Utilities, Inc.®

SUMMERTREE WATER SYSTEM
WATER SYSTEM ANALYSIS

Prepared By:

cph

W. Wade Wood, P.E.
FL Reg. No. 69051

1.0 Background

Utilities Inc. of Florida (UIF) owns and operates the Summertree Water System (Summertree) in New Port Richey, Pasco County, Florida. The water system primarily serves residential customers throughout the service area. The water system is located on the south side of State Road 52, approximately 1.5 miles west of County Road 587 (Moon Lake Road). A location map for the Summertree community is illustrated in Figure 1.

In 2005, UIF commissioned an engineering consultant, TBE Group, to evaluate various treatment alternatives that would improve water quality throughout the distribution system in a reliable fashion. The TBE Group's Water Quality Analysis Report was submitted to UIF at that time.

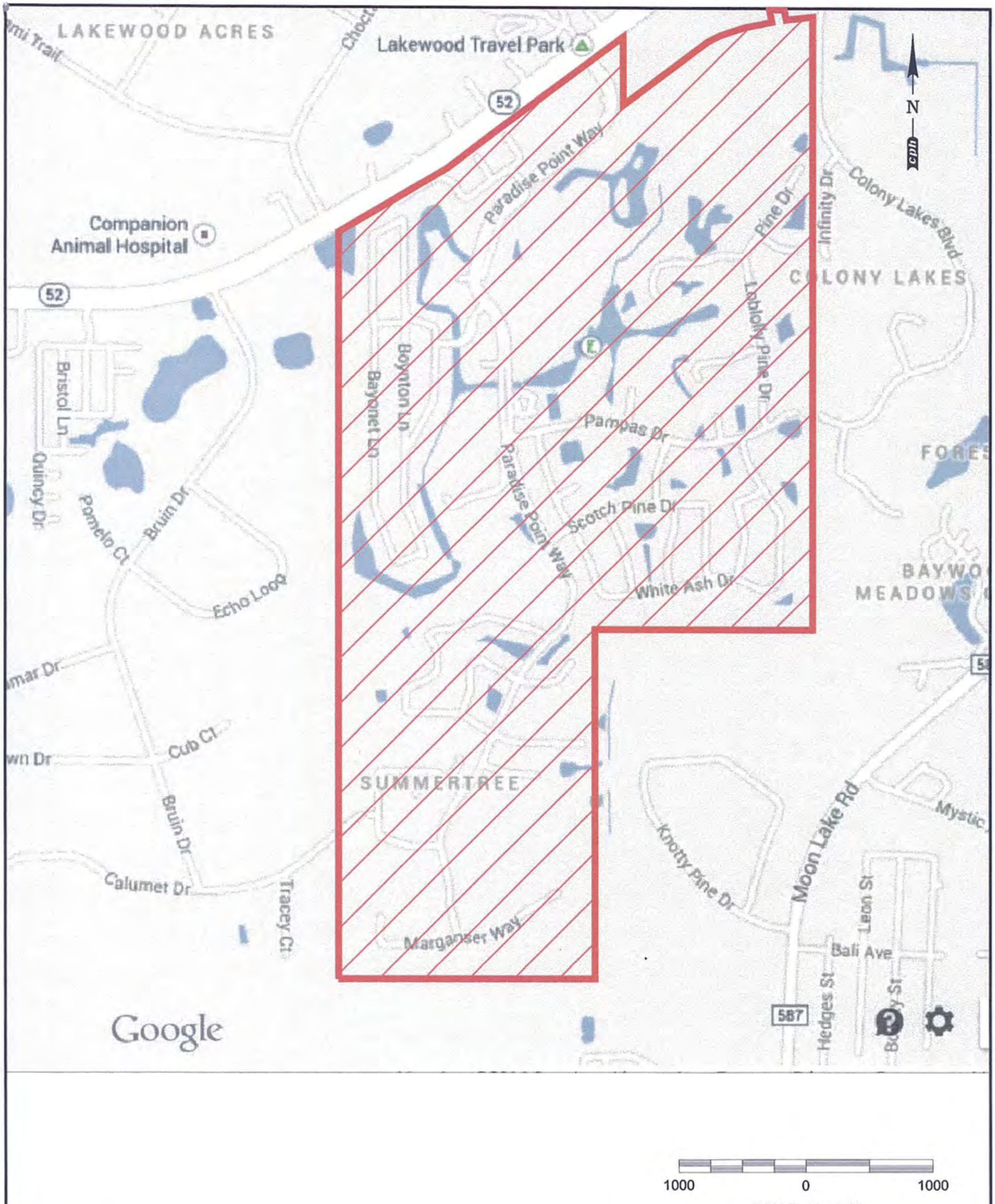
The Summertree water system is comprised of four (4) wells, Well #1, Well #2, Well #13, and Well #17. Based on conversations with staff, Well #17 has the worst water quality due to the presence of a significant amount of iron and sulfide in the aquifer at that location. Consequently, Well #17 is used solely as a backup water source. The water quality parameters that create concerns and complaints from the Summertree customers are attributed to the presence of sulfide compounds in the raw water, particularly hydrogen sulfide. Hydrogen sulfide, even in low concentrations, produces a rotten egg smell, which contributes to customer complaints.

In order to improve water quality using the existing treatment equipment, the Utility increased the chlorine dosing rate at Wells 1, 2 and 13 in order to oxidize the hydrogen sulfide while maintaining adequate disinfection of the source water. This method is routinely used throughout the water industry to inhibit the production of hydrogen sulfide odors in the distribution system. However, the effectiveness of this approach is limited when the source water contains a significant amount of organic material. Chlorine dosage rates that are set sufficiently high enough to maintain adequate disinfection while also oxidizing the native sulfide compounds may result in the production of disinfection byproducts (DBP's) such as Total Trihalomethanes (TTHM's) and Haloacetic Acids (HAA's). To inhibit the production of DBP's the utility modified its method of disinfection in 2006 from "free" chlorine to "total" chlorine, using a chloramination system that utilizes a combination of sodium hypochlorite and ammonium sulfate. Disinfection of the source water using a combination of the two chemicals has been effective as a disinfection agent while minimizing the production of DBP's since that time.

CPH has been directed by UIF to review the previously completed water quality engineering analysis as well as current water quality data in order to prepare an analysis of alternatives that will improve water quality. A site visit was conducted of the

Summertree facilities in coordination with UIF staff. Based on our discussions with UIF personnel, three (3) strategies were considered as outlined below:

- Construct a centralized Water Treatment Plant (WTP) with upgraded treatment.
- Upgrade water treatment at each well site.
- Interconnect with Pasco County Utilities' water system and purchase water in bulk thereafter.



Utilities, Inc.

cph www.cphcorp.com	5601 Mariner St #204 Tampa , Fl 33609 Ph: 813.288.0233	Date: 03/06/2014	Scale: 1"=1000'	SUMMERTREE SYSTEM	FIGURE 1
		Job No. X	File: FIG NO. 1	Utilities Inc. of Florida LOCATION MAP	©2014

2.0 Existing Water System

The existing water system is comprised of three (3) water production wells supplying three (3) hydropneumatic tanks that are used to dampen changes in system pressure. As specified by the Florida Department of Environmental Protection (FDEP), each well has a rated capacity of 125,000 gallons per day (gpd). The system operates under Public Water System (PWS) No. 6511423, with a permitted total Maximum Day Capacity of 375,000 gpd. The system is disinfected through the application of chloramines, which consist of the addition of both chlorine and ammonia to ground water to produce a "total" chlorine residual. Specifically, the raw water is injected with sodium hypochlorite (chlorine) and ammonium sulfate (ammonia) at each well site. In addition to pressurizing the system, the hydropneumatic tank is used to provide adequate contact time (CT) for disinfection to occur.

Figure 1: Well No. 1

Well #1 is located in the northwest corner of the service area on Bayonet Lane within a secured building. The hydropneumatic tank and chemicals are adjacent to the well house within a secure fenced area. Per the previous analysis performed for the system, Well #1 has an actual production capacity of 78 gpm (112,320 gpd), which is lower than the rated capacity.

Well #2 is located at the community recreation center along Paradise Pointe Way. The well and hydropneumatic tank are contained within a secured building and fenced area, respectively. Well No. 2 has a production capacity of 576,000 gpd.

Figure 2: Well No. 2

Figure 3: Well No. 13

Well #13 is located along Cocowood Drive, just south of the Arborwood community pool. The well, hydropneumatic tank and chemicals are contained within a fenced area. This well is capable of producing 504,000 gpd.

