Attachment 5

Capacity Analysis Report

DRAFT

CITY OF ALTAMONTE SPRINGS
ONSITE SEWAGE TREATMENT AND DISPOSAL SYSTEM REMEDIATION PLAN
AND
WASTEWATER TREATMENT PLAN

FEBRUARY 2024

CAPACITY ANALYSIS REPORT

CITY OF ALTAMONTE SPRINGS
REGIONAL WATER RECLAMATION FACILITY
950 Keller Road
Altamonte Springs, FL 32714
Seminole County

PUBLIC WORKS AND UTILITIES DEPARTMENT

Director	David Bass, P.E.
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Division Director for Water, Wastewater, and Reuse	David Ammerman, P.E.

FDEP 62-600.405

Signature Sheet

OWNER: **CITY OF ALTAMONTE SPRINGS**
225 Newburyport Ave.
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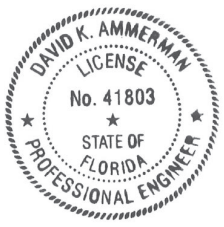
I have reviewed and am fully aware of the recommendations and schedules set forth in this report

David Ammerman, P.E.
Division Director for Water, WW, and Reuse

DATE: July 13, 2022

ENGINEER: David Ammerman, P.E.

The information contained in this report is true and correct to the best of my knowledge, and the report was prepared according to sound engineering principles and has been reviewed with the utility staff of Altamonte Springs



This item has been digitally signed and sealed by David Ammerman on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

FL PE No. 41803
City of Altamonte Springs
950 Keller Road
Altamonte Springs, FL 32714
(407) 571-8712

DATE: July 13, 2023

Executive Summary

This Capacity Analysis Report was prepared by the City of Altamonte Springs for the City's Regional Water Reclamation Facility (RWRF) to comply with Florida Department of Environmental Protection (FDEP) Chapter 62-600.405, Florida Administrative Code. This regulation requires the City to make a 10-year projection of wastewater flows at the time of the 5-year operating permit renewal.

This report provides background information on the RWRF and provides an update on upgrades and improvements since the last permit renewal. Major upgrades done in the previous 10 years include aeration system improvements and a new headworks facility, the AFIRST Project, which includes a stormwater pump station, and implementation of a Reuse Augmentation Facility (RAF) and transmission piping to allow the City to withdraw stormwater from Cranes Roost to augment the City-wide reuse system and deliver excess water to Apopka's expanding reuse program. More recently the City completed an upgrade of the wastewater treatment process from a modified Ludzack-Ettinger process to a four stage Bardenpho process capable of enhanced nutrient removal. All of these changes are acknowledged in the City's current operating permit.

Based on this analysis, it is estimated that flows to the Regional Water Reclamation Facility (RWRF) could be approximately 9.5 million gallons per day (mgd) by the year 2032. This is 78 percent of the 12.5 mgd design capacity of the facility. Neither the average daily flow nor maximum three-month average daily flow are expected to exceed the permitted capacity in the next 10 years; therefore, there is no requirement to begin scheduling plant expansion.

City of Altamonte Springs Regional Water Reclamation Facility Capacity Analysis Report

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City of Altamonte Springs
Regional Water Reclamation Facility
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Introduction

Facility Data

This capacity analysis report was prepared in response to Florida Department of Environmental Protection (FDEP) requirements outlined in Chapter 62.600-405, F.A.C. This report also supports the Altamonte Springs Regional Water Reclamation Facility (RWRF) operating permit renewal application.

Facility Name:	Regional Water Reclamation Facility (RWRF) (City of Altamonte Springs RWRF)
GMS Identification No.:	3059M01771

Permit

NPDES/FDEP Operation Permit:	FL0033251
Date Issued	1/18/2018
Expiration Date	1/17/2023

Related Permits

FDEP Multi-Sector Generic Permit (MSGP) for Storm-water Discharge:	FLR05F763-004
Date Issued	11/21/2019
Expiration Date	11/20/2024

Background

The Altamonte Springs RWRF was originally designed in 1973 and was placed into operation January 1977. The facility was designed as an advanced wastewater treatment plant that used chemical precipitation for phosphorus removal and a two-sludge system for nitrogen removal. The original plant capacity was based on an average daily flow of 7.5 mgd.

Between 1986 and 1989 the plant was upgraded to a 12.5 mgd treatment facility that included nitrogen and phosphorus removal, post aeration, flocculation, and high-level disinfection treatment processes. This upgrade enabled the City to begin its progressive water reuse project known as “Project APRICOT” (“A Prototype Realistic Innovative Community of Today”) which provided reclaimed water for landscape

irrigation and other non-potable water demands.

