development forms to see what yields the best results in this North Florida ecosystem. It was noted that flatwoods have drainage issues and - in this location - phosphatic soils that should be considered in designing the form of development and in construction techniques. There were also questions as to why Envision Alachua was proposing development in the flatwoods considering their difficult drainage issues.

50-Year Timeframe

Panelists agreed that the 50-year timeframe for the plan provides opportunity for Plum Creek to be innovative and possibly "utopian" in its approach to planning, and to design these lands to enable people to have a more sustainable lifestyle. Technological improvements may help achieve some of the goals, but we should not rely totally on technology to fix all our problems. Systems should be designed to be adaptable as new technologies become available.

Appendices

1. Agenda for March 14 Meeting
2. Resumes for Panelists
3. Meeting Summary prepared by Joan Chaplick
4. Written Comments from Dr. Robert Knight
5. Written Comments from Dr. Treavor Boyer
6. Written Comments from Dr. Joseli Macedo

AGENDA FOR MARCH 14 MEETING

APPENDIX 1

ENVISION ALACHUA

A community discussion on the future of East County

Envision Alachua Water Management Technical Advisory Panel (TAP)

Date: **March 14, 2014** Time: **8:30 AM – 1:00 PM (**Note: Time Changed**)**

AGENDA

8:30	**I.**	**Welcome and Introductions** A. Agenda Review B. Meeting Outcomes C. Brief Overview of Envision Alachua	Daniel Iacofano, MIG Sam Poole, Berger Singerman Steve Seibert, The Seibert Law Firm
8:45	**II.**	**Project Background Presentation** A. The Integrated Water Resource Management System B. Envision Alachua Sector Plan Water Policies C. Water Supply Data and Analysis D. Questions and Comments	Tim Jackson, Plum Creek Bryan McDonald, CH2M HILL Jeff Lehnen, CH2M HILL
10:00		B R E A K	
10:15	**III.**	**Panel Members' Responses to Key Questions and Recommendations** A. Are the assumptions in the integrated water resource management system plan reasonable? B. Are the results and recommendations in the plan reasonable? C. Do the proposed solutions appropriately address the key issues? D. Are there solutions which have not yet been considered? E. Is there additional data, analysis or research needed?	All
11:45	**IV.**	**Presentation and Discussion of Integrated Water Resource Alternatives Analysis**	All
12:30	**V.**	**Lunch and Summary, Next Steps and Closing Remarks**	Daniel Iacofano Sam Poole Steve Seibert
1:00		**Close...**	

RESUMES FOR PANELISTS

APPENDIX 2

Envision Alachua Water Management Technical Advisory Panel (TAP)

Participant Biographies

Facilitator

Daniel Iacofano, Ph.D., FAICP, ASLA
Principal/CEO, MIG, Inc.

Education
- Ph.D., Environmental Planning, University of California at Berkeley
- Masters of Science, Environmental Psychology, University of Surrey, England
- Bachelor of Urban Planning, Summa Cum Laude, University of Cincinnati

Daniel Iacofano is a founding principal of MIG with over 30 years of experience in facilitation and community outreach, urban and strategic planning and organizational development. He is nationally recognized as an expert and innovator in the areas of process design and management, public participation, consensus building, and facilitation, specifically for community and strategic planning projects. His projects have addressed issues ranging from environmental impacts and education to housing and economic development in a wide range of communities.

Mr. Iacofano has facilitated literally thousands of meetings as part of organizational and strategic planning projects for diverse groups of public and private sector clients that have significant impacts on the physical environment. He combines a deep knowledge of environmental planning theory and practice with an inclusive process to build consensus around a common vision. His training techniques for all levels of management and staff in strategic planning, team building and performance evaluation have been fundamental in developing over 50 strategic plans for organizations in the areas of landscape architecture, environmental and land use planning, economic revitalization, higher education and corporate operations. These include the ASLA, Landscape Architectural Foundation, the National Parks Service's Pacific West Region, City of Portland, San Francisco Planning and Urban Research Association (SPUR) and Schools of Design at California State University, California Polytechnic University at San Luis Obispo and Pomona, Texas State Technical College, University of Texas at Austin, Georgia Institute of Technology, and Texas A&M.

Mr. Iacofano's work has been recognized by the American Planning Association, Environmental Design Research Association, National League of Cities, International Downtown Association and American Society of Landscape Architects. He has been a visiting lecturer at several universities and has written and lectured extensively in the United States and abroad. He is author of *Public Involvement as an Organizational Development Process; Meeting of the Minds: A Guide to Successful Meeting Facilitation* and *The Inclusive City*, a collection of project studies highlighting the best of universal, inclusive design for buildings, neighborhoods and urban spaces.

Presenters

Sam Poole
Berger Singerman

Sam Poole has extensive experience in planning and zoning in the development and redevelopment of Florida's cities. He has over 25 years of experience addressing both conventional and new urbanism land development issues in Florida. Working statewide for both private and public sector clients, Sam has prepared comprehensive plans, plan amendments, and land use codes enabling development of conventional as well as mixed use new urbanism projects from towns to neighborhoods to individual buildings. Sam has particular skills dealing with environmental constraints impacting the use of land and water. He served as Executive Director of the South Florida Water Management District from 1994 to 1999, where he directed a staff of 1700 with annual budgets of $500 million to restore the Everglades and protect South Florida's water supply and flood mitigation system.

Education

- J.D., *cum laude*, Northwestern University Law School
- Master of Regional Planning, University of Pennsylvania
- B.S., Forestry, *cum laude*, University of Florida

Awards & Recognition

- *Chambers & Partners USA, America's Leading Business Lawyers*, Environment-Florida (2012)
- *Florida's Super Lawyers* (2007-2009)
- Selected "Most Effective Lawyer" by South Florida *Daily Business Review*, 2005
- *South Florida Legal Guide* "Top Lawyer" (2007-2009; 2011-2013)
- University of Florida "Distinguished Alumnus" 2000 AV® Preeminent™ rated by Martindale-Hubbell

Tim Jackson, P.E.
Director, Real Estate, Plum Creek

Tim serves as a Director of Real Estate for Plum Creek in Gainesville, Florida, and is currently engaged in advancing the Envision Alachua Sector Plan. He formerly served as President of Glatting Jackson, Inc. a community planning firm where he spent 27 years in private practice. With more than 35 years of experience, Tim has helped public and private clients by creating innovative solutions for great cities. Tim's work in community design, regional planning and visioning, masterplanning, integrated land use and transportation planning, context sensitive solutions, and livable transportation helps communities throughout North America become more connected, economically vibrant and sustainable.

Tim currently serves as Chairman of the Board of 1000 Friends of Florida, a private not-for-profit corporation that has been advocating for smart growth since 1986. Over his past 20 years on the Board, he led the organization's development of the Florida 2060 Plan, and has served on numerous advisory committees including the ULI Committee on Regional Cooperation in 2005, and the Leadership Committees for the Florida Transportation Plan 2025 Update and 2050 Plan.

He is an active member of the American Society of Civil Engineers. Activities have included co-chair of the 1999 and 2006 Specialty Conferences on Context Sensitive Solutions, co-chair of the Environmental Issues committee (1993 – 2010), and steering committee for the 2011 and 2013 Green Streets and Highways Specialty Conferences. He was the 2011 winner of the Wilbur Smith Award.

Tim was born and raised in Brandon, Florida. He holds a Bachelor of Civil Engineering and a Master of City Planning from the Georgia Institute of Technology, and a Master of Planning from Florida State University.

Presenters (continued)

Steve Seibert

The Seibert Law Firm

Steven M. Seibert is a 1977 graduate of The George Washington University, where he was chosen for Phi Beta Kappa, and is a 1980 graduate of the law school at the University of Florida. For the succeeding decade, he practiced environmental and land use law in both the public and private sectors.

Seibert was elected to the Pinellas County (FL) Commission in 1992 and served as its Chairperson twice. He chaired or sat on several regional and statewide committees, usually dealing with water, transportation, land use or environmental issues.

After re-election in 1996, Steve was asked to lead Florida's Department of Community Affairs and served in that capacity from 1999-2003. In the following years, Seibert has operated his own law firm, served as the initial Executive Director of the Century Commission for a Sustainable Florida and as a Senior Vice President and Director of Strategic Visioning for the non-partisan "think tank," the Collins Center for Public Policy.

In 2013, Seibert co-founded triSect, LLC, a strategy consulting firm which brings together the business, government and independent sectors to solve community challenges.

Steve Seibert has been a Florida Supreme Court certified mediator for 20 years and has gained a statewide reputation for helping to resolve contentious public and private sector disputes. He was awarded the statewide "Excellence in Mediation Award" and was significantly involved in helping to broker the end of the Tampa Bay "water wars." Seibert received the 2013 Bill Sadowski Memorial Public Service Award from the Environmental and Land Use Section of the Florida Bar.

Bryan McDonald, P.G.

CH2M Hill

Bryan is a hydrogeologist and project manager in the Gainesville, Florida office, with 25 years of experience with CH2M Hill. Bryan also serves as a client services manager, operations leader and was the project delivery leader for the Florida water business group from 2003 to 2009. Bryan has completed groundwater resource and other projects throughout the southeastern US including SC, NC, GA, FL, and LA. He specializes in groundwater supply development and Aquifer Storage Recovery (ASR). He has completed numerous presentations on ASR technology. Bryan has also managed many other type projects including stormwater, utility privatization, engineering design and organizational assessment.

Presenters (continued)

Jeffrey D. Lehnen
Senior Hydrogeologist, CH2M Hill

Years of Relevant Experience: 36
Education: B.S., Geology, University of Florida
Professional Registration: Professional Geologist: FL (#447)

Jeff is a senior hydrogeologist in CH2M HILL's Gainesville office. He has more than 36 years of experience in water resource planning and the design, construction, and testing of Floridan aquifer water supply wells, Class I and V deep injection wells, ASR wells, and monitoring wells in Florida. Jeff has contributed to continuing efforts by SJRWMD to develop a rational Water Supply Plan that addresses regional water supply issues while impacting all users fairly. His participation in SJRWMD's Modeling Subgroup and MFL committees helped influence the District's policy decisions through the use of sound science.

Jeff has served as the principal investigator of dozens of studies, field tests, designs, permitting, construction, drilling, testing, reporting, of groundwater projects throughout Florida. These include: water use permitting projects, wellfield water quality, water supply alternatives, development, wellfield optimization, well head protection, groundwater modeling, ASR feasibility tool development, design, rehabilitation, acidization, construction and testing of Floridan aquifer and Cretaceous wells.

This work has been performed for clients throughout Florida that include projects for JEA, GRU, Ocala, Okaloosa County, Progress Energy Levy Nuclear, JEA Brandy Branch, Fort Meyers, Florida Keys Aqueduct Authority, Cooper City, Sunrise, Palm Coast, Gulf Power, Air Products, Pratt and Whitney, West Melbourne, BP Highlands County, SFWMD, SJRWMD, Manatee County, Miami Dade Water and Sewer Authority.

He is experienced with water quality characterization, geophysical logging, and diagnostic well testing, groundwater flow models, seismic testing, well hydraulic tests, packer pumping tests, and geophysical techniques to evaluate hydrogeologic conditions, determine sources of brackish water, and to optimize the design of water supply, injection, ASR, and monitoring wells.

Panel Members

Glenn Acomb, FASLA

Senior Lecturer, Department of Landscape Architecture, University of Florida

Education

- MLA, Harvard University, 1978
- BLA, Louisiana State University, 1972

Areas of Expertise

- Green Infrastructure and Low Impact Development
- Green Roofs and Vegetated Walls
- Low Impact Development
- Sustainable Community Design
- Sustainable Construction
- Water Conservation in the Site and Landscape

Teaching

Mr. Acomb has been teaching at the University of Florida since 1996. In 2009, he was selected as the College of Design, Construction and Planning's "Teacher of the Year," and in 2011, he was awarded the college's FRSA/Earl Blank Fellowship to enhance roofing technology.

Research Interests

Mr. Acomb has participated in numerous past research grants that provided assistance to State Agencies, national trade organizations, and community groups to provide assistance in creating sustainable design standards, exploring sustainable solutions to site design through water conservation, and exploring green roof technology. Examples include the National Association of Home Builders, Florida Department of Transportation, U.S. EPA, the St. Johns River Water Management District, the Suwannee River Water Management District, and the Florida Chapter of the American Society of Landscape Architects.

Current research activities involve researching new selections of green roof media and plant materials for projects in sub-tropical climates; wind uplift on green roofs for hurricane regions' building codes; and the performance of design and plant selections in LID stormwater devices in Florida.

Areas of Specialization

Sustainable Community Design and Land Development

In 2003, Mr. Acomb co-founded the "Program for Resource Efficient Communities (PREC)," a cross-college, multidisciplinary group of faculty that conducts outreach and research of sustainability measures in community design and land development practices.