In total, the three (3) Summertree production wells, Well #1, Well #2, and Well #13, have a combined production rate of 1,192,000 gpd. An illustration of the existing water system is shown in Figure 2, detailing the locations of each well.

cph — SCALE: 1" = 300' DATE: 6-11-2012 JOB NO.: U0722 FILE: SYSTEM MAP	WATER DISTRIBUTION SYSTEM UTILITIES INC. OF FLORIDA SUMMERTREE SYSTEM	Utilities, Inc.	SHEET W-1

3.0 Water Quality

FDEP regulations require that public water systems treat their raw water source(s) sufficiently to meet primary and secondary drinking water standards as defined in Chapter 62-550, Florida Administrative Code (F.A.C.). This regulation defines the maximum contaminant level (MCL) for each of several constituents that may be found in water sources. Originally the water quality concerns arose from customer complaints resulting from the odors generated by the elevated hydrogen sulfide levels in the water. In addition to color, odor and taste issues, hydrogen sulfide can cause corrosion of metal surfaces and materials contained within the distribution system or in customer piping.

Water quality data generated from the 2005 analysis was reviewed in conjunction with water quality testing conducted in April 2012. The testing from the 2005 analysis was limited in scope. The testing done in 2012 analyzed the secondary drinking water standards including sulfide. The testing results for the April 2012 samples are contained in Appendix A and summarized below:

Parameter	(units)	MCL	Well No. 1	Well No. 2	Well No. 13
Aluminum	mg/L	0.2	0.061	0.061	0.061
Iron	mg/L	0.3	0.083	0.13	1.0
Zinc	mg/L	5	0.0100	0.0140	0.0130
Copper	mg/L	1	0.00044	0.00009	0.00560
Manganese	mg/L	0.05	0.0051	0.0049	0.0110
Silver	mg/L	0.1	0.000088	0.000085	0.000086
Chloride	mg/L	250	23	25	32
Fluoride	mg/L	0.4	N/A	N/A	N/A
Sulfate	mg/L	250	16.0	17.0	18.0
Color	Color Units	15	13	7	9
Odor	T.O.N.	3	1.0	1.0	1.0
TDS	mg/L	500	190	200	230
Sulfide	mg/L	N/A	N/A	N/A	N/A
pH	pH unit	6.5-8.5	7.0	7.3	6.9
MBAS	mg/L	0.5	0.038	0.038	0.038

Wells #1 and #2 did not produce any constituents that exceeded the secondary drinking water standards. Well #13 had an iron concentration of 1.0 mg/L; the MCL is 0.3 mg/L, thus requiring the need for treatment and/or removal. As stated in Rule 62-550.325(1) F.A.C., *Community Water Systems can sequester iron and manganese using* *polyphosphates when the maximum concentration of iron and manganese does not exceed 1.0 mg/L.*

However, the combined iron and manganese level for Well #13 exceeds the 1.0 mg/L threshold. Therefore, a sodium silicate sequestrant can be considered for treatment as defined in Rule 62-550.325(2): *Community Water Systems can sequester iron and manganese using sodium silicates, when the maximum combined concentration does not exceed 2.0 mg/L.*

In February 2014, secondary water quality parameters were taken throughout the distribution system. For each sample taken throughout the system, color exceeded the MCL. Since color at the individual well site did not exceed the MCL limits, it is evident that chemical reactions are occurring in the distribution system to produce color. In addition to color, iron exceeded the MCL limit in four (4) of the twelve (12) samples. This is attributed to the high concentration observed from Well #13. It should be noted that sulfide was also tested in the distribution system. Although the concentration was low, sulfides were present in the distribution system. The secondary water quality sample results are included in Appendix A.

In an effort to improve water quality in the system, the Utility routinely flushes portions of the distribution system to ensure proper turnover is occurring, thereby reducing the water age in the piping system. Any proposed modifications to the existing treatment method must consider the distribution system components and attributes. Based on a review of the sample data and the current flushing methodology, it is assumed that there is a persistent biomass present in the distribution system. This reflects the difficulty of achieving two divergent requirements on a continuous basis – add sufficient oxidants to the water supply to produce complete disinfection while at the same time minimize the production of disinfection byproducts, primarily TTHM's and HAA's. Therefore, any improvements must include options to clear the pipelines of any accumulated biomass. This can be accomplished by periodically switching to "free" chlorine disinfection in conjunction with a system-wide flushing effort in order to burn off any organics and bio-growth in the system. Alternatively, biomass may be mechanically removed from the water mains through the use of pigging equipment. However, this approach is not applicable to water service lines due to the small pipe diameter.

Hydrogen Sulfide

Guidelines for the treatment of hydrogen sulfide are included under the category of total sulfides, which are defined in Rule 62-555.315(5) – Public Water System Wells. This rule defines the concentration ranges for total sulfides and the requirement to remove hydrogen sulfide from the water source. Even though the sulfide results from the February 2014 samples do not show elevated levels of sulfides, earlier analyses showed results ranging from 0.2 to 2.4 mg/L.

Prior to 2006, the utility's method of reducing the formation of hydrogen sulfide was to increase the chlorine dosage rate in order to oxidize the sulfide. As previously mentioned, this is a common practice to overcome low concentration levels of hydrogen sulfide. However, long term, this practice could cause the creation of biomass in the distribution system. This biomass 'consumes' the chlorine in the distribution system making it harder to maintain chlorine residuals in the remote sections of the piping network. This is also thought to contribute to the formation of DBP's. The switch to "total" chlorine has allowed the Utility to remain below the MCL for TTHM's and HAA's.

The sulfide levels in each of the wells are detailed below. Two sets of samples were analyzed, November 2004 and April 2012. The November 2004 samples were collected for the 2005 engineering analysis. As shown, the results greatly differ (ND = None Detected).

Identification	Nov-04	Apr-12
	Sulfide (mg/L)	Sulfide (mg/L)
Well No. 1	ND	ND
Well No. 2	0.2	ND
Well No. 13	0.4	ND-
Well No. 17	2.4	ND

The April 2012 samples indicate the absence of sulfides in the raw water. No known changes have occurred in the wells between the 2004 samples and the 2012 samples that would have affected groundwater quality. Typically, water quality doesn't change this drastically. However, through review of all the data, it was determined that the samples collected in April 2012 were analyzed using a different analytical method than the samples collected in November 2004. For the April 2012 samples, the analytical method used was SM4500-S-D whereas the November 2004 samples were analyzed using method EPA378.1. The specific analytical method determines the type and amount of preservative used preserve the sample in its original state prior to lab analysis being conducted. A sample taken without preservative will allow a reduction in the pH of the water transforming the sulfides from the soluble to the gaseous phase. From the past analysis and conversation with utility staff, it is evident that hydrogen sulfide is present in the raw water of at least one of the wells. Prior to initiating the design of any treatment upgrades, it is recommended that the manufacturers of the proposed equipment conduct a new round of sampling, with direct involvement from the utility, to confirm the mineral content of the source water.

The highest value of sulfide was found at Well #17, which is not customarily used as a water source in day to day operation of the wells. However, the sulfide results from Well #13 are greater than 0.3 mg/L and thus require some level of treatment.

Disinfection Byproducts

Water quality test were not conducted for the DBP's during the February 2014 analysis. However, the 2005 report stated that both TTHM's and HAA's were greater than the acceptable limits of 80 mg/L and 60 mg/L, respectively. During the previous report, the method of disinfection was to dose the water with chlorine only. As previously mentioned, the utility is currently using a combination of chlorine and ammonia to produce chloramine. This practice is commonly used in water systems to minimize the production of DBP's. Therefore, since operational changes have been made to the disinfection methodology, it is recommended that additional samples be collected at each well to determine the concentration of DBP's and their precursors. This should be completed prior to moving forward with treatment design work.

Iron

As previously mentioned, Well #13 had an elevated iron concentration. Iron is commonly found in shallow wells throughout Florida and is included in the list of secondary drinking water parameters. Typically iron can be managed in the system by dosing the water source with a sequestering agent. As defined in Rule 62-550.325(2), the option to use a sequestering agent is based on the combined concentrations of iron and manganese. For Well #13, a sodium silicate sequestrant can be used to manage the iron. However, if each of the wells is manifolded to a centralized facility, the impact of Well #13's iron would be diluted below 1.0 mg/L, allowing the use of a polyphosphate sequestrant as an alternative.