In 1989, reclaimed water facilities were constructed at the plant to support the development of Project APRICOT. These facilities included low head transfer pumps, two 3-million gallon (mg) reclaimed water ground storage tanks and a high service pump station for reclaimed water distribution. Simultaneously, as the reclaimed water facilities were being constructed at the plant, a reclaimed water distribution system was being constructed to provide reclaimed water to residential customers and commercial businesses within the City. Based on a strong commitment from the City of Altamonte Springs, the reclaimed water distribution system was expanded over the years and reclaimed water lines now extend throughout the City.

Several improvements to the RWRF and reuse system have been implemented in recent years. These include:

- In 2015, the City completed construction of the AFIRST (Altamonte-FDOT Integrated Reuse and Stormwater Treatment) Project. This project involves pumping stormwater from the City's Cranes Roost stormwater facility to a 3.0 mgd Reuse Augmentation Facility (RAF) consisting of high-level disinfection, storage, and pumping. Water treated at the RAF is pumped directly into the APRICOT distribution system providing additional non-potable water supplies for use within the City of Altamonte Springs or for transfer to Apopka.
- The AFIRST program included extension of a 6.3 mile, 24" diameter reclaimed water transmission pipe to the City of Apopka allowing transfer of reclaimed water from the RWRF and treated stormwater from the RAF to be delivered to the City of Apopka for use in their public access reuse system.
- Also in 2015 the City made improvements to the aeration and blower system.
- In 2015, the City replaced the existing influent pump station and headworks and constructed a new Return Activated Sludge (RAS) pump station.
- In 2016, the City received approval for a one-year 20-gallon per minute (gpm) potable reuse pilot demonstration project called pureALTA to evaluate the treatment of reclaimed water to drinking water quality. This project is still in operation.
- In 2016 the City also initiated design, permitting and construction of treatment upgrades to convert the existing modified Ludzack-Ettinger process to a four stage Bardenpho process capable of enhanced nutrient removal. Phase I and Phase II of these upgrades were completed in 2021.

Service Area

The service area for the City of Altamonte Springs RWRF is shown in Figure 1 and includes the City of Altamonte Springs as well as areas serviced by wholesale wastewater customers including portions of the cities of Longwood, Winter Park, Maitland, and Eatonville, along with portions of unincorporated Seminole County.

Overview of System

Balancing Reclaimed Water Supplies and Public Access Demands for Irrigation

The primary components of the City of Altamonte Springs wastewater treatment and beneficial reuse system consist of the Regional Water Reclamation Facility (WRF) located at 950 Keller Road which produces reclaimed water and the Project APRICOT public access reuse (PAR) system which utilizes the reclaimed water for irrigation and other non-potable uses. There are both diurnal and seasonal variations characteristic of wastewater flows, the source of the reclaimed water, and the demand for reclaimed water, which is primarily urban irrigation. Both the diurnal and seasonal patterns of supply and demand are inversely correlated to one another. Or stated another way – when one of these parameters increases the other parameter tends to decrease and vice versa. For example, wastewater flows are generally at a minimum between midnight and 6 AM, which corresponds to the time when most urban irrigation systems are set to come on. This inverse correlation is also seen at a seasonal level with irrigation demand at a maximum in the warm dry months of April, May and early June when wastewater flows are typically at their lowest. Wastewater flows will generally increase in the rainy months of July, August, and September due to infiltration and inflow (I/I) while the need for irrigation decreases because of increased precipitation. The differences in reclaimed water supplies and demands can lead to shortages to the reclaimed water customers in the spring when demands are high, and supplies are low and excess reclaimed water in the summer when wastewater flows increase and the demand for irrigation is reduced due to rainfall. The City has comprehensives strategies to manage periods of shortage and excess which are described below.

Managing Shortage

Figure 2 provides a process flow diagram of the options available to the City to meet the PAR demands when the available reclaimed water supplies are insufficient to meet the need for urban irrigation. The use of all available reclaimed water produced at the RWRF is the priority water supply used to meet non-potable irrigation demands in all situations. In the event there is not enough reclaimed water to meet the demand for irrigation the City is able to access the following surface water supplies:

- The City can route excess surface water into the sanitary collection system from Cranes Roost, Lake Orienta, Lake Maltbie, Lake Adelaide, and the Weathersfield stormwater pond to supplement reclaimed water supplies if needed. Of these potential supplies Lake Orienta is the most reliable source of surface water and is the most frequently used. Water from Lake Orienta is pumped from a pump station dedicated to retrieving surface water into a wastewater lift station. This water flows through the collection system and receives treatment along with the raw wastewater flowing to the WRF. Lake Orienta can provide up to approximately 2 mgd of supplemental water but the water can only be harvested when the water level the lake is above a water level elevation of 58’ NGVD.
- As part of the AFIRST program the City modified a storm water pump station taking water from Cranes Roost. The modification facilitated harvesting of up to 3 mgd of surface water from Cranes Roost which is delivered to the Reuse Augmentation Facility (RAF) located at the City’s abandoned WTP #4 property. The RAF includes filtration, chlorination, storage and high service pumping and can provide up to 3 mgd to the APRICOT distribution system. Similar to

Orienta, the use of water from Cranes Roost is subject to water level restrictions with harvesting only allowed when the water level in Cranes Roost is greater than 48' NGVD.

- In the event that supplemental water from Lake Orienta and Cranes Roost is unavailable or insufficient to make up for the short fall in reclaimed water supplies the City may turn to ground water from Floridan Aquifer wells located at the City's WTP #3. Well numbers 5 and 8 previously served as potable supplies but are now used only to augment Project APRICOT if required. Ground water is chlorinated and pumped to a ground storage tank (GST). High service pumps connected to the GST deliver water directly into the APRICOT distribution system. The ground water augmentation facility can provide up to 4 mgd of supplemental ground water.

- In the rare case where both surface water and ground water are unavailable or unable to offset a shortage in the supply of reclaimed water the City can deliver potable water to the GSTs located at the RWRF. The potable supply flows through a standpipe with an air gap as a cross connection control measure. The use of potable water to supplement the APRICOT system is seldom required but can deliver up to 2.6 mgd of additional supply.

Managing Excess Reclaimed Water Supplies

Figure 3 provides a process flow diagram of the options available to the City to manage excess reclaimed water when flows to the WRF excess APRICOT demands. As is always the case, the priority is to ensure that available reclaimed water is used to meet customer demands. When the need for irrigation water has been met and additional reclaimed water remains the City can divert excess reclaimed water to the City of Apopka. This diversion is part of the AFIRST system and consists of a 6.3 mile, 24" diameter pipe extending from the APRICOT distribution system to GSTs located at the City of Apopka WRF. Flows to Apopka are controlled by the pressure control assembly (PCA) located on the north side of 414 just west of Bear Lake Road. Once delivered to Apopka, water can either be reused by the City of Apopka for irrigation or routed into a newly-constructed) c. 2022) 200 mg reservoir for storage. Stored water is subsequently retrieved, filtered, and chlorinated (similar to the RAF) and used when local reclaimed water supplies are insufficient to meet demands. The flows in the AFIRST pipeline to Apopka are controlled through a 50-year agreement between the City of Altamonte Springs and the City of Apopka which allow:

- A rolling 12-month average flow of 4.5 mgd,
- A max day flow of 7 mgd

The complete reuse agreement is provided in Appendix A. There is no required minimum flow to Apopka.

Sending excess reclaimed water to Apopka allows this water to be beneficially reused and so is prioritized over other wet weather effluent management options. However, in the event the AFIRST flow to Apopka is not able to handle excess reclaimed water supplies the City has the following management options:

- Excess reclaimed water can be diverted to an on-site pond. This pond provides approximately 3 mg of storage and allows for additional time to adjust to short term excess supplies if needed. Any water routed into the pond is drained to the headworks when conditions allow for this additional flow.
- The City can also deliver water to Cranes Roost. While this is allowed by permit, the occurrence of excess reclaimed water often corresponds to periods when water levels in Cranes Roost are at or above the desired maximum water level. As such this option is rarely used.
- In the event the wet weather management strategies described above are unable to manage excess reclaimed water supplies the City has a permit to discharge to the Little Wekiva River. The implementation of AFIRST and the ability to send excess water to Apopka has dramatically decreased the use of the Little Wekiva discharge with recent discharges limited to extreme wet weather (hurricanes) and a power failure which briefly shut down the transfer of reclaimed water to the GSTs. However, the surface water discharge remains a critical element of the City's ability to meet its permit requirements under a wide range of operating conditions.

Permit Capacity and Compliance Reporting Requirements

As described in the Overview of System section, the City operates a comprehensive wastewater utility focused on the best use of available water resources. This resource management program has resulted in an operating permit that includes monitoring and compliance points within the RWRF site as well as numerous locations outside of the RWRF property that are associated with either mitigating shortages or managing excess in periods when reclaimed water supplies exceed the demand for urban irrigation.