Panel Members (continued)

Treavor Boyer

Assistant Professor, Environmental Engineering Sciences, University of Florida

Education

Ph.D., Environmental Engineering, University of North Carolina at Chapel Hill

My research interests include physical-chemical processes in natural and engineered aquatic systems, with a focus on studying the impact of natural organic matter. Past and current research includes removing disinfection byproduct precursors by coagulation and ion exchange; using ion exchange to remove natural organic matter and hardness; applying physical-chemical treatment to waste streams, such as membrane concentrate and landfill leachate; evaluating selective phosphorus removal; and modeling physical-chemical unit processes. My overall research program has two primary goals: (1) to elucidate the role of natural organic matter in physicochemical processes and (2) to understand water quality and water treatment in Florida. The basis for Goal 1 is primarily fundamental aquatic chemistry. I have two projects underway that address Goal 1. These projects are "Removal of Natural Organic Matter and Hardness by Combined Ion Exchange Treatment" and "Profiling Changes in Natural Organic Matter through Physical-Chemical and Biological Processes". The basis for Goal 2 is principally process engineering. I have two projects underway that address Goal 2. These projects are "Evaluation of Non-Chloride Ion Exchange Treatment" and "Sustainable Removal of Phosphorus from Surface Water". The projects for Goal 2 are based on water quality and water treatment problems identified in Florida; however, the results of this research are also applicable to aquatic systems outside of Florida. I believe that the goals of my research program provide a unified framework for studying natural and engineered water systems.

Panel Members (continued)

Mark W. Clark

Associate Professor, Wetland Ecology
Wetland Biogeochemistry Laboratory
Wetland Extension Program
University of Florida

Departmental Research Areas

- Soil Quality/Ecosystem Services
- Soil/Landscape Analysis
- Wetlands and Aquatic Systems

Research Focus

Wetland nutrient assimilation and storage processes, vegetative succession dynamics, wetland macrophyte ecophysiology, and ecological engineering design using wetland processes to improve water quality and enhance ecological function of altered landscapes.

Courses Taught

- SWS 4244 - Wetlands
- SWS 5235 - South Florida Ecosystem Services
- SWS 5242 - Wetlands and Water Quality
- SWS 6932 - Wetlands and Watersheds Seminar

Select Publications

- Otto, G. M., M. W. Clark, T. J. Walker and T. L. Crisman, 1998. Reintroduction of wetland functions to the urban landscape: The Stormwater Ecological Enhancement Project. Proceedings from the XXVII International Association of Theoretical and Applied Limnology Congress, August 8-14, Dublin, Ireland.
- Lapointe B. E. and M. W. Clark, 1992. Nutrient inputs from the watershed and coastal eutrophication in the Florida Keys. Estuaries 15(4):465-476.
- Bennet, F., M. W. Clark, and T. L. Crisman (Submitted, Ecological Engineering). Effect of wetland vegetation on infiltration of stormwater basins.

Wendy D. Graham, Ph.D.

Education

- B.S.E. Environmental Engineering, University of Florida, 1981
- Ph.D. Civil Engineering, Massachusetts Institute of Technology, 1989

Wendy D. Graham is the Carl S. Swisher Eminent Scholar in Water Resources in the Department of Agricultural and Biological Engineering at the University of Florida and Director of the University of Florida Water Institute. She graduated from the University of Florida with a Bachelor's degree in Environmental Engineering. Her PhD is in Civil Engineering from the Massachusetts Institute of Technology. She conducts research in the areas of coupled hydrologic-water quality- ecosystem modeling; water resources evaluation and remediation; evaluation of impacts of agricultural production on surface and groundwater quality; and development of hydrologic indicators of ecosystem status. She has served as PI or co-PI on over $11 million in grants and contracts, has supervised 30 doctoral and master's thesis committees and has served on an additional 45 graduate student committees.

Panel Members (continued)

Dr. Robert L. Knight
President, Howard T. Odum Florida Springs Institute

Bob Knight is an environmental scientist with more than 35 years of professional experience in Florida. He is the founder of the Howard T. Odum Florida Springs Institute. Bob is also an adjunct professor in the Department of Environmental Engineering Sciences at the University of Florida where he teaches a graduate-level course on the ecology of springs.

He is currently active on restoration efforts for the Santa Fe River springs, Kings Bay/Crystal River springs, Ichetucknee Springs, Rainbow Springs, and Silver Springs, and is on the Board of Directors for both the Silver River Alliance and the Wakulla Springs Alliance, two citizen advocacy organizations.

Joseli Macedo, Ph.D., AICP
Associate Professor and Interim Chair
Department of Urban and Regional Planning, University of Florida

Education
- Ph.D.,Architecture, University of Florida, Gainesville, Florida, 2000
- M.C.P., Community Planning, University of Cincinnati, Cincinnati, Ohio, 1992
- B.Arch., Architecture and Urbanism, Universidade Federal do Paraná, 1985

Areas of Expertise
- Community Planning
- Cross-Cultural Design
- Global Contexts
- Housing Studies
- International Planning
- Sustainability
- Urban Design

Teaching
- DCP 7790: Philosophy of Inquiry
- URP 6341: Urban Design Studio
- URP 6905: Urban Planning & Design in Brazil

Research Interests
- Informal Settlements
- Human Settlements in Riparian Areas
- Urban Planning Pedagogy

Centers
- Center for International Design and Planning
- Center for Latin American Studies
- International Center

MEETING SUMMARY PREPARED BY JOAN CHAPLICK

APPENDIX 3

Envision Alachua Phase III Water Management Technical Advisory Panel

Summary of March 14, 2014 Meeting

Prepared by

MIG, Inc.

June 2014

in support of the Envision Alachua process convened by Plum Creek

Background

On Friday, March 14, 2014, Plum Creek convened the Envision Alachua Water Management Technical Advisory Panel (TAP). The purpose of the panel was to provide advice and direction on the water and wastewater management strategies in the Envision Alachua Long Term Master Plan. Panelists were asked to review background materials in advance of the meeting. These included: background information on the Envision Alachua Vision and Goals for Environmental Conservation and Water and Envision Alachua Sector Plan (EASP) Comprehensive Plan Amendment application; The Integrated Water Resource Management System Based on the Envision Alachua *Vision, Goals and Guiding Principles;* EASP proposed water policies; EASP Water Supply Data and Analysis report; and the Integrated Water Resource Alternatives Analysis prepared by CH2M Hill.

Plum Creek convened the panel for the purpose of getting feedback from a variety of water and land use planning experts on the water management strategy for the proposed Long Term Master Plan (LTMP). Plum Creek intends to use this information to improve its application and increase its ability to achieve the goals and planning principles described in the Vision document prepared in 2012 with input from the Envision Alachua Task Force.

The following participants were present:

Panelists

- Glenn Acomb, FASLA, Department of Landscape Architecture, University of Florida
- Treavor Boyer, Ph.D., Environmental Engineering Sciences, University of Florida
- Mark W. Clark, Ph.D., Soil and Water Science Department, University of Florida
- Wendy D. Graham, Ph.D., University of Florida Water Institute
- Robert L. Knight, Ph.D., Howard T. Odum Florida Springs Institute
- Joseli Macedo, Ph.D., AICP, Department of Urban and Regional Planning, University of Florida

Other Participants and Presenters

- Sam Poole, Berger Singerman
- Steve Seibert, The Seibert Law Firm
- Rob Olszewski, Plum Creek
- Jeff Lehnen, CH2M Hill
- Greg Galpin, Plum Creek
- Pierce Jones, Ph.D., Institute of Food and Agricultural Sciences, University of Florida
- Bryan McDonald, CH2M Hill
- Tim Jackson, Plum Creek
- Daniel Iacofano, MIG, Inc.

I. Welcome and Introductions

Daniel Iacofano, CEO and Principal of MIG, Inc., Lead Facilitator for the Envision Alachua process, opened the meeting and welcomed the participants. He asked participants to conduct self-introductions. He then briefly reviewed the agenda and meeting format. He emphasized the key questions he wanted the group to keep in mind as they heard the presentations. These were as follows:

- Are the assumptions in the integrated water resource management system plan reasonable?
- Are the results and recommendations in the plan reasonable?
- Do the proposed solutions appropriately address the key issues?
- Are there solutions that have not yet been considered?
- Is there additional data, analysis or research needed?

Daniel then reviewed the planned TAP process:

- March 14, 2014: Panel convenes
- Co-chairs prepare meeting summary
- April 2014: Panel members review summary and respond
- April 2014: Co-chairs edit and finalize comment summary based on water Panel member review and forward document to Water Technical Team to use as a basis for further planning.

Following Daniel's introduction, Sam Poole, TAP co-chair, made opening remarks referencing the 1985 Growth Management Act and its influence on the state. He described how this effort by Plum Creek is intended to transform the outcome of population and job growth. We are now looking at a 50-year plan horizon. Our objective is to create a sustainable quality of life in Eastern Alachua County and be sustainable while avoiding the pitfalls of unplanned growth that have occurred in the western half of the County.

Steve Seibert, TAP co-chair, shared that he comes to this work from a land use planning perspective. He highlighted how this planning project is different from others in the past because it reflects what the community wants. Through Envision Alachua, Plum Creek engaged a very diverse group of county residents and asked them to think about what they want to happen over the next 50 years. It was a remarkably committed group of people that has remained actively involved for almost 3 years. When the Envision Alachua effort started in 2011, there were no specific areas targeted for development. The Envision Alachua Community Task Force identified the locations that are now being discussed as sites for development. The goals used to develop the strategy are not abstract; they came from the community, whose input is taken very seriously.

II. Project Background Presentation

Following Steve' remarks, Daniel provided a brief overview of the Envision Alachua planning process. He introduced participants to Plum Creek with maps showing their national, state-wide and county-wide landholdings.

The Envision Alachua process was convened, in part, based on comments by County staff suggesting to Plum Creek that they provide a master plan for their lands in the County. The current zoning allows the building of one residential unit per five acres. Plum Creek thought that this land use could be improved upon, and convened Envision Alachua to consider critical needs of the community and determine if and how the Plum Creek lands could play a part in helping address these needs.

The Task Force established a set of guiding principles for the Envision Alachua planning process, as follows:

- A holistic approach to sustainable conservation and economic development
- An opportunity for a unique partnership and collaboration between the public and private sectors
- An open dialogue with the community representing economic development, business, local government, education, conservation and communities in Alachua County

Envision Alachua is a three-phase effort. Phase I resulted in the creation of the Envision Alachua Vision, Goals and Planning Principles for Plum Creek lands in Alachua County. Phase II resulted in Plum Creek's submittal of the EASP application to the County. Phase III is currently underway. The Sector Plan application is under review, and work is beginning on Detailed Area Specific Plans for the initial areas to be developed.

Daniel then provided a brief summary of the extensive community engagement effort that has taken place. He also suggested that participants visit the project website at www.EnvisionAlachua.com.

The Phase I process yielded a Vision document, which describes the shift from a rural residential pattern to one with compact development and an emphasis on economic opportunity, along with large scale conservation. It is an economically-driven plan, as opposed to residential, which is more commonplace. The plan is job-oriented, with the goal of capturing and retaining the intellectual capital that is coming out of the University of Florida (UF) and other local educational institutions. The plan also features a substantial conservation component.

Daniel also reviewed the LTMP and related land uses that are in the Sector Plan application, submitted to the County in mid-December 2013. The Sector Plan process requires that plans include four main land use categories. Daniel reviewed the land uses in the LTMP, which include employment-oriented mixed use, rural, conservation and agriculture.
Daniel described how the plan will attract companies to build on our existing strengths and promote an "economic progress corridor" connecting local resources such as UF, Santa Fe College and the Innovation District through east Gainesville to Hawthorne, concentrating new employers in a more accessible way. He also showed a map that demonstrated how the additional conservation lands included in the plan will help complete the "Emerald Necklace" around Gainesville. He reviewed pie charts that summarize the distribution of acreage in the plan, with 87% of lands being designated for conservation, agriculture and open space.

In the process, agriculture has emerged as a key sector, and we have the opportunity to create an agritechnology hub. He also reminded the panel that the buildout for the plan will take place over 50 years. He cited examples of similar economic development processes, such as Austin, Texas and Research Triangle Park in North Carolina, to show how it takes a while for progress like this to evolve.

Daniel briefly described the landscape linkages that will be supported by the plan, and then reviewed the allowable uses in each of the four land use categories. He commented on several of these, noting that some uses, such as industrial, have changed in nature and are now much cleaner, and therefore more desirable to live near, than in the past. He also commented on how the plan protects the rural character of the land and the historic nature of communities such as Windsor.

Daniel reviewed the land use program and related assumptions that helped inform the water analysis. He reviewed several proposed policies to help show how Plum Creek will bring this to life. The development is compact and integrated - a completely different prototype from typical developments.

He then introduced Tim Jackson, Plum Creek, who provided an overview of concepts for water management in the plan. He reviewed the goal and planning principles for water use that are included in the Vision document. Plum Creek wants to provide leadership and set an example for how water is used. In order to translate these aspirations into reality, Plum Creek formed a Water Technical Team to create the Integrated Water Resource Management Plan.