Color

The MCL for color is 15 color units (CU). None of the wells produced color concentrations exceeding 15 CU. The three wells sampled were Well #1, Well # 2, and Well #13, and their respective color values were 13 CU, 7 CU, and 9 CU. However, all of the distribution samples showed color concentrations over 15 CU. The elevated color concentrations in the distribution system are assumed to be the result of a chemical reaction in the system, possibly between the disinfectant and any biomass that may be prevalent. Based on the color samples taken from each of the wells, it would not be recommended to provide treatment for color reduction. Prior to any treatment modifications, it would be recommended to thoroughly flush the distribution system to remove any possibly biomass in the system and to repeat the flushing process at least annually.

4.0 System Demands

The system currently has approximately 1,140 connections, primarily single-family and duplex units, serving an estimated population of 2,850. There are a handful of general service connections that are attributed to the community recreation areas. The monthly operating reports (MOR's) were reviewed for 2013. During 2013, the average day demand was 245,345 gpd or approximately 86 gallons per capita per day (gpcpd).

Based on the historical average day demand, the estimated maximum day demand is projected to be approximately 0.500 MGD based on a standard peaking factor of two. Facilities are designed and permitted around the anticipated system maximum day demand. With estimated maximum day demands of approximately 0.500 MGD, any improvements should be based upon a maximum day demand of 0.625 MGD, providing a nominal excess capacity of 20%. This additional capacity would provide the Utility with the means to meet additional system demand caused by customer growth through buildout of the community. The demands analyzed from the MOR's are detailed in the table below.

Month	Well No. 1 (gpd)	Well No. 2 (gpd)	Well No. 13 (gpd)	Well No. 17 (gpd)	Total Pumped (gallons)	Avg (gpd)
Jan-13	1,058,000	2,756,000	2,683,000	4,000	6,501,000	**209,710**
Feb-13	880,100	4,157,000	2,710,000	1,000	7,748,100	**276,718**
Mar-13	3,095,000	4,156,000	411,000	1,000	7,663,000	**247,194**
Apr-13	2,792,000	3,896,000	0	1,000	6,689,000	**222,967**
May-13	2,528,000	5,647,000	1,000	1,000	8,177,000	**263,774**
Jun-13	1,955,000	5,283,000	0	8,000	7,246,000	**241,533**
Jul-13	2,441,000	3,265,000	393,000	2,000	6,101,000	**196,806**
Aug-13	1,735,000	1,036,000	3,916,000	1,000	6,688,000	**215,742**
Sep-13	1,573,000	957,000	4,828,000	1,000	7,359,000	**245,300**
Oct-13	1,591,000	2,706,000	4,198,000	2,000	8,497,000	**274,097**
Nov-13	1,566,000	3,433,000	3,559,000	6,000	8,564,000	**285,467**
Dec-13	1,361,000	3,138,000	3,706,000	5,000	8,210,000	**264,839**
AVG	**1,881,258**	**3,369,167**	**2,200,417**	**2,750**	**7,453,592**	245,345

As previously mentioned, Well #17 is only used as a backup water source. However, to ensure the well remains viable, the Utility routinely flushes the well to get proper turnover in the well column.

5.0 Water Treatment Alternatives

The main constituent of concern for improved water quality is hydrogen sulfide. As defined in Rule 62-555.315, raw water sources with <0.3 mg/L of total sulfides and <0.1 mg/L of Iron can be treated by direct chlorination. However, it further states that *"Direct chlorination of sulfide in water in the pH range normally found in potable sources* *produces elemental sulfur and increased turbidity. Finished water turbidity should not be more than two nephelometric turbidity units greater than raw water turbidity".*

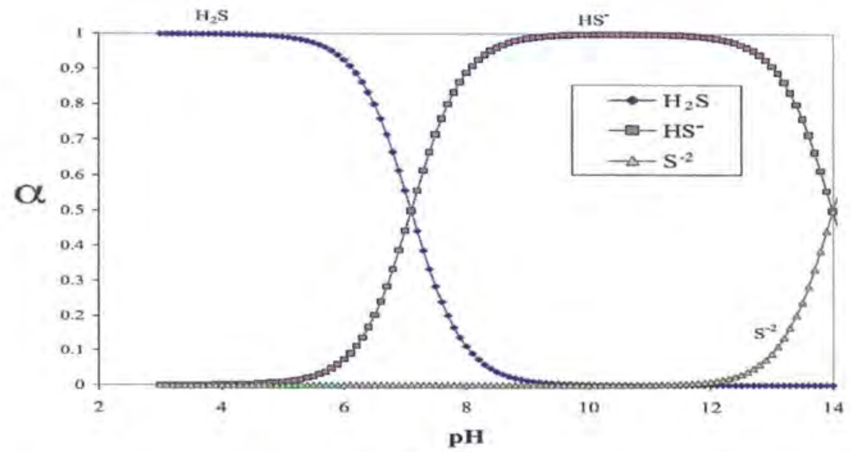
It will be essential to remove the hydrogen sulfide from the raw water prior to the addition of disinfectants to prevent oxidation of the sulfides from occurring within the distribution system. In addition to hydrogen sulfide treatment, color and iron should be evaluated in the treatment scheme as well. In order to accomplish this and provide water quality comparable to Pasco County, there are three (3) viable options to improve water quality throughout the system; Aeration, Ion Exchange, and Membrane Treatment.

Aeration

Aeration is a common treatment method used to remove hydrogen sulfide from raw water sources. With respect to the Summertree system, aeration would not be feasible for treatment at the individual well sites; aeration would be used only at a centralized facility. There are two types of aeration methods that may be used to remove sulfides, cascade aeration and packed tower aeration. The preferred methodology is dependent on the hydrogen sulfide level in the raw water. As outlined in Rule 62-555.315, source water containing "moderate" amounts of total sulfide, between 0.3 mg/L and 0.6 mg/L, can be treated cost effectively using cascade or "tray" aeration. For tray aeration, the raw water is typically pumped to the top a storage tank and is allowed to cascade over rows of perforated trays. This process aerates the raw water, releasing the hydrogen sulfide from the raw water. Although effective in low concentrations, this method is not very efficient in removal, due to the limited surface available for aeration.

The second method, packed tower aeration, is typically used when hydrogen sulfide levels are considered "significant", in excess of 0.6 mg/L. This process requires the raw water to be pumped to the top of a fiberglass tower that houses plastic media in the shape of small plastic balls. The balls are perforated providing much more surface area for the raw water to be aerated. As the raw water falls through the tower, ambient air is blown countercurrent to the water flow, creating the aeration effect. This process is much more effective in removing hydrogen sulfide from the raw water source.

The total sulfide in water consists of three species: H_2S, HS^-, and S^{2-}. The distribution of the species is dependent on pH as shown in the figure below.



As detailed above, by dropping the pH of the raw water to six standard units (SU), the sulfide in the raw water is converted from its liquid form to gaseous form, allowing for 99% removal efficiency. This process is typically performed by adding a strong acid.

One of the drawbacks to either type of aeration is the release of the odorous air. As the aeration process takes place, the hydrogen sulfide is released as a gas, which is attributed to the "rotten egg" smell. This odorous air will need to be captured and treated. The common types of odor control are chemical scrubbing, bio-scrubber, and bio-filtration. A biofilter would ultimately be the recommended option for odor control. The odorous air is blown through an internal media that is moistened to produce a microbial growth that interacts with the hydrogen sulfide-laden air. The microbes consume the hydrogen sulfide from the air and clean air is expelled from the unit. The drawback to this process, including the other odor control options mentioned, is the waste stream produced from the unit. As the microbes in the biofilter consume the hydrogen sulfide gas, sulfate is released, which blends with the moisture content in the media to generate sulfuric acid (pH at 1.0 SU or below). Although small in volume, this waste stream will need to be accounted for in the overall design. Typically, this waste stream is disposed of in a sewer system.

Ion Exchange

Ion exchange is a process that utilizes a resin to react with the impurity ions in the raw water. The impurity ions, such as hydrogen sulfide and iron, bond to the resin, purifying the water. Ion exchange is a process that could be performed at the individual well sites or at a centralized facility. The ion exchange units will require adequate room for installation and piping modifications, if feasible for each well site. There are two drawbacks to ion exchange, resin change out and waste streams. As the resin consumes the impurities, the resin bed will become saturated and new/clean resin will be required. This process will be specific to the manufacturer. The resin that can be cleaned will produce backwash water that will require disposal into a sewer system. To be feasible for each site, a sewer system must be nearby to dispose of the backwash water.