Figure 4 indicates all the compliance monitoring points listed in the City of Altamonte Springs operating permit. Figure 5 provides additional details on compliance monitoring points within the WRF property. Appendix B provides a detailed description of the monitoring location, monitoring site number, the parameters and permit limits for all compliance monitoring points. Table 1 provides a summary of selected permit limits for the City of Altamonte Springs WRF.

Table 1 Summary of Selected Permit Limits

					Limit						
Location	Discharge Point	Monitoring Site Number	Parameter	Units	Annual Average	Monthly Average	Weekly Average	Single Sample	Monthly Geometric Mean	Min	Max
Keller Road WRF	Plant Influent	FLW-1	Influent Flow	mgd	12.50	Report	Report				X
	Discharge to the Little Wekiva River (D-001)	FLW-5	Flow	mgd	3.75	Report					X
		EFD-1	BOD	mg/L	5.0	5.0	7.5	10.0			X
			TSS	mg/L	20.0	30.0	45.0	60.0			X
			F. Coliform	#/100mL	200			800	200		X
			Ammonia (as NH_4)	mg/L		1.0					X
			Nitrate (as N)	Lb/Year	26,640						X
			Phosphorus (as P)	Lb/Year	3,252						X
	Reclaimed Water (R00-1)	FLW-2	Flow	mgd	12.50	Report					X
		EFA-1	BOD	mg/L	20.0	30.0	45.0	60.0			X
			F. Coliform	#/100mL				25			X
			F. Coliform	% Less than Detection		75				X	
			Chlorine Residual	mg/L				1.0		X	
			Total Nitrogen (as N)	mg/L	10.0	Report					X
			Total Phosphorus (as P)	mg/L	Report	Report					X
		EFB-1	TSS	mg/L				5.0			X
Reuse Augmentation Facility		FLW-7	Flow	mgd	3.0	Report					X
		EFA-2	TSS	mg/L				5.0			X
			F. Coliform	#/100mL				25			X
			F. Coliform	% Less than Detection		75				X	
			Chlorine Residual for Disinfection	mg/L					1.0	X	

Operating Protocol

A monitoring and operating protocol is required for public access reuse systems per FDEP Rule 62-610.463 and is intended to prevent the distribution of reclaimed water not meeting high level disinfection requirements for public access reuse systems. The City maintains an operating protocol to guide the production and delivery of non-potable water produced at the WRF and the RAF. Copies of these operating protocols are provided in Appendix C and are summarized below.

Keller Road Operating Protocol

The operating protocol for the WRF is based on online monitoring of reclaimed water quality prior to the transfer of the water into the onsite ground storage tanks which supply water to the public access reuse system. The compete Keller Road Operating Protocol is provided in Appendix C-1 and summarized below.

- Turbidity is monitored downstream of the filters, upstream of the chlorine contact basin (TURB#1).
    - An alarm sounds for a turbidity reading of 1.9 NTU to alert operations to the potential that the turbidity is approaching the limit of 2 NTU. This allows time for operations to take corrective action such as adding alum upstream of the filters.
    - Turbidity readings of greater than 2 NTU for greater than 30 seconds indicates the reclaimed water does not meet the requirements for high level disinfection and cannot be used for public access irrigation.
- Chlorine residual is monitored at the discharge of the chlorine contact basin.
    - An alarm sounds when the chlorine residual reaches 1.2 mg/L alerting operations that the chlorine residual is approaching the minimum concentration of 1 mg/L. This allows time for operations to diagnose and correct the cause of the low chlorine residual.

    - A chlorine residual of less than 1.0 mg/L for greater than 30 seconds indicates the reclaimed water does not meet the requirements for high level disinfection and cannot be used for public access irrigation.
- Reclaimed water not meeting the above criteria results in:
    - The low head transfer pumps to the reclaimed water ground storage tank are disabled. This results in the substandard reclaimed water flowing by gravity to a 250,000-gallon effluent holding tank. Once the equalization tank fills it overflows into a pipe which discharges to the Little Wekiva River.
    - Operations works to diagnose and correct the cause of the substandard water.
    - When high level disinfection resumes and has been verified operations will manually enable the low head transfer pumps delivering reclaimed water to the ground storage tanks at the WRF.
    - Any water in the effluent holding tank is drained to the headworks of the plant for re-treatment.

RAF Operating Protocol

RAF operations are controlled based on both flows and water levels in Cranes Roost and water quality produced by the RAF. The compete RAF Operating Protocol is provided in Appendix C-2 and summarized below.

- The maximum daily withdrawal from Cranes Roost for use as irrigation shall not exceed 3.0 million gallons.
- The maximum annual withdrawal from all surface water sources shall not exceed 950 million gallons.
- Withdrawals must cease when Cranes Roost elevation reaches the minimum elevation of 48.00 ft. NGVD. Current infrastructure limits withdrawal to approximately 49.00 ft. NVGD.