The team proposes a new water ethic standard for its lands, based on the following principles:

- Conservation first
- Right water for the right use
- Efficiency of use
- Source protection and restoration
- Performance monitoring over 50 years

Tim showed a Water Management Concept Diagram, intended to cover the entire 60,000 acres in the Sector Plan. Rainwater and groundwater will be conserved, harvested and captured for other uses. Stored water, as well as treated wastewater, will be put into uses including natural systems, agriculture, industry, focused irrigation and created wetlands. As water is used, it is returned to the groundwater system.

As part of the Sector Plan, a series of water policies were developed based on the Water Management Concept. These include:

- The use of large water storage facilities for water harvesting and capture shall be encouraged.
- All agriculture and silviculture activities shall follow the most recent applicable best management practices. It is recognized that this policy:
    - Removes one home per five acre land use on 25,000+ acres and allows no wells or septic tanks.
    - Removes intense agriculture from 23,000+ acres.
- The priority for use of reclaimed water shall be given to environmental restoration

projects, industrial users and agricultural users.
- State-of-the-art system components (e.g., water recycling) shall be incorporated where appropriate and feasible.
- Residential lots shall not be irrigated with potable water (except for a limited period during the initial establishment of landscaping).
- There shall be no individual wells for individual residences or businesses. All wells within the employment-oriented mixed use areas shall be regulated as part of the utility system.
- The use of Florida-Friendly plant species shall be required for landscaping within the employment-oriented mixed use areas, with a preference for native species.
- Identify one or more regionally significant water quality improvement projects that aim to reduce existing watershed impairments of Lake Lochloosa, that is, to provide nutrient reduction below the existing baseline condition.

To help illustrate what can be achieved by prohibiting the use of potable water to irrigate landscaping in residential areas, Pierce Jones showed a chart summarizing a study of a sample of 2,338 Alachua County single family homes built since 2000. With sprinkler systems, these houses use 358 gallons per day. He also identified 697 local single family homes without sprinkler systems, which used an average of 190 gallons per day. The main point he emphasized was that eliminating water usage for irrigation substantially reduced average daily water usage. Water use in apartments and condominiums was even lower with the apartment users averaging 119 gallons per day and condominium users averaging 94 gallons per day.

With regard to identification of water quality improvement projects to reduce watershed impairments at Lake Lochloosa, Tim showed a map of the drainage basins and the position of Plum Creek's lands in relation to them. A second map showed the "Regional Pollutant Load Reduction Alternative," demonstrating how water can be stored and treated. Possible strategies include treating water from the creek and an alum treatment facility located near Lochloosa Lake.

Tim explained that these policies also address how they can be implemented as part of the future Detailed Specific Area Plans (DSAP). He noted the areas identified for the possible location of the first two DSAPs, which are near Hawthorne and East Gainesville, adjacent to SR 20. He shared a few example concepts of what those two DSAPs might look like. The DSAP concepts that he showed were shared for informational purposes only; they are not part of the EASP.

These policies also include the following related to stormwater:
- The use of Low Impact Development techniques are allowed and encouraged. This includes:
    - Vegetated swales
    - Bioretention, rain gardens
    - Shade trees
    - Permeable pavements
    - Narrow street widths
    - Eliminate curb, gutter
    - Shared driveways, parking
    - Rainwater harvesting

- Rooftop run-off
- Education on maintenance

Finally, Tim provided a summary of Envision Alachua's water resources and supply leadership/ethic:

- Conservation first
- Integrated water supply, wastewater, stormwater, natural systems
- State of the art conservation, treatment, delivery
- Reduce conventional water use by 50%

Following Tim's presentation, Daniel asked if there were any comments or clarifying questions.

Glenn Acomb asked about the metrics that will be used to determine if the 50% reduction described in the Task Force goals has been achieved. He inquired if Plum Creek had used a best case scenario for the estimates. Tim responded that Plum Creek is seeking the panel's ideas to make the policies stronger. Dealing with the issues involved in irrigation and agriculture are two big steps. The policy language says "encourage," not "require." He noted that the specifics are not yet designed, and that we are open to guidance.

Robert Knight asked for clarification of the acreage—the Water Management Concept Diagram talks about 60,000 acres, but it was stated that Plum Creek owns 65,000 acres in the County. Tim explained that the Sector Plan excludes the 5,000 acres that are located within the cities of Gainesville and Hawthorne. Robert also suggested that it would have been helpful to receive the process summary materials in advance of the meeting.

Mark Clark wanted to know, how definitive are these goals? Tim responded that the policies were established to achieve the goals and they are definitive. He explained that if we allow any irrigation it will influence what is on site. We have some flexibility on irrigation, for example, to help establish plants, but the policy of not using potable water is definitive.

Mark also inquired about reuse water. Will it be used for landscaping or will it be redirected to other uses? Tim explained that it will first be directed to natural systems, then industrial, followed by agricultural uses. Tim asked if Plum Creek's policy should go further and say that no reuse will be directed toward landscaping. Mark responded that if the goal is ultimately not to have landscaping dependent on irrigation and instead only dependent on rainfall then no in-ground irrigation infrastructure should be put in place, reuse or otherwise. Instead, select vegetation that can survive under natural rainfall patterns and be cognizant of soil and natural groundwater conditions when determining species selection. There are plenty of examples of species that are adapted to the site.

Wendy Graham requested that at some point the group discuss large water storage and dispersed water storage. She noted that the graphic in the PowerPoint featured a large-scale storage unit. Is that the only type of storage we are considering? If not, we may want to change the graphic we use.

Joseli Macedo stated that she wanted to hear more about the housing and jobs equation and how that came about. It was explained that East Gainesville and Hawthorne have undeveloped areas and available housing. The housing deficit in the plan was intentional and was intended to provide an incentive for new residents to join these communities where there is significant capacity in the existing neighborhoods. The area will be well- served by transit and help balance an imbalanced situation. It's necessary to connect the surrounding neighborhoods. Steve Seibert added that this is not a retirement community—it's about jobs.

Joseli also expressed concern that the policy of allowing use of potable water for limited periods to establish vegetation is imprecise and it may not be practical to limit use of potable water in that way if potable watering systems are allowed.

Daniel then introduced Bryan McDonald from CH2M Hill, who gave a presentation on the water supply data and the analysis that was performed to develop a potential water supply and treatment process based on these policies. (See pages 32-42 of the presentation handout for more details.)

The analysis was completed based on four steps:

- Multiple workshops with the Water Technical Team
- Estimation of water demands, flows and loads
- Evaluation of Water Supply and Treatment, Wastewater Treatment and Reuse Alternatives Analysis
- Development of conceptual design

Next, they reviewed the proposed maximum employment-oriented land use program over 50 years and the assumptions that estimated numbers were based on, including: square footage for the different economic development and community uses; number of jobs; and number of homes.

They reviewed estimated water use projections, based on a maximum of 10,500 new housing units, plus use for schools, manufacturing, research and development and office facilities, and retail. They calculated low, medium and high totals for usage in order to have a range of projected numbers. A range of 2.56 to 7.85 million gallons per day (MGD) was estimated.

They estimated wastewater flow as well, using the same assumptions, and calculated a range from 2.31 to 6.48 MGD. They also estimated irrigation demands. These estimates range from 1.1 to 5.7 MGD, with the low estimate based on the assumption that irrigation would be used for common areas and the high estimate based on the assumption that irrigation would be used for common areas and agriculture.

Next, Bryan described the alternatives analysis for the integrated water resources system that included the following steps:

- Completion of an alternatives analysis process including water supply options and wastewater treatment options
    - Included stormwater, reclaimed water, and natural treatment with constructed and natural wetlands evaluated
- Evaluation of treatment methods, facilities location and phasing of construction

They began the alternatives analysis by reviewing the evaluation criteria and weighting factors for each criterion. These criteria included: achievement of the integrated water resources plan; relative lifecycle cost; the level of community support; environmental stewardship; flexibility; and difficulty with acquiring the necessary permitting.

Bryan went on to describe the preliminary water supply and treatment alternative developed by the CH2M Hill group. Initially, water supply will be drawn from the Upper Floridan aquifer, which has a known water quality and quantity. Their research has shown that there should be little or no impact up to 3 MGD. This will allow time for testing the Lower Floridan aquifer as a future source, and also allow flexibility regarding operations and phasing of treatment and nanofiltration systems. The future nanofiltration system will produce softer, more aesthetically pleasing water, and utilizing the Lower Floridan aquifer as a supplemental source is in line with federal and regional water management goals.

To further clarify this, Bryan showed a map of existing wells in the project area with and their sources, as well as a diagram of a cross section of the Upper Floridan aquifer, ranging from 150 feet down to the surface. He also showed a process flow diagram explaining how water from Upper and Lower Floridan wells is processed and where the water winds up. The diagram shows how some nanofiltration is used on water from Lower Floridan wells to produce a membrane concentrate for use in common areas and agricultural irrigation.

Bryan next showed a chart of estimated water treatment plant capacity and phasing. The chart showed the possible expansion of treatment facilities based on an assumption of linear growth. The following slide showed the potential layout of a water treatment plant, which could be located in a green site or in combination with development near Hawthorne. These slides showed how capacity could be expanded over time in four phases to meet project needs over 50 years.

The next stage of the alternatives analysis was to develop a preliminary wastewater treatment and reuse alternative. Wastewater treatment meeting public access reuse standards, with a constructed wetland for storage, will do the following:

- Utilize effluent for reuse
- Include constructed wetlands, providing community feature and opportunity for groundwater recharge
- Provide flexibility to collaborate with the City of Hawthorne and add facilities based on future demand
- Meet FDEP goals that encourage maximum reuse

Bryan showed a map demonstrating the possible layout of the Wastewater Alternative Concept. It included a constructed wetland as a public feature and storage for reused water, as well as identifying wetlands for limited wet weather discharge, if needed. He then displayed a process flow diagram showing how this reuse water would be processed and used. This included a provision for beneficial solids, that could be reused and kept on site. The chart which followed showed estimated wastewater treatment plant capacity and phasing over 50 years, assuming linear growth. Accompanying maps showed preliminary site plan layouts for the four phases of the water reclamation facility, which again could be located either in a green site or developed in conjunction with the City of Hawthorne.

Daniel asked if there were any questions or general comments from the group.

Wendy expressed that this strikes her as a very demand side-focused analysis. It spells out how much water we need and what the sources will be, rather than trying to determine the "hydrologic carrying capacity" of the site. She would like to see a water budget and know more about how we are establishing baseline information. It is based on existing forestry uses or the usage allowed under the current one residence per five acre zoning? She commented that we are removing water out of the aquifer and returning it to the surface; she considers this to be a disconnect since we are altering the water timing and quality delivered to surface systems.

Daniel asked if there was a recommended solution or approach. While we are unable to "leave no footprint" with the water usage, we can look into these concerns.

Mark noted that the analysis is focused on water reuse. We are treating the water to human contact standards, but we are not focusing on nutrient load. This may need to be addressed more strongly through a nutrient budget analysis.

Treavor Boyer asked if we are using new or existing facilities for distribution and collection. He noted that whatever approach is used, we should take an approach that minimizes pumping since it uses so much energy. Taking a decentralized approach may work better since it is more energy efficient. A consideration of energy use should be prominent in our analysis.

Glenn suggested that it would be useful to show a scenario with a more aggressive water budget and the urban form that achieves it. He also suggested showing a conventional alternative in comparison with a "shoot for the moon" alternative, then using this information to sort out the alternatives and related metrics.

In response, Daniel asked Dr. Pierce Jones to share more information about his current research. Pierce referenced the graphic from the presentation that showed daily water consumption based on the type of residence—single family, apartment and condominiums—and the significant drop in consumption. Single family residential water use includes water for irrigation. Once you remove the need for irrigation, water usage drops substantially. The chart provides a good indication of base demand.

Glenn suggested that we show the Union Street Station example and its related design and compare it with a more aggressive urban form that uses less water to help determine what is optimal. The comparison and related graphic would be very useful. He also noted that in the traditional urban form, there is little room for water capture. Daniel suggested that we do a test design and compare and contrast the two. This might be completed as a student project for Pierce's class.

Wendy asked if there was a per capita use goal or reduction. The response was that yes, a 50% reduction in use target was established by the Task Force. She asked for more explanation of what we would use to establish the target and how it would be applied. She also asked for similar metrics to help better understand the needs of agricultural and commercial usage Robert commented that he was troubled by CH2M HILL including the high end of the range in its charts since Plum Creek has committed to a new water ethic. He questioned why we were even showing this and wanted to know what the intended maximum numbers were. Tim responded that the report was done before all the policies were finalized. Now, with all the policies in place, we are determining what the high end of the range will be.

We would like that informed by this panel.
Mark wanted to know how quantitative the assessments were and how the weighting was achieved? Bryan explained that it was based on open discussion with the team over the course of three workshops.