For this analysis, we consulted with Moss Kelley, who is the sales representative for Orica Watercare. Orica Watercare utilizes a Magnetic Ion Exchange (MIEX) process to treat raw water. An identical process was used for a water system that had similar water quality issues; therefore, it is a proven treatment process for hydrogen sulfide removal. Additionally, Orica Watercare performed a pilot study on the source water at Summertree Well #13 in 2007 and is thus familiar with the system and the water quality from each well.

The results of the pilot study showed that the MIEX Resin Treatment reduced the dissolved organic carbon (DOC) by an average of 64%, reducing the average raw water concentration of DOC from 4.36 mg/L to 1.57 mg/L. This in turn reduced the DBP TTHM and HAA5 precursors by an average of 70% and 74% respectively. Hydrogen sulfide was reduced on an average of 56%; however, later trials showed a removal of as much as 65%. Additionally, the MIEX Resin Treatment consistently removed iron and color from the raw water.

Through our discussions with Moss Kelly, two treatment options were indentified, (1) individual pressurized vessels to be used at each well site, and (2) a gravity fed system to be used at a centralized facility. The pressurized ion exchange unit recommended by Orica Watercare utilizes a contactor vessel, polishing vessel, and a regeneration skid. The raw water is introduced into the pressurized contactor vessel. This is where the water will react with the resin. From this vessel, the water is transferred to the polishing vessel to further purify the water. The regeneration skid is used to clean the resin as it becomes inundated with impurities. The clean resin is then returned to the contactor vessel. Each of these units could be installed at the wells site; however, if Well #17 is reconnected back to the system it would be recommended to pipe this well to Well #13. The site housing Well #17 is space limited and is located directly between two single family homes. Well #13 is located next to a community pool, has some buffer and has adequate space available for site improvements.

The unit proposed for a centralized facility is a 2.0 MGD treatment units containing two1.0 MGD contactors in a gravity system. This configuration assumes that Well #17 is used as a raw water source. Similar to the units described above, raw water would be introduced into the contactor vessels and would flow by gravity to the polishing units. The resin would be cleaned by a regeneration unit. The differences between this configuration and the pressurized configuration are the resin transfer tank and brine tank. The regeneration skid would pump the clean resin to the resin transfer tank, where it will be transferred into each of the contactor vessels. The brine tank is used as part of the resin regeneration process.

Membrane Treatment

Membrane treatment is a common treatment used for water systems that are in coastal locations in order to remove chloride at elevated levels. Although chlorides are not prevalent in the Summertree Wells, membranes can be effective in removing organics and iron from the raw water. There are two common types of membrane treatment, Nano-Filtration and Reverse Osmosis. In order to determine the most appropriate membrane, a pilot test would need to be conducted. However, based upon on experience, more than likely a low pressure Nano-Filtration unit would be more than capable of removing the constituents from the raw water. To achieve hydrogen sulfide removal, aeration would still be required following membrane treatment. Typically this is accomplished using packed tower aerators. The packed towers would operate as previously discussed.

Membrane treatment would only be feasible for a centralized facility. There is not enough space available at the individual well sites to install the required components. The membrane treatment process begins by introducing raw water into canister filters. These filters are place ahead of the membranes in order to remove larger diameter particles so as to protect the actual membranes from damage. These canister filters typically have internal elements with 5-micron openings. The raw water is then be repumped to achieve the necessary pressure to pass the water through the membranes and through the aeration process. The membranes would be configured on a skid, in an array that would be determined through the pilot study. After passing through the membranes, the permeate (treated water) would then pass through a packed tower aerator for hydrogen sulfide removal. The concentrate (wastewater) would require a means of disposal. Depending upon volume and concentration of the concentrate water, it possibly could be disposed of in the onsite lift station; however, review of Pasco County's industrial pretreatment ordinance would need to be reviewed and compared to the results of the pilot study to determine if that disposal method is a viable option.

6.0 Treatment Plant Alternatives

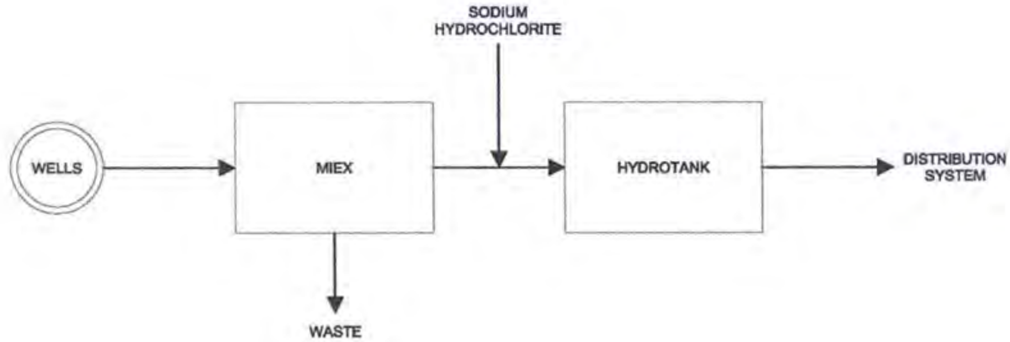
As previously mentioned, the Summertree Water System is comprised of three (3) individual water treatment sites that supply and sustain system demands, Well #1, Well #2, and Well #13. Each well site contains its own treatment, chloramine disinfection, and uses a hydropneumatic tank to pressurize the system. Well #17 is a backup well that is only used in an emergency due to the highly mineralized water produced by the well. Based on the current configuration of this system, three options were evaluated to improve the water quality; individual treatment at each well, centralized water treatment facility, and an interconnection with Pasco County.

Individual Treatment

Each of the individual sites has limited spacing for improvements; therefore, the only viable treatment option for individual treatment is pressurized ion exchange, due to the need for storage and pumping of conventional treatment systems. As previously discussed, we coordinated with Moss Kelley/Orica Watercare to determine the viability of MIEX treatment at each individual well site. In 2006 Orica Watercare performed a pilot study on Well #13. The new water quality analysis provided by the Utility was given to Orica Watercare for this evaluation. Based on their recommendations, they have recommended two different capacity MIEX systems, one for Well #1 and one for Wells #2 and #13. With this type of treatment, Well #17 could be utilized and thus increase system capacity.

The proposed MIEX treatment system can provide the level of treatment to allow the Utility to switch back to conventional disinfection, i.e. "free" chlorine. The known impurities in the raw water, such as hydrogen sulfide, iron, color, and organics, can be removed through this treatment process, providing water quality comparable to the water produced by Pasco County. Site modifications would be required at each site to redirect the wellhead piping into the pressurized contactor vessel. As previously discussed, the proposed MIEX units are comprised of a contactor vessel, polishing vessel, and regeneration skid. The raw water would be pumped through the contactor vessel. In this initial vessel, raw water will react with the resin to remove the impurities. From the contactor vessel, the water would pass through the polishing vessel, providing further treatment before being discharged into the distribution system.

Following the polishing vessel, new piping would be required to connect to the existing hydropneumatic tank. The water would be dosed with chlorine prior to passing through the hydropneumatic tank, allowing the water to achieve complete disinfection prior to delivery to the nearest customer. A typical process flow diagram for this option is detailed below.



The capital cost to install MIEX treatment systems at each well site is estimated to be $4.1 Million, and increase operational cost by approximately $32 per 1,000 gallons based on the current average flow of 245,000 gallons. It is anticipated that the volume of wastewater would increase as well, created by the backwashing of the MIEX resin. This price could be reduced by approximately $1.0 Million if Well #17 is not utilized. However, it is recommended that Well #17 be included in the design in order to optimize the investment in the existing wells and to meet fire flow requirements. Based on the number of homes within the community, this breaks down to approximately $3,600 per home. This capital investment for these improvements is anticipated to increase the homeowner's bills by approximately $45 per month.

Centralized Water Plant

In order to have a centralized water treatment facility, raw water from all of the wells would need to be piped to one area. The Utility owns a piece of property in the center of the service area that is adequate for construction of a centralized facility. The property is surrounded by trees that would provide a natural buffer for the benefit of the residents. Additionally, the site contains a lift station that can be utilized for disposal of any waste stream generated from the proposed treatment process.