III. Panel Members' Responses to Key Questions and Recommendations

After a short break, the group reconvened to begin a discussion of the five key questions:

- Are the assumptions in the integrated water resource management system plan reasonable?
- Are the results and recommendations in the plan reasonable?
- Do the proposed solutions appropriately address the key issues?
- Are there solutions that have not yet been considered?
- Are there additional data, analysis or research needed?

Daniel encouraged participants to be very direct, explaining that we are seeking to learn what we missed, not just receive validation of what we proposed.

Glenn described his comments as mostly "what-ifs." The area is largely flatwoods with very limited infiltration. The ability to return water to the system is limited. He suggested using an aggressive, best-case physical arrangement to further our analysis. He also suggested we look where we can harvest and store water in a big way to limit aquifer consumption.

He continued by saying that we know from pilot projects and some limited research that the more restriction of irrigable landscape, the better we control water consumption. Some people don't accept what the native landscape looks like in the dry season and will use potable water to ensure a more appealing landscape.

Reclaimed water still has nutrient load, which creates its own problems. There are positives and negatives associated with our approach and we have to anticipate what these are. He believes the biggest issue is trying to see if water budget can be visualized in a way that gets us closer to a limited withdrawal.

Daniel commented that we are so programmed in our culture regarding landscape preferences. Some social engineering may be needed to change these preferences. He gave an example of the change in social programming regarding smoking—how the number of people smoking in the US has been reduced dramatically through a combination of pricing, education and social pressure.

Glenn continued that people may find a way to defeat what we are advocating. We need to be smart about how we use native plants in landscaping, since people won't likely accept that as their only landscape choice. He also recommended that conservation and harvesting need to be pushed to the maximum.

Sam Poole asked if we have looked at how changes in water pricing will impact people's use. Currently, water is extremely low-cost. The answer is yes—and price is often the only factor that will significantly change how people use water. Pierce shared an example of how during times of poor air quality, mass transit is free in order to help get people out of their cars and reduce air quality impacts.

Robert noted that we have set some lofty goals and that now it is a matter of living up to them. He described what he thinks this process will require. Plum Creek's proposal is coming at a time when the resources of the Floridan aquifer are overly stressed and the whole Floridan aquifer is overtapped. We are also located in the springshed of Silver Springs, a resource that is particularly stressed. He commented that Silver Springs' flows are down 32% independent of the impact of rainfall fluctuations. The District is establishing minimum flows and levels for Silver Springs. He stated that the District has determined that Silver Springs has only three additional CFS to be tapped.

As such, he believes our use of the data is wrong. The system is overpermitted and overused. He disagrees with the thinking that there is 3 CFS of additional capacity. Current pumping is about 2.4 billion gallons per day, with existing permits for 4.65 billion gallons per day. He also noted that the Floridan aquifer is a single aquifer. Upper and lower are one and the same - if you pump from the lower, you induce recharge from the upper. While they are separated by a confinement layer, there is limited permeability between the two. The lower aquifer should not be considered an alternative source since it is the same as the upper.

He referenced the work of Cynthia Barnett, noting that she believes there needs to be a net water benefit. The project should have a net reduction in water use, and is the only responsible way to go.

He noted the District has allowed exploitation of the aquifer. There's a significant drawdown of the Floridan aquifer under the Murphree wellfield, and Plum Creek owns that wellfield.

The project has the ability to change water usage in Northern Florida by targeting a net reduction. Plum Creek can provide leadership and has enough land to make a difference. He would prefer that we had commitments rather than aspirations.

Daniel suggested that we are comparing the project versus the "no project alternative," which includes what is already entitled. Robert responded that we need some water balances. We must look at a predevelopment water balance, an existing water balance, a water balance for the current entitlements, and a future water balance based on the proposed land uses.

Robert continued that we are all overconsuming from the Floridan aquifer. We need to achieve more than "no net increase." We should instead focus on achieving a net reduction of 50%. For example, if Plum Creek will need 10 MGD, then Plum Creek should take 15 MGD off the table. Why not purchase existing agricultural land and convert it to forestry that is not irrigated? If we could manage not to use any ground water, we will have done enough. If you can live off surface water and rainfall, that would do it.

Daniel asked if it would be sufficient to take a phased approach and commit to weaning off the water. Robert's response was no, that it would not be sufficient since the impacts are real now, not at some point in the future.

Wendy commented that it is desirable to put the water back where it came from. We need to take into account that there is no free lunch. If you capture and use that water, it's coming from somewhere and the timing and quality of water release to natural systems is altered. We need to quantify the impacts of all alternatives.

Robert added that we also need to create a nutrient balance for nitrogen and phosphorus. The property is located in an area of impaired waters. He described how Orange Lake has a sink hole that feeds water to the south towards Silver and Rainbow Springs and puts that water right into the aquifer. He believes Plum Creek has the ability to create a net benefit and stop the use of fertilizer on its lands.

Rob Olszewski responded that Plum Creek provides one fertilizer treatment at very low levels during the whole rotation of the trees and that a rotation is 25 years. Robert responded that he thought the trees were treated three times during the rotation and he was pleased to hear they were only treated once.

Joseli prefaced her comments by saying that they were coming from taking a big picture view. She thought the goals were lofty and she encouraged that they be "even loftier." She compared the opportunity to what Disney originally proposed at the Epcot Center. Unfortunately, it turned out to be just a theme park. She wants to avoid another Seaside or Haille Plantation. She commented that even though Plum Creek owns the land, they won't be able to control human behavior. If we design it to enable people to have a more sustainable lifestyle—in a way that's different than the rest of Florida—that would be lofty indeed, bordering on utopian. She encouraged that, given our 50-year timeframe, we think "utopian" in our approach. She also cautioned Plum Creek not to rely on technology to fix all our problems. She suggested looking at the urban form and ways of controlling the environment without having control over it.

Communities that are walkable and bikeable attract people willing to live a different way. We need to attract these people and enable them to live more sustainably.

Daniel shared the design example of West Village in Davis, California. West Village's ability to achieve net zero energy use evolved over time during the planning process. Now it's built and is attracting people who want this ethic. It's still a small footprint—a population of 4,000-5,000 with high transit and bicycle use.

Joseli continued to note that everything affects water use. We also need to talk about how we address the energy needs and the solid waste that is generated. She asked if we can make composting mandatory.

Glenn wanted to know about the population that will live, work and play on these lands. What is our target profile? Daniel replied that we are envisioning the same people who live in Alachua County as participating. We know that both Hawthorne and east Gainesville residents would ideally like to live and work closer to home.

Tim responded that we are also seeking to attract the unique set of folks who need a large footprint for their advanced industrial and agrotechnology activities. The people who work in these industries want to be around other people who do related work.

Glenn wanted to know who will live here. The response is that approximately one-third will live and work here. Some will live here and work elsewhere. There will be some self-selection based on the unique pattern of development we are suggesting. It's easier to work from a clean slate and get the infrastructure right from the beginning. We won't be retrofitting.

Mark acknowledged the opportunity and value placed on public input. He noted that Plum Creek can set a new standard and set an example for those who need to retrofit. He didn't know how much you can make up for a lack of protection of ground water. The baseline we are benchmarking against will be critical information.

Mark noted that there has been no mention of climate change. At what point does this come into the modeling? He also noted the nutrient budget is really important. It has a present condition—how do we look at that as a benchmark, and how do we improve upon that? If we are irrigating with water that has nutrients in it, we are still adding nutrients to the system.

Mark also called out the 2,300 acres in agriculture and asked a number of questions. The most compatible use to achieve the proposed goals is likely silviculture. What are the expectations or goals for these proposed agricultural lands? Will the goal be to find a way to fit alternative agriculture into the system to minimize water use and nutrient loads by adapting agriculture to the present conditions or will it be to transform the land (by draining) to incorporate conventional forms of agriculture? Will it be to set strict water quality and quantity goals for these agricultural lands with the challenge being to develop new progressive production systems that are more compatible with the existing site conditions? How do we integrate the landscape with a cropping system that doesn't need drainage or irrigation? Can we? What are the types of crops that would work in these landscapes with minimal hydrologic manipulation and what would alternative agricultural look like on this land? Will it be local food production, or transformed into something else that has a more significant impact? Would the goal be to have no net use of water and zero discharge of nutrients? If we use reclaimed water for irrigation and fertilizer for crop production systems we may to rethink the level of treatment based on nutrient balance. Do we try to fit the crops into these constraints and work with IFAS to figure out what is compatible?

Treavor commented that energy use needs to be discussed more. It is a huge component of water. Its supply and treatment requires substantial energy. We know that the energy needed to move water is fixed, and the location of our facilities will dictate our energy costs.

Daniel asked if there was a pattern of where to put the pumping stations that would lead to lower use? Treavor responded that yes, there are exciting options for a more decentralized approach. One approach is where everyone collects water on their roof and deals with their own wastewater, or they rely on a neighborhood-based system where water doesn't have to travel very far and pumping is minimal. He recommended showing what a community could look like with decentralized facilities.

Treavor referenced the principle of using the right water in the right place. Essentially he estimates 50% of the demand for water is residential and 50% is advanced manufacturing. Our approach assumes that the uses require potable water.

Advanced manufacturing may not require potable water like residential uses do. We also assume the wastewater produced from advanced manufacturing is similar in volume and composition as residential waste water. This is not true. We understand the needs for the residential scenario. What does water look like for advanced manufacturing- what are its needs and what does it produce?

He continued that at household level, we need to consider how much potable water is needed. He explained that domestic wastewater is driven by urine, which is 1% of flow and 90% of the nitrogen in the waste stream. We have a small volume of waste responsible for a significant volume of wastewater. Can we look at dual distribution systems? Can we consider source separation?

He suggests applying the right water for right use principle to waste water. Can we look at "resource recovery" through decentralized or satellite water treatment, especially for wastewater, and capture nitrogen and phosphorus? The 50 year timeframe allows this thinking to be a reality

Daniel recommended against doing something now that precludes something in the future. He pointed out that companies such as Google and Apple are demanding these types of facilities and practices. There is also the concept of "precycling," where you don't generate the waste in the first place.

Daniel asked if there were some example communities we could look to. Treavor responded there were some examples from Switzerland and Sweden, citing no-mix toilets as an example.

Joseli wanted to know about the agricultural options that will allow us to produce our food locally. We can't continue to eat "7,000 mile salads." While people won't be entirely self-sufficient, we should consider what we can do to encourage and enable people to grow their own food. We should look at how we can live, work, play and eat. How can we select the right crops and/or agricultural practices that achieve these goals?

Wendy reinforced the idea of the need for a water budget and a nutrient budget. There's a good chance that climate cycles will change, and we need to think about a dynamic water balance. It's not steady state. Where do you set the boundaries of that? Do we achieve zero net locally by trashing someone else's community? She doesn't want that, but she also doesn't want our process to have "excellence get in the way of good." She expressed that she liked the inclusion of active monitoring, assessment and feedback. It would be good to have access to this data. The monitoring of the mistakes we make will be important.

Wendy stated that putting the water back where it came from is appealing. As a hydrologist, she wanted to see a map that shows where the aquifer recharge areas and surface outflows are. What does the water balance look like and who are the people that will want to live this way? We have an example from Davis, California. Will this transfer to Hawthorne and East Gainesville? The ability to pay will be an issue and those with capacity may want more land. She reminded the group that most market studies look backwards.

Joseli continued that everybody wants the next Silicon Valley—we can't all work in technology. Maybe East Gainesville and Hawthorne will work in agriculture, which will provide low-skilled jobs in local food production and manufacturing. Daniel responded that economic development efforts are focused on meeting the needs of those at all educational levels from a GED to a PhD.

Pierce noted that the planning for Union Station, which was started almost 30 years ago, included a cafe and sidewalk dining.

Wendy noted that taking water out of the Floridan aquifer and returning it to natural wetlands is not sustainable. She hopes we can use, treat and restore the water to the aquifer. We need to be aware that not all water is the same.

Daniel asked the group if they think that having one large-scale effort with a single owner gives us the opportunity versus what you can do under the current zoning. Was there agreement?

Mark responded that the only other way you can achieve this is through regulatory constraints. We have to communicate to end users that they have an opportunity to buy into the value. They can complement the new water ethic instead of fighting it.

Daniel asked the group to discuss a topic that was raised earlier in the meeting—large storage versus decentralized storage? He wanted more information from the group.

Robert talked about using natural wetlands for storage; there are difficulties with this. The current regulations have a very high standard that require reclaimed wastewater be thoroughly treated. He commented that the natural wetlands are already affected. For example, the natural wetlands at Orange Lake have dried up due to depression of the aquifer. This is common to the lakes. Redirecting treated wastewater to wetlands can be done, but must be approached carefully. We'll have trouble exceeding the capacity of these wetlands and there is a high potential for net ecological benefit.

Mark recommended that stormwater be approached the same way—it is more likely to be beneficial on smaller scale. He commented that natural wetlands are going to be cypress systems that have a buffering for evapotranspiration (ET). A large open lake system will have higher ET. If there are wetlands that are out there, that might be a better place to store water. All stormwater is not the same from a nutrient or contaminant basis. Since we are not applying fertilizer, it helps reduce what's going into the run-off. How do we (is it possible to) differentiate roof run-off versus landscape run-off?