The option of constructing a centralized facility will require each of four wells to be manifolded into a common raw water main and piped to the proposed site off of Paradise Pointe Way. This option would include Well #17 in the design of the facility. The manifolded raw water main will be piped directly into the selected treatment process.

There are three (3) viable options for well treatment: Packed Tower Aeration, Membrane Treatment, and Ion Exchange. Based upon past experience with these three options, the most cost effective treatment option may be aeration. However, before a treatment option is finalized, it would be recommended to allow vendors for each option to collect raw water samples and provide recommendations for removal of hydrogen sulfide, iron, color, and disinfection byproduct precursors (if required). Additionally, each of these options will produce some volume of wastewater. This wastewater volume will further increase the operational costs detailed below, through the bulk sewer agreement with the County.

Packed Tower Aeration

As previously discussed, aeration is a common method of removing hydrogen sulfide. This is accomplished by aerating the raw water and stripping off the hydrogen sulfide gasses. The output from each of the wells would be manifolded together and discharged at the top of the aerator. The blending of the wells' output will dilute the high iron concentration found in Well #13. Since the iron concentrations in Well #1 and Well #2 are lower than Well #13, the combined raw water streams will reduce the total iron concentration in the raw water. Based on the testing results from the April 2012 analysis, the weighted average of the raw water would be 0.5 mg/L. Some of the iron would be oxidized through the aeration process; however, a sequestrant would continue to be used to minimize iron content in the finished water.

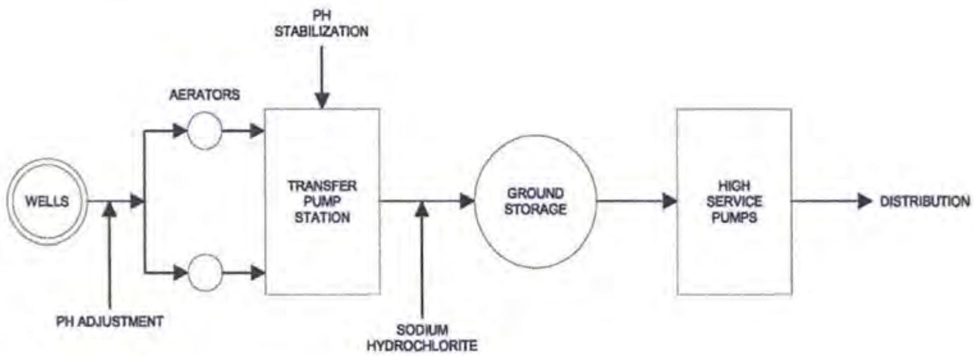
The manifolded raw water main would be piped directly into the aeration portion of the treatment scheme. For this facility, it is recommended that packed tower aerators be installed to scrub off the hydrogen sulfide gas. In this configuration, the raw water is pumped to the top of the aerator, and then falls by gravity through the internal media. While this is occurring, a fan blows ambient air countercurrent against the flow of water. This process aerates the water, removing the hydrogen sulfide from the raw water. Typically, packed towers can remove up to 75% of the hydrogen sulfide from the raw water. Based upon a weighted average of the wells, using the original sulfide results, the finished water hydrogen sulfide concentration would be approximately 0.3 mg/L. The removal efficiency would be further enhanced by injecting a strong acid to the raw water to lower the pH. At a pH of 6.5, 90% removal efficiency can be attained, producing a finished water hydrogen sulfide concentration of 0.1 mg/L. At this concentration, the concern of oxidizing sulfide in the distribution system greatly diminishes.

Prior to adding the disinfection agent, the pH of the post-aerated water will need to be increased in order to prevent corrosion and scaling. However, disinfection using sodium hypochlorite typically will slightly raise the pH. The stripped sulfide gas removed during the packed tower aeration process will need to be treated to prevent excessive odors on site. This can be accomplished through the use of air scrubbers or bio-filters.

Following aeration, the treated water would be collected in a transfer pump station where pH stabilization and disinfection will occur. This treatment method would support the return to the use of "free" chlorine using sodium hypochlorite and thereby eliminate the use of ammonia in the disinfection process. From the information reviewed, it does not appear that the existing wells are under the influence of surface water and therefore will not require 4-log treatment. However, if surface water influences on the wells are indicated by bacteriological sampling results, switching back to "free" chlorine will make it significantly easier to meet the 4-log removal criteria than the use of chloramines and a "total" chlorine residual.

From the transfer pump station, the treated water will be pumped into a ground storage tank. FDEP requires a minimum of 25% of the maximum day water demand flow. Based on a max day design capacity of 0.60 MGD, this would require a minimum tank volume of 0.15 MG. Considering the needed fire flows for a 2-hour sustained fire increases the volume requirement by approximately 120,000 gallons. This yields a necessary useful volume of 270,000 gallons. The tank should have a minimum overall capacity of 300,000 gallons to account for the last couple feet of water in the tank necessary for proper pumping operations.

Finished water would be pumped from the proposed ground storage tank by a new high service pump station. To handle a peak flow of 1.2 MGD (833 gpm), it would be recommended that two (2) 350-gpm and one (1) 750-gpm high service pumps be installed. The two smaller pumps will serve the daily needs of the service area while the largest pump would be used during periods of extreme demand, provide water to hydrants throughout the system, and used as an installed backup pump. The pumps would be operated with variable frequency drives (VFD's) allowing the speed of the pumps to be adjusted to handle varying flows. The minimum output from a single pump would be as low as 175 gpm. Additionally, an existing hydropneumatic tank at one of the individual well sites would be relocated to the proposed centralized WTP. A new finished water main would be required to connect the proposed high service pump station to the existing distribution system. The point of connection would be the existing 12-inch water main along Paradise Pointe Way near Pampas Drive. A process flow diagram for this process is detailed below.



This type of treatment primarily addresses the removal of hydrogen sulfide. This process doesn't specifically remove other impurities such as iron, color, and organics. There is potential to oxidize the iron and organics, but this would need to be determined as part of the design process based upon specific water quality data. Color will not be removed through this process, thus the finished water quality would be less than optimum. This option is estimated to have a proposed capital construction cost of approximately $2,000,000 and increase the operational cost by approximately $37 per 1,000 gallons, based on the system average flow of 245,000 gallons per day. With 1,140 connections, this capital cost breaks down to $1,755 per connection and approximately $22 per month. A breakdown of the cost is identified in Appendix B.

Ion Exchange

As previously discussed, ion exchange (MIEX) could also be utilized at a central facility. Unlike the systems used for treatment at individual wells, this proposed unit would be gravity fed. This system could produce a water quality comparable to the water produced by Pasco County. All impurities in the raw water could be removed through the interaction of the raw water with the resin used in the ion exchange process as described below.

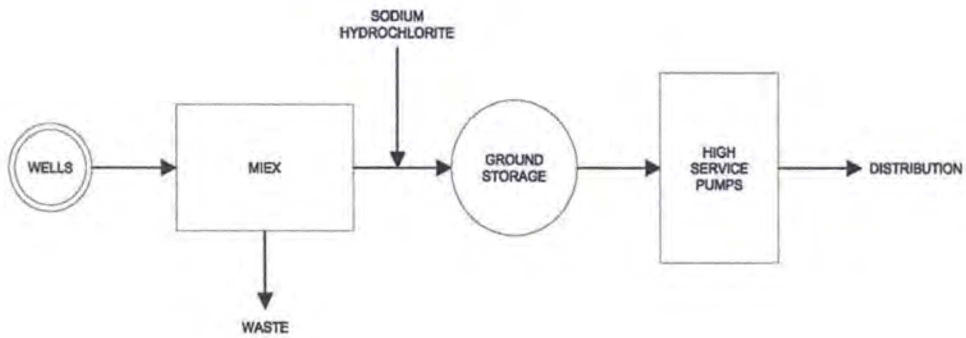
The raw water would be directly piped into the MIEX treatment process. Raw water would initially enter the contactor vessel and flow by gravity to the polishing vessel. Resin would be regenerated through the regeneration equipment and returned back into the contactor vessel following the regeneration step. This process would still require the periodic addition of fresh resin to replenish that which is lost through the treatment process. Not all resin is recaptured and cleaned. Spent resin or resin that breaks through the process will need to be replenished by clean/virgin resin.