Daniel asked: how do we arrive at the water-miserly design we need?
Glenn suggested that Plum Creek run two comparisons: the urban densified approach (the example shown is good) and an approach that expands and loosens up the density to include space for harvesting. Then they should calculate the surface areas nearby that would be capturing it. We should consider Treavor's decentralized, neighborhood model, or a co-operative type model. He suggested we look at these two new urban forms and how they can be made functional and sustainable. Run the metrics and see how much open space we need nearby.

Joseli suggested that instead of having a large storage tank, we create a lake that can also serve as an amenity.

Daniel stopped the discussion at this point and asked Bryan to present the integrated water resource alternatives prior to lunch being served.

IV. Presentation and Discussion of Integrated Water Resource Alternatives Analysis

Bryan began his presentation by reviewing the integrated water resources process, which consisted of the following steps:

- Completion of an alternative analysis process including water supply options and wastewater treatment options
- Evaluation of stormwater, reclaimed water, natural treatment including constructed and natural wetlands
- Evaluation of treatment method, facilities location and phasing

Next, Bryan showed two charts. The first ranked and explained the alternatives for water supply along with treatment processes and treatment facility locations (central and/or distributed) for each. The second gave a similar breakdown of wastewater treatment and reuse alternatives including wastewater treatment level, disposal method and treatment facility location. Finally, he again summarized the evaluation criteria (achieves integrated water resources plan; relative lifecycle cost; community support; environmental stewardship; flexibility; and difficulty permitting) and their weighting. He explained in detail what was considered as part of each criterion. Finally, he showed a series of charts that scored each water resource alternative on the basis of the six criteria and assigned each a "relative benefit score" on a scale from 0-100. These ranged from a high score of 82 for the public access reuse, reuse/constructed wetland (storage) alternative to a low score of 40 for the Upper Floridan, central lime softening alternative.

Glenn asked how the decision was made between the alternatives. He noted that the top five water supply alternatives listed on the chart were all very similar. The response was that the decision was made based on the Upper Floridan having known quantity and quality. Cost was also part of the equation.

Daniel asked the panel whether this was plausible. Wendy expressed that there's not enough gradation between the alternatives and how they were evaluated. There are too many "medium" scores. She commented that "you guys were easy graders."

Wendy noted that there will always be trade-offs, but that we need to be conscious about the way we make them.

Robert pointed out that there is a discrepancy between the amount of reclaimed water available and that needed for irrigation. We won't be able to meet the needs, and this was not addressed fully in the report. If we don't use reclaimed water for residential, will there be enough for the other uses or can we drop agriculture? He considered agriculture to be a source of pollutants for reclaimed water.

Daniel explained that our original thinking didn't include agriculture. Its inclusion evolved through the community process and people wanting local food production.

Wendy replied that she would push back on the proposal to reduce agriculture. Silviculture is not a food source and we need to figure what crops will be compatible.

Mark asked: what is a sustainable source of food, and how do we get agriculture in the larger region to compliment the local food need. Do we have to convert existing silviculture acreage into food production (which may not be the best location for that food production) or can existing food production area be diversified to support more local demand? What should we grow and what are the regional constraints and challenges for bringing it in?

Wendy asked: what happens next? Daniel responded that we want the best water concepts we can get. These comments will factor into our next round of thinking about the plan. If the application is approved, the DSAPs will include this level of refinement.

Tim added that the application is currently in front of County staff. This has helped us identify some places where we can strengthen our materials. It has also identified some additional considerations. The County Staff and Commission engage in policy issues, and this helps us explain the policy issues that are in front.

Mark commented that he is curious how we balance innovation with the practical realities of who will buy this. It would be nice to set that futuristic standard. What will the County come back with?

Daniel responded that we asked to push the envelope, and the panel has helped us do that. How much of this vision we can make reality will be the result of many interacting factors. Precedent-setting examples help us show how this can be achieved. If we put in a good process in place for how we get there, it can be achieved. This won't be built out in 5 years. None of this happens overnight.

Joseli noted that at the beginning of the meeting she didn't preface her comments by commending Plum Creek for how this has been approached. The community involvement is outstanding. She remarked, that said, unless some amazing technology comes along, few of us will see if this comes to fruition. She would like to see this energy put to good use, instead of just being something that is on the website. The West Village project at UC Davis included monitoring and performance measurement. UC professors are involved in the metric assessment. The idea that you can create a laboratory and hardwire it in to the development is a great opportunity and could be achieved. This would be a true test - being able to see the results and then adapt. That would be a huge win.

Robert noted that he lives in rural residential Alachua County. He thinks the Emerald Necklace is a good thing. He doesn't like the idea of having a new city out here.

Tim commented that the Task Force recognized that this will be an issue. Daniel commented that, based on current practices, no one would point to the west side of the county and say the development patterns are desirable.

Robert commented that Plum Creek will likely sell the land once they get the zoning. The new landowners may not be held to that same standard. Daniel noted that Plum Creek could also sell the land now and the new owners would be subject to the same Comp Plan policies.

Robert pointed out that the geology is different on the east and west side of the county. We want to push agriculture where it's wet enough that irrigation isn't needed. He noted that he is not opposed to 5-acre ranchettes, but he is opposed to new urban centers in rural landscapes. South Florida will be under water and residents will be coming up north. He hopes Plum Creek will implement these plans with the least amount of harm and a positive net benefit.

Glenn noted that in Florida, we have taken our urban propensity and moved it into different ecosystems as if this is a good thing. We have created a horizontal versus a vertical footprint. We need to put the water budget together and test the different development packages. He questioned why are we looking to the flatwoods and putting the urban model here. The question is: are we putting an old template where it shouldn't be? How do we make the model appropriate for these lands?

Daniel commented to the group on the size and capacity of Highway 20. The road has substantial capacity and Daniel wondered why such a significant investment was made. One participant joked that they thought Plum Creek had a role in having such a substantial road built. Tim Jackson replied that the investment in Highway 20 was identified in a statewide intermodal system plan that emphasized the need for all residents of the state to be connected by a four-lane road. Highway 20 was prioritized for its role in meeting hurricane evacuation needs and was widened. Daniel commented that this road infrastructure is grossly underutilized.

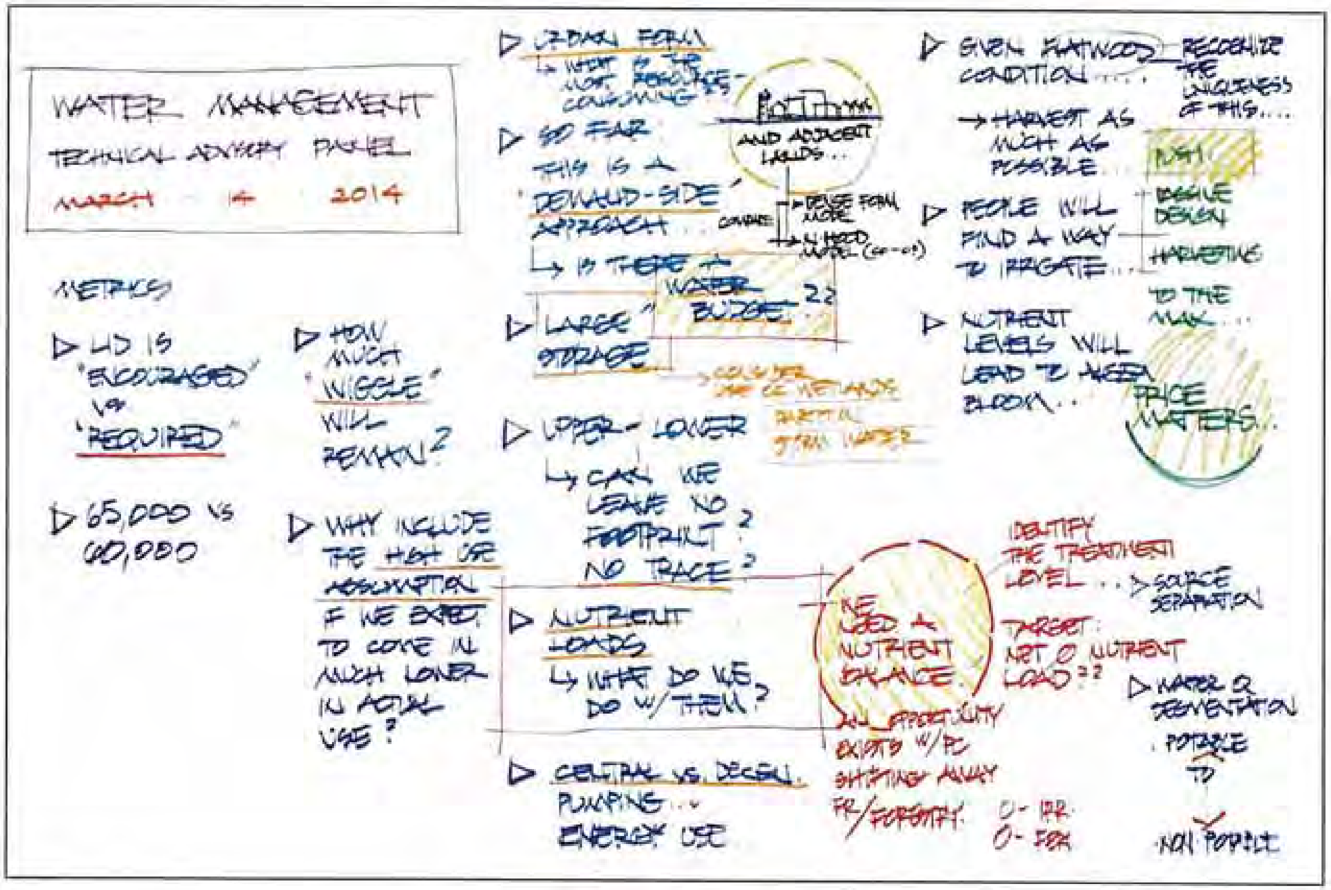
The Task Force directed us to concentrate our efforts here. It also helped respond to the needs of Hawthorne, which has been suffering economically due to job losses related to the closure of the Georgia Pacific mill. Hawthorne is already identified as an urban center. Area B is aligned with the County Comprehensive Plan.

V. Summary and Next Steps

Following the discussion, Daniel asked Sam and Steve for any closing comments.

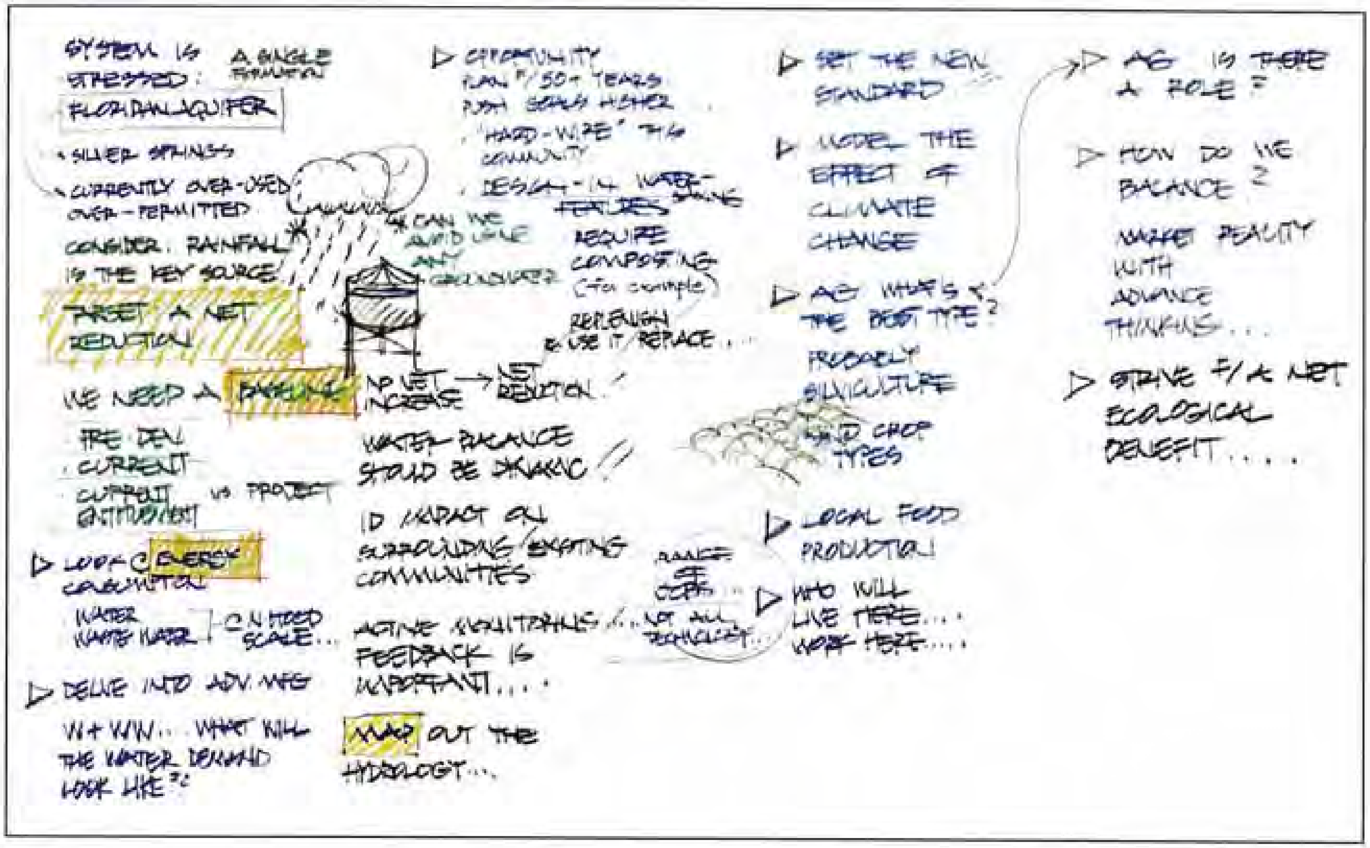
Sam commented that this has been a great meeting, and thanked the panel for their candor and directness. He noted that we are lucky to have this intellectual firepower, and that they had really answered our five questions. The panelists have done exactly what we had hoped they would do, and the meeting far exceeded our expectations. The question to consider is, can we actually design places as we do our technology platforms, to put in new systems that respond to changing technology? Population growth is coming, whether it's from South Florida or from those who have experienced the polar vortex. Steve commented that his personal goal is to develop the Institute for the Future. We don't give enough intellectual discipline to thinking about the future. What could it look like? What technologies will change? We need to think about establishing our systems today to include where we are going in the future. Sam suggested that this Institute might be hosted in this development.