Based on the information provided by Orica Watercare, the manufacturer of the MIEX system, this process will be able to remove all impurities of concern; hydrogen sulfide, iron, color, and organics. Based on past experience with MIEX, this system is capable of removing up to 99% of the hydrogen sulfide. However, do to the organics in the raw water a careful balance must be established to optimize the resin regeneration rate. Higher regeneration rates result in lower removal percentages of hydrogen sulfide, and lower regeneration rates result in higher hydrogen sulfide removal and lower organic removal. Color can be reduced by an estimated average of 70%, while iron may be reduced by an estimated average 21%. The combined raw water will improve finished water concentrations by optimizing the use of the wells that produce superior water quality with water produced from inferior wells. This will result in reduced treatment cost.

From the MIEX unit, the processed water will flow by gravity to a ground storage tank. As described in the previous section, a 0.3 million gallon ground storage tank would be constructed at the centralized facility. This treatment methodology will support a return to the standard method of disinfection using chlorine (sodium hypochlorite). The treated water would be dosed with chlorine prior to entering the ground storage tank. The tank will provide the required detention time prior to delivery of the finished water to the nearest connection to the system.

Finished water would be drawn out of the tank through a new high service pump station. The configuration would be identical to the one described in the aeration section using two (2) 350-gpm pumps and one (1) 750-gpm pump. Water would be distributed to the system through a new finished water main that would connect to the existing 12-inch water main along Paradise Pointe Way. One of the hydropneumatic tanks may be relocated from a well to the central treatment facility.

The ion exchange process has a waste stream associated with the regeneration equipment; however, this water is not considered aggressive and should not fall under Pasco County's industrial pretreatment program. Therefore, the waste stream generated from the water treatment process would be discharged into the onsite lift station.



The estimated capital cost associated with this option is $3.9 Million, and includes a 2.0 MGD MIEX treatment system, ground storage tank, high service pumping, chemical facilities, electrical equipment, instrumentation, and site piping. The operational cost for a centralized MIEX WTP is anticipated to be similar to the individual, $0.13/1,000 gallons, which should increase approximately $32 based on the current average flows of 245,000 gallons. Based on the number of home within the community, this requires a capital investment of an estimated $3,420 per connection. This anticipated capital cost is anticipated to increase each homeowner's monthly bills by $43.

<u>Membrane Treatment</u>

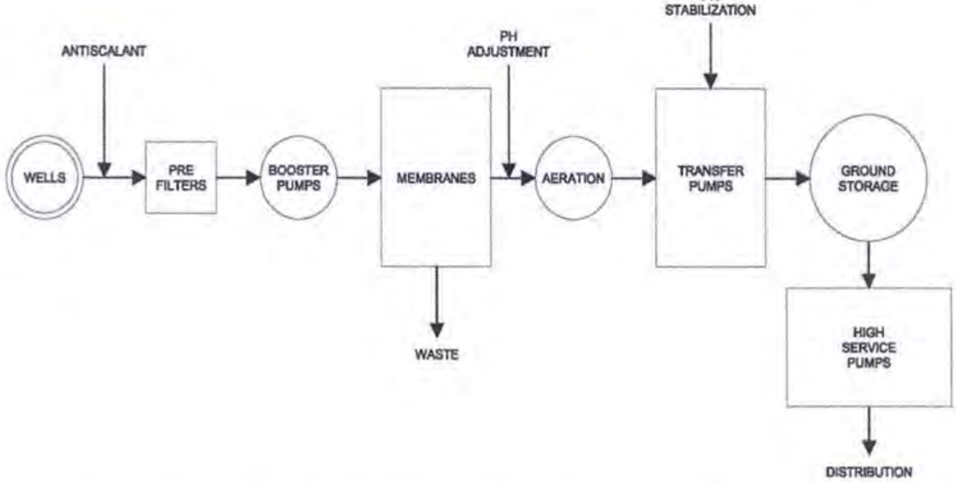
Similar to the previous two processes described above, the raw water would be piped to a central treatment facility through a common raw water main. Prior to entering the membrane process, the raw water should be passed through canister filters. These filters remove larger particles from the raw water, preventing damage to the actual membranes. Two (2) canister filters would be specified to provide system redundancy. Higher pressures are needed to properly operate the membrane process, to pass the water through the membranes effectively. Following the canister filters, inline booster pumps would be installed to produce the required pressure applied to the membranes. The operating range of pressure would be established during pilot testing.

Two skid-mounted membrane treatment units would be recommended, each with a capacity of 1.0 MGD to handle what would be the system's peak demand condition, all wells pumping to produce 1,228 gpm. The membranes would be configured in a specific array, which would be established through the pilot study to determine how many membranes are required in the first and second stages. Membrane treatment will be able to remove all impurities except for hydrogen sulfide. For this treatment methodology, aeration would still be required to remove hydrogen sulfide from the raw water.

The permeate (treated water) would flow from the membrane skids to packed towers. Water would be pumped to the top of the packed towers, identical to the process described in the Aeration Section above. The water would still require pH adjustment prior to and following aeration. Finished water would collect in a transfer pump station and pumped to a ground storage tank. Additionally, odor control would be required to treat odorous air expelled from the packed towers, such as bio-filters or chemical scrubbers. Sodium hypochlorite would be dosed at the pump station to achieve the minimum detention time.

Water would be stored in a 0.3 MGD ground storage tank and delivered to the distribution system through a new high service pump station. The high service pump station would consist of three (3) high service pumps. Two (2) 350-gpm pumps would operate in an alternating cycle and one (1) 750-gpm pump would provide adequate flow to fire hydrants located throughout the distribution system.

The major drawback to membrane treatment is the volume of and cost to dispose of the concentrate. Concentrate is the waste stream produced during the membrane treatment process. Typically this volume of water is 15% of the total processed water. At an average demand of 245,000 gpd, the average concentrate produced is estimated to be approximately 40,000 gpd, or 25 gpm. The concentrate possibly could be discharged into the onsite master lift station. However, the proposed constituents of the concentrate stream would need to be compared to Pasco County's industrial pretreatment program to ensure compliance. If the concentrate stream is out of compliance with the county's limits, the Utility could opt to pay a surcharge for disposal or alternatively construct a deep injection well. For the purposes of this analysis, it is assumed that the concentrate could be disposed of in the onsite lift station.



The estimated capital cost for membrane treatment is $5.5 Million. This price includes membranes, vessels, canister filters, instrumentation, control panels and associated electrical equipment, storage, pumping, chemical facilities, site piping, and emergency generator. Based on the number of homes within the community, the estimated cost per household is over $4,825, and would increase each homeowner's bill by approximately $60 per month.

Interconnect

The option of interconnecting with Pasco County would require connection to the County's existing 16-inch water main along County Road 52. We obtained a copy of the County's GIS map for this area and confirmed the existence of a 16-inch potable water main along the south side of County Road 52. The operating pressure of the County's system is known precisely in this vicinity; however, there is an existing 12-inch water main stub out near the intersection of Paradise Pointe Way and County Road 52. A 12-inch potable water main connected to the County's 16-inch water main should be capable of supplying the Summertree community at peak demand conditions for the present and future needs.

Water quality samples were collected from the County's distribution system in the Colony Lakes Subdivision to compare the finished water qualities of Summertree to Pasco County's water. Colony Lakes is the neighborhood located directly to the east of Summertree. This subdivision is presumed to be supplied by the 16-inch potable water main mentioned above; therefore the water quality observed from the samples collected in Colony Lakes should reflect the water quality Summertree should expect the County to deliver through an interconnect. A comparison of the water quality samples for Summertree and Pasco County at Colony Lake are detailed below.

Parameter	(units)	MCL	Summertree	Pasco County
Aluminum	mg/L	0.2	0.061	0.061
Iron	mg/L	0.3	**0.305**	0.038
Zinc	mg/L	5	0.011	0.019
Copper	mg/L	1	0.007	0.0049
Manganese	mg/L	0.05	0.006	0.00095
Silver	mg/L	0.1	0.00006	0.005
Chloride	mg/L	250	15	**39**
Fluoride	mg/L	0.4	0.084	0.16
Sulfate	mg/L	250	4.8	**100**
Color	Color Units	15	**23.2**	12.45
Odor	T.O.N.	3	1.000	1
TDS	mg/L	500	243	**350**
Sulfide	mg/L	N/A	0.006	-
pH	pH unit	6.5-8.5	7.54	8.1
MBAS	mg/L	0.5	0.038	0.038

The water quality parameters detailed in the table above are the averages of the water quality samples taken from Summertree and Colony Lakes. As detailed in the table, a majority of the parameters are comparable in nature. The biggest differences observed are iron, chloride, sulfate, color, and TDS. Based on the average concentrations detailed above for Summertree, iron and color exceed the MCL; however, if treatment improvements are performed, these parameters should be below the MCL. If the interconnect is established, the residents could anticipate an increase in chloride, sulfate, and TDS concentrations. These parameters are less than the MCL but exceed the current concentration values produced by the Summertree Water System.