The next step in the process will be the development of a meeting summary for panel members' review and response. A meeting wallgraphic is attached at the end of this document.



Meeting Wallgraphic – Part I

Meeting Summary, March 14, 2014 Water Management Technical Advisory Panel



Meeting Wallgraphic – Part II

Meeting Summary, March 14, 2014 Water Management Technical Advisory Panel

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WRITTEN COMMENTS FROM DR. ROBERT KNIGHT

APPENDIX 4

Envision Alachua Integrated Water Plan Review

Responses to Key Questions and Recommendations

Robert L. Knight, Ph.D.

Wetland Solutions, Inc.

March 14, 2014

Introduction

On December 5, 2013 Mr. Samuel E. Poole, J.D. and Steven M. Seibert, J.D., representing Plum Creek's Envision Alachua community planning process invited me to participate on a Technical Advisory Panel (TAP) to review the Envision Alachua Integrated Water Plan. In concert with Dr. Wendy Graham (chair), Dr. Joseli Macedo, Dr. Mark Clark, Dr. Treavor Boyer, and Glen Acomb, I was asked to attend a half-day meeting to hear an overview presentation about Plum Creek's Envision Alachua planning process and to offer my opinions/recommendations concerning the draft integrated water resource management plan prepared by Plum Creek's technical consultants.

Plum Creek requested that members of the TAC provide answers to the following questions:

- Are the assumptions in the integrated water resource management system plan reasonable?
- Are the results and recommendations in the plan reasonable?
- Do the proposed solutions appropriately address the key issues?
- Are there solutions which have not been considered?
- Is there additional data, analysis, or research needed?

This document summarizes my review comments, professional opinions, and recommendations pertaining to the Envision Alachua Integrated Water Plan,as well as answers to these five questions.

General Understanding of the Draft Integrated Water Resources Plan

The document entitled ***"Brief Overview of Envision Alachua"*** is very general and does not give many detailed specifics about the Plum Creek development proposal for Alachua County. For this reason this review is somewhat limited in specifics other than for the information gleaned from the companion document ***"Long-Term Master Plan"*** and the two CH2M HILL water plan reports ***"Water Supply Data and Analysis Envision Alachua Sector Plan"*** and ***"Integrated Water Resource Alternatives Analysis"***.

Recommendation #1: the Final Integrated Water Resources Plan should provide a summary of the most current development master plan, including maps showing land areas devoted to each of the four main land use categories (conservation, employment-oriented mixed use, agriculture, and rural) proposed for all of Plum Creek's land holdings in Alachua County.

Plum Creek's total land holdings in Alachua County occupy approximately 65,000 acres, north and east of Gainesville. About 5,000 acres are located within the urban boundaries of Gainesville and Hawthorne. The remaining 60,000 acres are within rural zoning boundaries and were the subject of this water resources plan review. The largest combined Plum Creek tracts include the following (unofficial names based on their general locations):

- The SR 121 Tract located east of NW 59th Drive, south of NW 156 Avenue, and west of SR 121
- The SR 231 Tract generally east of SR 231, south and north of NW 156 Avenue, north of NW 53 Avenue, and west of Race Track Road (CR 225)
- The Waldo Tract located east of Race Track Road (CR 225) and west of the City of Waldo
- The Windsor Tract located east of CR 234, and generally between and north of Hawthorn Road (SR 24) and SR 26, and west of US 301
- The Orange Lake/Lochloosa Lake Tract east of the Paynes Prairie Preserve State Park and Micanopy, south of Hawthorn Road (SR 24), and east of US 301

According to CH2M HILL, nearly 24,000 acres of the total 60,000 acres are currently in conservation easements and will not be developed. CH2M HILL also states that the ultimate goal for Plum Creek conservation lands in Alachua County is about 45,000 acres. These numbers lead me to assume that an additional 21,000 acres of Plum Creek land will be placed into new conservation easements, and that the approximate land area dedicated to the other three main land use categories (employment-oriented mixed use, agriculture, and rural) is about 15,000 acres. Other figures obtained from CH2M HILL documents indicate that over the 50-year planning horizon, irrigated agriculture will occupy an estimated 840 acres, residential will occupy about 3,500 acres, advanced manufacturing will occupy about 1,087 acres, and that research and development (R&D), office, and retail enterprises will occupy about 161 acres. These quantified areas total about 5,600 acres. For this analysis it is assumed that the unaccounted 9,400 acres will be devoted to other rural, transportation, utilities, recreation, schools, and common areas that are not irrigated. In the absence of a detailed inventory of the lands being considered for intensive development, I am fairly certain that many of my quantitative review comments are likely to be inaccurate. In this regard please refer to Recommendation #1 above.

The Envision Alachua long-term, 50-year, master plan embraces the following water use vision: ***"water resources will be managed sustainably with an emphasis on overall system stewardship and conservation of water"***. The key water planning principles for Plum Creek's Envision Alachua include:

- Protection of water recharge areas
- Optimization of water conservation with a goal of 50% less water usage than current norms
- Use of Florida-friendly landscaping throughout
- Demonstration of leadership in promoting and adopting innovative approaches for water management
- Collection, treatment, and reuse of stormwater to the maximum feasible extent

Other notable commitments in the Envision Alachua vision document include the following:

- A holistic/integrated approach to water management that meets both human and environmental needs
- A plan that determines the amount of water necessary to sustain a thriving natural environment and insures that amount of clean water is delivered to the streams, wetlands, lakes, and wildlife affected by the Envision Alachua project
- A plan that does not exceed a safe yield of groundwater resources that includes a positive net recharge, *i.e.*, more water is returned to the Floridan aquifer than is removed
- A project where wastewaters and stormwaters are fully treated and recycled to beneficial uses that create and enhance the health of wetlands and wildlife habitats
- A conservation-first strategy that reduces total water demand, lives within a water budget, respects the true value of the resource, and uses no potable water for irrigation

Plum Creek intends to create a model for new developments based on Cynthia Barnett's ***"water ethic"*** that results in a ***"net water benefit"*** for both water quantity and quality. Plum Creek proposes the ultimate goal of working with regional partners to lead in ***"establishing a new water economy with a water ethic where innovative and systemic approaches can be showcased statewide and nationally"***.

The review comments and the technical evaluation of the integrated water plan provided below assume all of these goals and principles will be codified as actual contractual commitments between Plum Creek and the residents of Alachua County.

Summary of the Proposed Integrated Water Resource Plan

This section provides my understanding of the principal technical findings described in the two CH2M HILL reports that were provided to the TAC.

In the Background section of CH2M HILL's Water Supply Data and Analysis report it is stated that ***"…the water supply needs must not adversely impact the existing water resources, the surrounding environment, or the local and regional communities"***. The stated goal of this report is to balance ***"…the resources of those areas with the needs of the environment in all of Plum Creek's planned areas"***.

It is noted that CH2M HILL's report states that ***"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"***. This statement is incorrect since neither silviculture nor limited agriculture is synonymous with undeveloped land uses. While these land uses may have less manufactured infrastructure than urban and commercial developments, they are by no means "natural" land uses and they both exact quantifiable levels of adverse impacts to surrounding natural environments. Please refer back to Recommendation #1 for the need to provide a comprehensive inventory of the historic, existing, and future uses for all of Plum Creek's 60,000 acres included in the Envision Alachua integrated water resources plan.

CH2M HILL reports forecasted 50-year water demands for the proposed Envision Alachua project. Low, medium, and high water use estimates are provided by CH2M HILL with no certainty provided concerning which estimates are most reasonable for the actual, as-built Plum Creek project. While CH2M HILL highlights the need for a ***"water balance in the water supply plan"***, no such balance is provided. Since Plum Creek is committing to meeting the goal of no potable water use for irrigation, it appears that CH2M HILL's "high" water use estimates should be removed from this evaluation.

Recommendation #2: CH2M HILL should prepare detailed estimated water balances for four land use scenarios: pre-development, existing, future based on existing zoning requirements, and the most likely future built-out conditions with the requested land use zoning changes.

CH2M HILL does not include recreation and open-space irrigation requirements in their water use projects based on the assumption that reclaimed wastewater will be utilized for these purposes. But the report also concludes that the water use and wastewater production estimates are significantly different, indicating that reclaimed water will supply less than 50% of the irrigation supply needs of agricultural land uses and residential areas. Thus, any recreational (*e.g.*, golf courses and ball fields) or open space irrigation will require additional water supply beyond CH2M HILL's estimates.

CH2M HILL estimates a total future average water demand for the Envision Alachua development ranging from about 10.5 to 17.5 million gallons per day (MGD). Somewhere between 2.3 and 6.5 MGD of this total may be supplied by reuse of reclaimed water, for an estimated "new" groundwater use range between about 8 and 11 MGD.

It is informative to compare CH2M HILL's projected water uses in consistent units of water use intensity. I have chosen to use units of gallons per day per acre (g/d/ac) of land use. Based on the assumptions provided by CH2M HILL, water use intensities can be compared for the following land uses:

- Advanced manufacturing – 1,848 g/d/ac
- R&D, office facilities – 1,742 g/d/ac
- Retail – 871 g/d/ac
- Residential – 702 g/d/ac
- Agricultural irrigation – 3,690 to 5,714 g/d/ac
- Residential irrigation – 3,429 g/d/ac
- Parks and common area irrigation – 3,429 g/d/ac

Based on this comparison it appears likely that inclusion of agricultural and residential irrigation in this project will make the project's goals for "no net effect" on local water resources less achievable.

Recommendation #3: Plum Creek should estimate and commit to a time-line of maximum allowable water uses throughout the 50-year development plan.

CH2M HILL identified six potential water sources for Plum Creek's Envision Alachua development:

1. Treated wastewater
2. Stormwater
3. Surficial aquifer
4. Intermediate aquifer
5. Upper Floridan aquifer
6. Lower Floridan aquifer

Two of these potential sources – surficial and intermediate aquifer systems -were not considered further due to unknown reliability and potentially low water quality.

CH2M HILL's proposed reliance on groundwater supplied from the Lower Floridan aquifer as an alternative to groundwater from the Upper Floridan aquifer is unrealistic and could result in significantly higher water treatment costs. On the west side of Gainesville the Lower Floridan aquifer is used for wastewater disposal via underground injection by Gainesville Regional Utilities. Also, there is insufficient evidence to assume that the Middle Semi-Confining Unit will act as an effective aquitard and prohibit the movement of groundwater downward from the Upper to the Lower Floridan aquifer. This semi-confining unit is notably inconsistent in spatial extent and thickness across North and Central Florida, and even when it is present there is always the possibility of penetrating fractures, sinkholes, and solution channels. As stated by McGurk and Presley (*Simulation of the Effects of Groundwater Withdrawals on the Floridan Aquifer system in East-Central Florida, SJRWMD Technical Publication SJ2002-3*),***"the middle semi-confining unit is leaky, and its lithology is very similar to that of the overlying and underlying aquifer units"***. Removal of deeper groundwater by pumping is likely to induce additional recharge from the Upper Floridan to the Lower Floridan and thus adding additional impacts to the potentiometric water levels in the Upper Floridan aquifer. Also, high sustained rates of pumping from the Lower Floridan aquifer may induce upconing of deeper saline groundwater into the Lower Floridan aquifer. For these reasons it is considered unlikely that the Lower Floridan aquifer will ever be used as a significant source of potable water in Alachua County and should not be considered further as an "alternative" water supply..

Three additional potential "alternative" water supply sources were also identified by CH2M HILL but none of these three sources were seriously considered as viable:

- Indirect and direct potable use of municipal wastewaters
- Surface water
- Seawater/brackish groundwater

It is my conclusion that the most reliable and cost effective high quality source of potable water for Plum Creek's Envision Alachua community will be the Upper Floridan aquifer and that in reality this is the water source that is most likely to suffer impacts due to this proposed project. It is the avoidance of impacts to the Upper Floridan aquifer and a goal of "no net impact" or better that should be advanced with further refinement of the Envision Alachua water resources plan.

However, in the spirit of creating a truly innovative plan and Florida model that avoids aquifer impacts from the start, I believe CH2M HILL should conduct a more detailed analysis of storage, treatment, and utilization of a relatively small fraction of the direct rainfall and stormwater available on these 60,000 acres. For example, based on a conservative estimate of average rainfall of 51 inches per year over this land area, minus 71% evapotranspiration, the total rainfall income during an average year would be about 66 million gallons per day. As little as 10% of this average income, if stored between wet and dry years, could possibly provide the majority of the water needed to support the proposed project.

CH2M HILL's second report provided to the TAC analyzes alternative integrated water resource plans. Eight alternative potable water supply and water treatment options and seven wastewater treatment and disposal options were evaluated based on six specific criteria and weighting factors provided to CH2M HILL by the Plum Creek water consulting team. The six evaluation criteria and their weighting factors included the following:

- Achieves integrated water resources plan (25%)
- Relative lifecycle cost (20%)
- Community support (15%)
- Environmental stewardship (15%
- Flexibility (15%)
- Difficulty permitting (10%)

Based on this alternatives analysis scheme the relative ranking of water supply alternatives from highest to lowest in terms of "relative benefit" scores was:

- Upper Floridan with standard water treatment, future Lower Floridan with nanofiltration – 0.77
- Lower Floridan, central nanofiltration – 0.76
- Lower Floridan, distributed nanofiltration – 0.75
- Upper Floridan, central, standard water treatment – 0.73
- Upper Floridan, distributed, standard water treatment – 0.72
- Upper Floridan, central, nanofiltration – 0.50
- Upper Floridan, distributed, nanofiltration – 0.49
- Upper Floridan, central, lime softening – 0.40

These closely-spaced ranking scores indicate that there is no significant difference between the first five options listed above. If Plum Creek accepts the arguments against utilization of the Lower Floridan aquifer provided above, then the analysis of water source alternatives can be limited to alternative's four and five above: Upper Floridan aquifer with either central or distributed water treatment.

Based on CH2M HILL's alternatives analysis scheme the relative ranking of wastewater treatment and disposal options from highest to lowest was:

- Public access reuse, reuse/constructed wetland storage – 0.82
- Central WWTP, AWT, treatment wetland to receiving wetland recharge 0.69
- Central WWTP, public access reuse, treatment wetland to receiving wetland recharge – 0.65
- AWT/public access reuse, reuse/treatment wetland to receiving wetland – 0.58

- Public access reuse, reuse/treatment wetland to receiving wetland – 0.54
- Central WWTP, AWT, reuse/treatment wetland to receiving wetland – 0.51
- Central WWTP, indirect potable reuse, direct recharge/receiving wetland – 0.43

Based on these scores it appears that the first wastewater treatment/disposal option is clearly superior to the six remaining alternatives.

CH2M HILL's selected water supply/treatment alternative was the "hybrid" option utilizing the Upper Floridan aquifer initially with standard treatment and supplemental use of the Lower Floridan aquifer with nanofiltration. The selected wastewater treatment/disposal alternative was treatment to public access standards, storage in constructed wetlands, and beneficial reuse.

Recommendation #4: Plum Creek should evaluate the sufficiency and cost of water resources supplied by direct rainfall capture and storage. If rainfall and stormwater capture are not found to be preferable to achieving the overall project goals, then water supply plan should indicate that the Upper Floridan aquifer will be the principal source of potable water throughout the 50-year planning horizon for Envision Alachua and demonstrate how this project will provide a net benefit for this aquifer and the lakes, springs, and rivers it supports.

Recommendation #5: Plum Creek should abandon the idea of the Lower Floridan aquifer as an "alternative water supply" and should avoid any effort to pump water from this portion of the Floridan aquifer.

Evaluation of Plum Creek's Integrated Water Resources Plan

Regional Scale

Due to the spatial and temporal scope of Plum Creek's Envision Alachua Integrated Water Resource Management Plan and the development it proposes, it is necessary to consider the macro-scale of water resource issues in North and Central Florida. This evaluation leads with a brief synopsis of some relevant regional issues, followed by a summary of more local issues, and then provides comments and recommendations pertaining to the alternatives analysis and plan presented to the TAC.

Alachua County has an average annual water income of about 51 inches of rainfall each year, with unequal distribution over spatial and temporal dimensions. Annual rainfall totals often vary between less than 35 inches per year to over 65 inches per year. It is estimated that about 71 percent of the annual rainfall in this region of the state is lost through evapotranspiration at a rate that also roughly correlates with annual rainfall, with an average of about 37 inches per year, and a normal inter-annual range from as little as 30 inches per year to as much as 48 inches per year.

The net water input remaining after ET takes it share, is in the range of less than 3 to as much as 20 inches per year, with an average of about 14 inches per year. On average about 12 inches of this available precipitation recharges the deeper aquifers and the remainder runs off as surface flows to tide. During dry years the amount of rainfall that recharges the Floridan aquifer is less than one half of the annual average recharge, and during wetter years recharge can be several times average rates.

Under pre-development conditions recharge to the Floridan aquifer was in a long-term balance with discharge from the Floridan aquifer through springs and diffuse discharges. The majority of this discharge was through springs that fed baseflows to rivers and estuaries. With the advent of groundwater production wells in the 1880s this water balance began to change. Under predevelopment conditions without pumped discharges, average Floridan aquifer levels were higher than current levels. Groundwater levels have declined as groundwater extractions in North and Central Florida and in Coastal and Southeast Georgia have increased over the past 130 years.

Spring flows are dependent on aquifer levels and fluctuate up or down as a result of the year-to-year variation in rainfall and recharge. However, significant springflow declines independent of rainfall variability became evident in the 1970s and 1980s throughout North and Central Florida. The estimated total average reduction in spring flows throughout this area of Florida was about 34 percent by 2009. Individual springs show different levels of average flow reductions dependent upon their topographic position in the Florida landscape. As aquifer levels have fallen across the peninsula, the topographically highest springs have lost more of their average flows than springs located at lower elevations. Adjacent springs may compete for groundwater based on their controlling surface water levels, with lower springs "pirating" flows from nearby, higher elevation springs.

The majority of the Plum Creek Envision Alachua proposed high-intensity development areas lie within the 1,300+ square mile historic springshed that feeds Silver Springs. Silver Springs has long had the reputation as the largest spring (in terms of annual flows) compared to any other spring in Florida,the United States, and possibly in the world. Silver Springs no longer holds this distinction, with its average flow consistently below nearby Rainbow Springs since 2000. Rainbow and Silver springs share an over-lapping springshed. As regional Floridan aquifer levels have fallen, the Silver Springs springshed has diminished as the Rainbow Springs springshed has increased in size. However, with groundwater pumping rates more than doubling since the 1960s, the average flow, independent of rainfall, has declined at both springs, with Silver showing along-term average flow decline greater than 32%, and Rainbow's annual average flows have declined by about 18%.

A number of technical evaluations of the effects of flow and level changes on human use and water resource values in several of Florida's major springs, rivers, and lakes have been conducted by the water management districts to support establishment of regulatory Minimum Flows and Levels (MFLs). The range of flow reductions that cause "significant harm" in springs that have been the subject of these studies are from about 3 to 20%, with an average maximum allowable flow reduction of less than about 10%. Ongoing studies by the St. Johns River Water Management District have determined that the MFL standard for Silver Springs will allow a maximum reduction in median spring discharge of about 5%. As stated above, the long-term average flow reduction at Silver Springs independent of rainfall variation is over 30% and well beyond the point of "significant harm". A recent evaluation of flow changes in all of the 1,000+ artesian springs in North and Central Florida documented an overall reduction in average flows of over 30%.

Similar evidence of over-utilization of the Floridan aquifer by anthropogenic uses can be provided from all of the surrounding surface waters that will be directly or indirectly affected by additional groundwater withdrawals in Eastern Alachua County. For example, the Suwannee River WMD has determined that the Lower Santa Fe River and springs will not meet their MFL and are in "recovery". The same is true for the Ichetucknee Springs group and for the many lakes whose levels are below regulatory MFLs east of Alachua County in the "lakes region" in and around Melrose, Hawthorne, and Keystone Heights. Orange Lake which is known to be connected to the Upper Floridan aquifer and is directly downstream of the proposed Envision Alachua project, does not have an established MFL but has demonstrated record-breaking low water levels during the past decade.

In summary, based on considerable empirical evidence as illustrated by the examples offered above, it is reasonable to conclude that the Floridan aquifer throughout North and Central Florida is already over-utilized to the point where many if not most surface water-dependent environments (wetlands, springs, lakes, stream, etc.) are past the point of significant harm. This significant harm includes both biological and economic components with lost fish and wildlife habitat, diminished water quality, reduced recreational value, increased sinkhole formation, dry wells, and lost economic vitality.

This conclusion has ramifications for any proposed new and existing groundwater development projects in North and Central Florida. To comply with Florida law that mandates protection of water-related human use and water resource values, total groundwater use must be reduced well below existing pumping rates. Existing consumptive use permits in this area of the state currently allow an average groundwater pumping rate of more than 4 billion gallons per day

(BGD). The existing groundwater use in this area is about 2.4 BGD as estimated by the U.S. Geological Survey. To achieve a maximum 10% reduction in spring flows the Florida Springs Institute has estimated that existing average groundwater uses will need to be cut back by more than 50%. This would equal a reduction of permitted quantities by about three fourths.

For these reasons this review concludes that to achieve the goals and principles established for Plum Creek's Envision Alachua project, there can be no net increase in use of groundwater from the Floridan aquifer. To actually achieve a "safe-yield", Plum Creek should seek to achieve a net reduction in groundwater use by 50% more than the total water use (an overall net reduction of 1.5 times Plum Creek's groundwater use). Developing and implementing a strategy to accomplish this goal would set an example for all users of this priceless resource, and for the state regulators who have allowed the current over-use of the Floridan aquifer. Thus if the Envision Alachua Project is projected to use an average of about 10 MGD of new groundwater from the Floridan aquifer, then the project goal should be a net reduction of about 15 MGD of overall groundwater use. Suggestions for possible means of achieving such a forward-thinking goal are provided later in this evaluation.

Recommendation #6: Plum Creek should meet with state and regional water managers and other affected stakeholders to establish a unified approach to reverse the present condition of excessive regional groundwater pumping. Plum Creek should develop a detailed strategy to achieve an overall net reduction of groundwater uses throughout the 50-year development plan.

Local Scale Issues

The proposed Plum Creek Envision Alachua project has the potential to degrade local surface waters and groundwaters in and adjacent to Alachua County. The Floridan aquifer under most of the eastern half of Alachua County is "less vulnerable" to direct contamination from surface land uses due to relatively low permeability soils and confining layers of humate-cemented flatwood soils, and clays of the Hawthorn Formation. However, the majority of the surface flows from the proposed employment-oriented mixed-use, agriculture, and rural development areas drain to the south to Lochloosa Lake, Orange Lake, and Orange Creek.

Orange Lake is in the northern end of the combined Silver and Rainbow Springs Springsheds. Orange Lake is a karst feature and has been shown to have direct hydrologic connection to the Floridan Aquifer upstream of Silver and Rainbow springs through a natural sinkhole adjacent to the Heagy-Burry boatramp. It has been estimated that an average between 15.5 and 24.3 million gallons per day exits Orange Lake at this sinkhole and recharges the Floridan Aquifer.

A recent dye trace study conducted with funds provided by the Florida Department of Environmental Protection (FDEP) and the St. Johns River Water Management District (SJRWMD) documented the southerly movement of groundwater from the Orange Lake Sinkhole at the southwest end of Orange Lake at an average rate of about 1,400 ft/d. Silver Springs is approximately 20 miles from Orange Lake for an estimated average travel time of about 74 days. Rainbow Springs is located about 28 miles from Orange Lake, for an estimated travel time of about 104 days.