The proposed 12-inch water main would be connected to Summertree's existing distribution network in the vicinity of the entrance to Summertree. This will require construction of approximately 1,500 linear feet (LF) of 12-inch water main between County Road 52 and the nearest point of connection to an existing 12-inch water main.

Paradise Pointe Way is the main roadway in and out of the community. This road right-of-way is heavily landscaped and contains numerous shrubs and large oak trees. Protection of existing vegetation and restoration of the right-of-way will be essential. The right-of-way contains fewer conflicts further south as Paradise Pointe Way approaches Golf Round Drive. To minimize impacts to the community and right-of-way aesthetics, directional drilling would be utilized. This would reduce restoration costs and thus be more cost effective compared to standard open cut construction methods. This method will still require entry and receiving pits, temporarily disturbing the existing right-of-way conditions at these locations. Standard pipe installation using open trench cutting may be feasible within the community in certain locations, but this construction method will generate more restoration costs.

This option will also require the decommissioning of the four (4) production wells and each of their associated water treatment facilities. The wells cannot be left inactive, thus each one must be closed out in conformance with the rules and regulations of the Southwest Florida Water Management District. The existing wellheads will need to be removed and the wells will need to be abandoned and capped. Additionally, there is liability leaving inactive and abandoned equipment at non-operational sites; therefore it would be necessary to demolish all existing equipment and components within each of the WTP sites. This will require notification and permitting through FDEP.

The anticipated costs for this option are estimated to be $2.6 Million. In order to connect to the County's system, impact fees will be required to purchase adequate capacity to serve the community at build out conditions. Impact fees are based on equivalent residential units (ERU's). At built out there will be approximately 1,300 residential homes and a few small commercial connections. The impact fee cost for this option was provided by Pasco County, which is $1,561.00 per ERU. There is potential that these fees could change depending upon final determination from the County. It should also be noted that the meter set fee of $616.80 in this letter was based on an 8-inch connection. The minimum connection size for this system would be 12-inch size in order to provide adequate fire flow, so this meter set fee will need to be established through negotiations with the County. A detailed breakdown of the anticipated project costs are detailed in Appendix B.

7.0 System Flushing

The Utility understands that routine flushing within the distribution system is a concern for the residents of Summertree. Residents have indicated that many homeowners within the community have seen their homes impacted by ground subsidence resulting in the injection of grout to stabilize house foundations at considerable cost. Residents worry that additional groundwater withdrawals associated with the flushing program may have contributed to the observed groundwater subsidence or may have a future impact. Therefore, to the extent that flushing activity can be reduced, this concern can be addressed.

Flushing the distribution system is a common practice for many water utilities, although, improving the finished water quality should significantly reduce the volume of flushing required for Summertree. As previously discussed, the Utility has had difficulty maintaining optimum chlorine residuals in remote sections of the distribution system. Based on the previous method of operating the water system, it is assumed that biomass was developed in the distribution system. This could have been caused through the oxidation of hydrogen sulfide in the distribution system. When this occurs, the oxidized material begins to form a biomass in the pipelines. The biomass typically forms in the remote sections of the distribution system, where the use of water is lower and turnover of the volume within the pipelines doesn't occur on a frequent basis.

As mentioned, the improved water quality should reduce the need to routinely flush the distribution system. However, prior to any proposed improvements, the distribution system should be thoroughly cleaned, either through a heavily chlorinated full bore unidirectional flush or ice pigging. As part of the design effort, either treatment improvements or construction of the interconnect, a distribution system cleaning protocol should be established. This protocol would include sampling sections of the distribution network to quantify nitrate, nitrite, and dissolved oxygen, before and after the cleaning activity, to ensure the biomass has been eliminated from the pipelines.

It should be noted that flushing ultimately cannot be eliminated. It will continue to occur in order to insure that adequate disinfection has taken place. However, if the utility modifies the existing treatment system, this would allow a switch in disinfection methodology. The utility currently utilizes chloramines because of the presence of hydrogen sulfide in the raw water and to reduce the formation of DBP's. Improving treatment, by removing hydrogen sulfide from the raw water, will allow the Utility to convert back to "free" chlorine, sodium hypochlorite. Disinfecting by sodium hypochlorite and thoroughly cleaning the distribution system should theoretically eliminate the need to flush on a consistent basis.

If the interconnect is constructed annual flushing of the distribution system will be required. The County also disinfects using chloramines. This method of disinfection requires a "free" chlorine flush of the system on a periodic basis. As mentioned, this typically occurs annually; however, the frequency of the "free" chlorine flush should be increased to bi-annually or quarterly if warranted after analysis of periodic sampling within the distribution system to monitor the development of biomass.

8.0 Recommendations

The Summertree Water System has received customer complaints regarding water quality, specifically, the odors generated from the excess hydrogen sulfide in the raw water, color, taste and iron deposits. This evaluation reviewed three options to provide improved water quality; advanced treatment located at the individual well sites, advanced treatment at a centralized water treatment facility; and an interconnect with Pasco County wherein all of the water would be supplied through a master meter. Based on our evaluation of the capital cost, feasibility, operational cost, and finished water quality parameters, we recommend that Utilities Inc. of Florida pursue a potable water interconnect with Pasco County, including a thorough cleaning of the distribution system.

The cost to construct the interconnect is anticipated to be $2,575,241, which includes the payment of Pasco County impact fees as established from the letter received from Pasco County on February 24, 2014. The estimated impact fees are $1,779,540, based on 1,140 connections, and account for a majority of the cost detailed above. The impact fees typically are prepaid by the Utility and are paid back over time by the customers through the rate structure established by the PSC. The direct capital cost to construct the interconnect with Pasco County is estimated to increase the customer's monthly water bills by at least $24.76.

The interconnect would provide improved water quality with respect to iron and hydrogen sulfide; however, the residents can expect increased concentrations of chloride, sulfate, and TDS. These constituents are less than the MCL, and the increased concentrations are not anticipated to be detrimental to the residents. These improvements will still require the Utility to flush the distribution network on a periodic basis in order to be compliant with DEP rules regarding disinfection and system maintenance. As previously discussed, the County disinfects by the addition of chloramines. Disinfecting by chloramines requires "free" chlorine burns of the distribution system on a periodic basis. This is typically performed annually and would be coordinated with Pasco County. However, if deemed necessary more frequent "free" chlorine burns may be required. If the distribution system is thoroughly cleaned to remove any organics or biomass from the system, it is anticipated that the Utility would only be required to perform the annual "free" chlorine burn in conjunction with the County's schedule.

APPENDIX A – WATER QUALITY

Utilities, Inc. of Florida
Summertree
Test results, secondary drinking water parameters & sulfide
February 14, 2014

Parameter	(units)	MCL	Max Value	Well 1 2012	Well 2 2012	Well 13 2012	House Tap 11615 English Elm	Nearby System Site 11619 English Elm	House Tap 11508 Yellow Birch	Nearby System Site 11704 Rosetree	House Tap 11439 Golf Round
Aluminum	mg/L	0.2	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061
Iron	mg/L	0.3	1.0	0.083	0.13	1.0	0.08	0.52	0.23	0.35	0.10
Zinc	mg/L	5	0.0200	0.0100	0.0140	0.0130	0.0130	0.0088	0.0100	0.0095	0.0200
Copper	mg/L	1	0.0200	0.00044	0.00009	0.00560	0.0200	0.0041	0.0130	0.0022	0.0078
Manganese	mg/L	0.05	0.0087	0.0051	0.0049	0.0110	0.0046	0.0058	0.0059	0.0059	0.0052
Silver	mg/L	0.1	0.000059	0.000088	0.000085	0.000086	0.000059	0.000059	0.000059	0.000059	0.000059
Chloride	mg/L	250	18	23	25	32	17	17	15	13	13
Fluoride	mg/L	0.4	0.096	N/A	N/A	N/A	0.076	0.074	0.092	0.096	0.090
Sulfate	mg/L	250	5.7	16.0	17.0	18.0	4.9	4.6	4.8	4.4	4.8
Color	Color Units	15	32	13	7	9	23	19	25	21	24
Odor	T.O.N.	3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
TDS	mg/L	500	260	190	200	230	260	260	240	240	230
Sulfide	mg/L	N/A	0.0062	N/A	N/A	N/A	0.0062	0.0062	0.0062	0.0062	0.0062
pH	pH unit	6.5-8.5	7.6	7.0	7.3	6.9	7.4	7.5	7.5	7.6	7.6
MBAS	mg/L	0.5	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038