Orange Lake is an Outstanding Florida Water (OFW) and is protected from any degradation of water quality, especially nutrients such as nitrogen and phosphorus, that enter the lake from upstream land uses such as fertilized forest, row crops, rangeland, and rural residential development. The Orange Lake TMDL states that the lake is impaired by nutrients and requires a mandatory reduction of nutrients entering the lake. Also, both Silver Springs and Rainbow Springs have TMDLs for total nitrogen. Silver Springs has a target nitrogen reduction of 79% of existing loads. Rainbow Springs has a target reduction of 81% of existing loads. Any nitrogen released from Plum Creek's Envision Alachua project to Lochloosa and Orange lakes that reaches the underlying aquifer through the Orange Lake Sinkhole, will increase the nitrogen load to these two springs. Also, the release of any priority pollutants from industrial process water and agricultural and urban pesticides is not compatible with protection of potable drinking water for the many private and public wells tapping the Upper Floridan aquifer between Orange Lake and Silver and Rainbow springs.

This documented hydrological connection between surface water and groundwater provides both opportunities and challenges for the proposed development. The opportunity is that if additional clean wastewater and stormwater are stored in area wetlands and fully cleansed of nutrients before they enter this drainage system, then those waters can provide an increase in beneficial recharge to raise water levels in Orange Lake and in the underlying Floridan aquifer. The challenge is to do what very few other commercial and urban developments do and that is insure that all of these waters are fully cleansed of nutrients and other pollutants before they reach any sensitive downstream waters.

Recommendation #7: CH2M HILL should prepare detailed estimated nutrient mass balances for four land use conditions: pre-development, existing, future built-out under current zoning, and future build-out with the Envision Alachua plan. Plum Creek should commit to a >50% net reduction in the quantities of total nitrogen and total phosphorus exiting the affected surface watershed and groundwater basins throughout the 50-year development plan.

Responses to Key Questions and Recommendations

A. Are the assumptions in the integrated water resource management system plan reasonable?

The following assumptions in the plan are not considered to be reasonable:

- CH2M HILL's inference that existing Plum Creek conservation lands are environmentally benign is not considered to be a reasonable assumption. In fact, industrial forests and areas of "limited agriculture", are areas of very limited biodiversity, and discharge unacceptably high levels of nutrients applied as fertilizers.
- Although not specifically stated but implied, any assumption that the proposed Envision Alachua plan can be considered to be separate and apart from regional groundwater quantity and quality issues is not considered to be reasonable.
- The Lower Floridan aquifer is not likely to be suitable as an "alternative water supply" and should not be considered for use.
- Capture and storage of direct rainfall and stormwater runoff should be evaluated as a possible water supply alternative
- Any assumption that reclaimed wastewater effluent will provide adequate water to supply the irrigation needs of the proposed intensive agricultural development and of recreation and public use areas is likely false.

B. Are the results and recommendations in the plan reasonable?

I generally agree with many of the results and recommendations provided by CH2M HILL concerning water quality treatment. However, the following results and recommendations provided by CH2M HILL are not considered to be reasonable:

- The Lower Floridan aquifer should not be included in any of the water supply alternatives.
- Permitting of treatment (natural) wetlands under Chapter 62-611, Florida Administrative Code (FAC) is very difficult and expensive. Where ever the use of natural wetlands is proposed, they should be replaced by constructed (man-made) wetland treatment systems built in uplands. Any discharges of stormwater or wastewater that will reach natural wetlands or other surface

waters will need to be fully treated to achieve applicable water quality standards before final discharge.

C. Do the proposed solutions appropriately address the key issues?

In my professional opinion the technical solutions proposed by CH2M HILL do not address all of the key principles as outlined by Plum Creek's Envision Alachua development plan. Specific examples include the following:

- Key principles for water resources state that uses will be "sustainable", within a "safe-yield", and not cause any harm to surrounding environmental and public resources. As described above the area's springs, lakes, and rivers are already harmed by excessive groundwater extraction and nutrient pollution. Any new use of groundwater whether from the Upper or Lower Floridan aquifer will add additional harm to these resources. In other words there is no more capacity to absorb even the relatively small impacts of a fully integrated water resources management plan. Actual estimated net groundwater uses for the CH2M HILL proposal are very high (more than 10 MGD) and environmentally unacceptable.
- An alternative water supply option based on rainfall capture and storage should be developed for comparison to the Upper Floridan aquifer alternative.

D. Are there solutions which have not yet been considered?

Yes, there are solutions that have not yet been considered. Two proposed solutions to achieving water quantity and quality sustainability that Plum Creek may wish to consider include the following:

- All unavoidable groundwater uses can be offset by use reductions elsewhere in the region. The proposed goal should be a net reduction in groundwater use equal to 1.5 times Envision Alachua's maximum water use. Thus, if Envision Alachua has the need to pump 10 MGD of groundwater, then Plum Creek must work with other permitted groundwater users and the SJRWMD to take 15 MGD of actual existing uses permanently offline. This goal is achievable by purchasing lands that currently have high/inefficient ground water use densities and locking them up in conservation easements that will never allow irrigated or fertilized land uses in the future.
- Pump no groundwater and utilize no fertilizer anywhere in the Envision Alachua development. An adequate water supply can be provided by total

reliance on rainwater and stormwater capture and storage. All landscaping throughout the project can be based on the use of drought-tolerant native plant species. All stormwater and wastewater can be treated with constructed wetlands.

E. Is there additional data, analysis, or research needed?

Yes. It is recommended that Plum Creek should complete the following additional evaluations:

- Fully describe the built-out plan for Envision Alachua so all water resource, infrastructure, and natural resources are fully described and quantified.
- Assess the likely regional and local environmental and socio-political impacts associated with the proposed Plum Creek Envision Alachua project.
- Construct a complete water balance for all land holdings in Alachua County, including predevelopment, existing conditions, and the future with existing zoning vs. the future with the proposed Envision Alachua plan.
- Construct nutrient (total nitrogen and total phosphorus) mass balances for all land holdings in Alachua County, including predevelopment, existing conditions, and the future with existing zoning vs. the future with the proposed Envision Alachua plan.
- Redo the analysis of water supply options as described above by eliminating use of groundwater from the Lower Floridan aquifer and adding direct rainfall capture and storage as an alternative water supply.

WRITTEN COMMENTS FROM DR. TREAVOR BOYER

APPENDIX 5

Sylvia Jones

From:	Sam Poole
Sent:	Tuesday, April 01, 2014 4:26 PM
To:	Sylvia Jones
Subject:	appendix 5
Attachments:	Urine source separation at UF.pdf

From: Boyer,Treavor H [mailto:thboyer@ufl.edu]
Sent: Friday, March 14, 2014 4:50 PM
To: Sam Poole; steve@trisectinnovates.com
Subject: Plum Creek follow up

Sam and Steve,

Thank you again for inviting me to be part of this exciting process! I thought more about the meeting on my bike ride back to campus. Below are expanded/elaborated points from the meeting.

1. I agree that the vision and plan should have lofty/ambitious goals, as many advocated at the meeting today. As an engineer, however, I want to find real solutions to real problems. Specific to water supply, this probably means some water from the Floridan aquifer. Maybe potable water supply from the aquifer and industrial water supply from reclaimed, stormwater, and other combinations. This underscores "right water in the right place." Also, the water budget (that many mentioned) would help inform decisions on water allocation.
2. To somewhat contradict my engineer ethic (real solutions to real problems), the possible scenarios and final options for water supply and wastewater treatment are "conventional" and not pushing the state-of-the-art. For example, more thought on centralized vs. decentralized treatment, greywater use, and even direct potable reuse.
3. I think an energy balance is needed for all drinking water treatment and wastewater treatment scenarios. For both drinking water and wastewater, the idea of "distributed" treatment is mentioned but not discussed in sufficient detail. One of the main reasons for doing distributed treatment is to decrease energy/pumping, i.e., keep the water closer to its use and reuse, but this is not described at any level of detail to evaluate. As mentioned at the meeting, technology will improve but pumping water and its energy requirements will remain fixed especially once a water plant, wastewater plant, and pipes are put in the ground.
4. The water/wastewater plan would benefit from a system-level diagram that shows the major inputs and outputs. For example, it would show the water flow path, energy and other chemical inputs, and emissions to the environment. Also, the system diagram would show the system boundary, which was discussed today. Attached is an example from our work on urine separation. The attached diagram shows all of the linkages for water, nutrients, energy, chemical inputs, and emissions to the environment if all urinals/toilets in dorms at UF were used for urine collection.
5. In closing, if Plum Creek wants to pursue the most lofty/ambitious goals, then the water/wastewater plan needs to be rethought. Probably from the beginning. For both water and wastewater, this would include centralized vs. decentralized, tailoring the water supply and treatment to its use, source separation of waste streams, water reuse and possibly direct potable reuse, and resource recovery. The new paradigm in wastewater will be source separation and resource recovery. With a 50 year planning timeframe, the next paradigm in wastewater management should be given careful consideration.

Thanks again. Best,

Treavor

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Treavor H. Boyer, Ph.D.

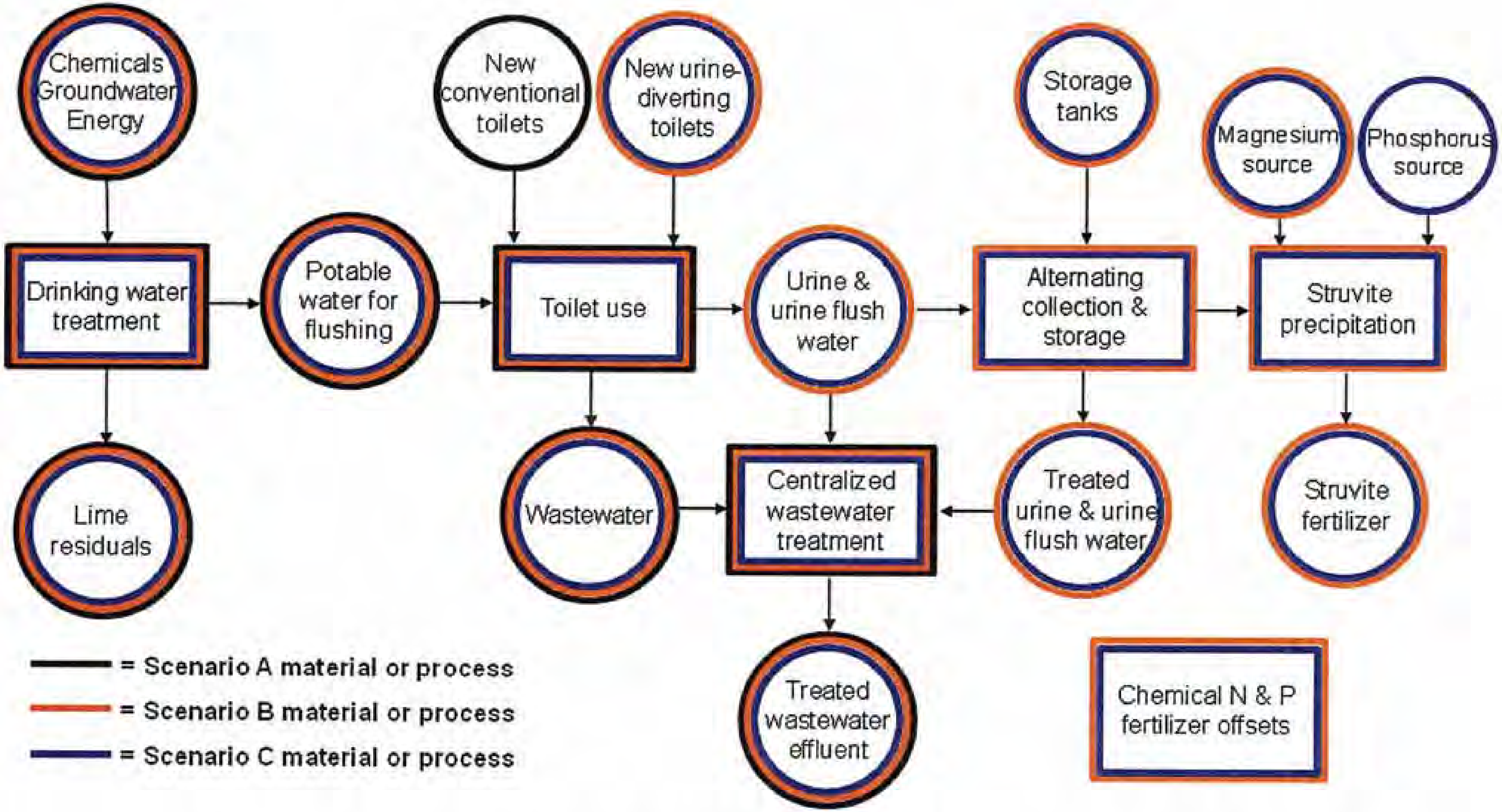

Figure S1. Simplified schematic of the material flows (circles) and processes (rectangles) considered in this life cycle comparison of three urine treatment scenarios at the University of Florida; materials and processes outlined in black pertain to Scenario A, those outlined in orange pertain to Scenario B, and those outlined in blue pertain to Scenario C

WRITTEN COMMENTS FROM DR. JOSELI MACEDO

APPENDIX 6

Written Comments by Dr. Joseli Macedo

April 26, 2014

This is a very thorough report. All comments and concerns were accurately captured and the organization of these summaries by question and then by issue is excellent. I only had comments about minor details on this report; a few more comments on the TAP document.

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