Parameter	(units)	MCL	Max Value	Nearby System Site 11436 Golf Round	House Tap 1800 Ivywoo	arby System 1800 Ivywoo	House Tap 11130 Merganser	Nearby System Site 11219 Merganser	House Tap 11212 Paradise Pt	Nearby System Site 1101 Kiskadee
Aluminum	mg/L	0.2	0.000	0.061	0.061	0.061	0.061	0.061	0.061	0.061
Iron	mg/L	0.3	0.1	0.140	0.092	0.79	0.11	1.0	0.11	0.13
Zinc	mg/L	5	1.0000	0.0120	0.0140	0.0046	0.0140	0.0020	0.0110	0.0110
Copper	mg/L	1	0.0140	0.0008	0.0140	0.0029	0.0086	0.0028	0.0055	0.0010
Manganese	mg/L	0.05	0.0086	0.0052	0.0047	0.0066	0.0052	0.0087	0.0053	0.0052
Silver	mg/L	0.1	0.008700	0.000059	0.000059	0.000059	0.000059	0.000059	0.000059	0.000059
Chloride	mg/L	250	0	13	16	18	15	13	14	14
Fluoride	mg/L	0.4	15.000	0.093	0.088	0.065	0.085	0.079	0.081	0.089
Sulfate	mg/L	250	0.1	4.6	4.9	5.1	4.8	5.7	4.4	4.5
Color	Color Units	15	6	21	32	19	22	30	23	19
Odor	T.O.N.	3	30.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
TDS	mg/L	500	1	230	240	260	240	230	240	240
Sulfide	mg/L	N/A	240.0000	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062
pH	pH unit	6.5-8.5	0.0	7.6	7.6	7.5	7.5	7.6	7.5	7.6
MBAS	mg/L	0.5	7.600	0.038	0.038	0.038	0.038	0.038	0.038	0.038

APPENDIX B – ESTIMATED CONSTRUCTION COST

SUMMERTREE WATER SYSTEM
INDIVIDUAL WATER TREATMENT PLANT - MIEX

Item Description	Quantity	Unit	Unit Cost	Total Cost
General				
Mobilization	1	LS	$323,000.00	$323,000.00
Treatment				
Piping Improvements	4	EA	$8,500.00	$34,000.00
Well #1 MIEX	1	EA	$600,000.00	$600,000.00
Well #2 MIEX	1	EA	$800,000.00	$800,000.00
Well #13 MIEX	1	EA	$800,000.00	$800,000.00
Well #17 MIEX	1	EA	$800,000.00	$800,000.00
Waste Disposal (Gravity Sewer)	4	EA	$5,500.00	$22,000.00
Chemical Feed Modifications	4	EA	$3,500.00	$14,000.00
Site Work	4	EA	$5,000.00	$20,000.00
Electrical				
Electrical & Instrumentation	4	EA	$35,000.00	$140,000.00
			Total	$3,553,000.00
			Contingency (15%)	$532,950.00
			Project Total	$4,085,950.00
			Cost/Month	$44.80

SUMMERTREE WATER SYSTEM
CENTRALIZED WATER TREATMENT PLANT - PACKED TOWER AERATORS

Item Description	Quantity	Unit	Unit Cost	Total Cost
General				
Mobilization	1	LS	$157,987.50	$157,987.50
Site Work	1	LS	$10,000.00	$10,000.00
Well Piping				
8-inch Raw Water Main	7,275	LF	$45.00	$327,375.00
12-inch Raw Water Main	400	LF	$75.00	$30,000.00
Treatment				
Packed Towers	2	EA	$150,000.00	$300,000.00
Odor Control	1	EA	$175,000.00	$175,000.00
Transfer Pumps	2	EA	$15,000.00	$30,000.00
Ground Storage	1	EA	$300,000.00	$300,000.00
High Service Pumps	3	EA	$12,500.00	$37,500.00
Site Piping	1	LS	$50,000.00	$50,000.00
Chemical Feed Facilities	1	LS	$20,000.00	$20,000.00
Concrete	1	LS	$25,000.00	$25,000.00
Electrical				
Electrical & Instrumentation	1	LS	$150,000.00	$150,000.00
Standby Power (Generator)	1	EA	$125,000.00	$125,000.00
			Total	$1,737,862.50
			Contingency (15%)	$260,679.38
			Project Total	$1,998,542.00
			Cost/Month	$21.91

SUMMERTREE WATER SYSTEM
CENTRALIZED WATER TREATMENT PLANT - MIEX

Item Description	Quantity	Unit	Unit Cost	Total Cost
General				
Mobilization	1	LS	$305,337.50	$305,337.50
Site Work	1	LS	$10,000.00	$10,000.00
Well Piping				
8-inch Raw Water Main	7,275	LF	$45.00	$327,375.00
12-inch Raw Water Main	400	LF	$75.00	$30,000.00
Treatment				
MIEX	1	EA	$2,000,000.00	$2,000,000.00
Ground Storage	1	EA	$300,000.00	$300,000.00
High Service Pumps	3	EA	$12,500.00	$37,500.00
Site Piping	1	LS	$50,000.00	$50,000.00
Chemical Feed Facilities	1	LS	$8,500.00	$8,500.00
Concrete	1	LS	$15,000.00	$15,000.00
Electrical				
Electrical & Instrumentation	1	LS	$150,000.00	$150,000.00
Standby Power (Generator)	1	EA	$125,000.00	$125,000.00
			Total	$3,358,712.50
			Contingency (15%)	$503,806.88
			Project Total	$3,862,520.00
			Cost/Month	$42.35

SUMMERTREE WATER SYSTEM
CENTRALIZED WATER TREATMENT PLANT - MEMBRANE

Item Description	Quantity	Unit	Unit Cost	Total Cost
General				
Mobilization	1	LS	$226,243.75	$226,243.75
Site Work	1	LS	$10,000.00	$10,000.00
Well Piping				
8-inch Raw Water Main	7,275	LF	$45.00	$327,375.00
12-inch Raw Water Main	400	LF	$75.00	$30,000.00
Treatment				
Membrane Treatment	1	LS	$2,750,000.00	$2,750,000.00
Packed Towers	2	EA	$150,000.00	$300,000.00
Odor Control	1	EA	$175,000.00	$175,000.00
Transfer Pumps	2	EA	$15,000.00	$30,000.00
Ground Storage	1	EA	$300,000.00	$300,000.00
High Service Pumps	3	EA	$12,500.00	$37,500.00
Site Piping	1	LS	$65,000.00	$65,000.00
Chemical Feed Facilities	1	LS	$30,000.00	$30,000.00
Concrete	1	LS	$45,000.00	$45,000.00
Electrical				
Electrical & Instrumentation	1	LS	$250,000.00	$250,000.00
Standby Power (Generator)	1	EA	$175,000.00	$175,000.00
			Total	$4,751,118.75
			Contingency (15%)	$712,667.81
			Project Total	$5,463,787.00
			Cost/Month	$59.91

SUMMERTREE WATER SYSTEM
INTERCONNECT WITH PASCO COUNTY

Item Description	Quantity	Unit	Unit Cost	Total Cost
General				
Mobilization	1	LS	$41,800.00	$41,800.00
Impact Fees & Bulk Rates				
Residential Impact Fee	1,140	EA	$1,561.00	$1,779,540.00
Piping				
12" Potable Water Main	1,500	LF	$85.00	$127,500.00
16" x 12" Tapping Sleeve & Valve	1	EA	$16,500.00	$16,500.00
Interconnect Assembly	1	EA	$12,000.00	$12,000.00
Connection to Exiting 12" Water Main	1	EA	$12,000.00	$12,000.00
Restoration & Tree Protection	1	LS	$50,000.00	$50,000.00
Site Abandonment				
Wells	4	EA	$15,000.00	$60,000.00
Demolition of Equipment & Buildings	3	EA	$30,000.00	$90,000.00
Restoration	1	LS	$50,000.00	$50,000.00
			Total	$2,239,340.00
			Contingency (15%)	$335,901.00
			Project Total	$2,575,241.00
			Cost/Month	$28.24