Water produced by the RAF must meet the high-level disinfection requirements applicable to reclaimed water intended for public access reuse. The specific limits and methods used to ensure the appropriate water quality is achieved is summarized below.

- Flow to the RAF must cease if water produced by the RAF does not meet the 5 mg/L TSS or Fecal Coliform permit requirements for high level disinfection.
- Turbidity and chlorine residual levels serve as an indicator of compliance with the RWRF Plant Operations Permit limits. These limits are currently:
    - 20 NTU or less turbidity of the RAF influent
    - 5 NTU or less average turbidity on RAF effluent
    - Shut down on 12.5 NTUs or greater turbidity of the RAF effluent for 20 minutes, and
    - 1.0 ppm residual chlorine. These limits are subject to change as more operations data becomes available.

Residuals

The FDEP classification for residuals is “Other.” The City currently has a contract with the following firm to haul and dispose of the wastewater residuals generated at its RWRF:

Compost USA of Sumter County
835 CR 529A
Sumterville, FL 33585

FDEP Permit No. FLA 841692

Compost USA operates sludge treatment facilities in Sumter County to produce an Exceptional Quality Sludge (per EPA 40 CFR Part 503).

Design Capacity

Treatment Plant

The City of Altamonte Springs RWRF was designed and/or modified based upon the design criteria presented in Table 2 and 3. Additional design criteria is provided in Appendix D of this report. The design capacity of the wastewater treatment plant is 12.5 mgd.

Table 2 Influent Basis of Design for the Altamonte Springs RWRF(1)

Influent Parameter	Units	Average Day (AD)	Max Month (MM)	Peaking Factor (MM/AD)
Flow	mgd	12.5	12.96	1.08
BOD	lb/day	23,519	31,777	1.25
	mg/L	235	294	
TSS	lb/day	27,522	35,344	1.19
	mg/L	275	327	
NH3	lb/day	3,027	3,567	1.08
	mg/L	30.25	33	
TKN	lb/day	5,054	6,118	1.12
	mg/L	50.5	56.6	
TP	lb/day	811	994	1.14
	mg/L	8.1	9.2	

(1) Source: Table 2-3 City of Altamonte Springs Process Improvements for Advanced Treatment, Preliminary Design Report. Atkins September 2017

Table 3 Effluent Basis of Design for the Altamonte Springs RWRF(1)

Effluent Parameter	Units	Limit
Flow	mgd	12.5
BOD	mg/L	5
TSS	mg/L	5
TKN(2)	mg/L	3
TP(2)	mg/L	1

(1) Source: Table 2-4 City of Altamonte Springs Process Improvements for Advanced Treatment, Preliminary Design Report. Atkins September 2017
(2) TKN and TP limits are not permit limits and are achieved only with alum and carbon addition as a means of reducing nutrient loading if a discharge to the Little Wekiva is required.

Residuals

Wastewater residuals were discussed in the previous section of this report titled "Permitted Capacity."

Reclaimed Water System

The City's RWRF has a reclaimed water pump station that includes five reclaimed water pumps. With one large volume pump on standby, the remaining two operating large-volume pumps, one operating intermediate-volume pump and one operating low-volume pump can provide the City's reuse system with a firm capacity of 21.4 mgd. Equalization of diurnal flows occurs via two 3-million-gallon ground storage tanks that are located at the RWRF site. Managing reclaimed water supplies and demands is described in detail in the previous sections of this report. The 2021 flows for the City's reuse system are summarized in Table 4.

Table 4
Summary of 2021 Reuse Flows

	Flow, mgd
RWRF Influent Flow	7.09
AFIRST Reuse Augmentation Facility (RAF) – Cranes Roost Supplement to Reuse System	0.10
Groundwater Supplement	0.07
Lake Orienta Supplement	0.06
Potable Water Supplement	0.00
Total Reuse Flows	7.32
Other:	
Little Wekiva River Discharge	0.00
Flow to City of Apopka via AFIRST pipeline	0.76

Historical Plant Performance

Wastewater Flows

Average monthly and the rolling 3-month average influent wastewater flows are shown in Figure 6. Figure 6 also includes the 10-year average historical influent flows and indicates the permit limit of 12.5 mgd as well as 50 and 75% of the permit limit which serve as triggers identified in the FDEP requirements for a capacity analysis report. As shown in Figure 6:

- The average annual flow to the plant has increased over the previous 10 years.
- The historical running average 3-month flow (shown as the dashed blue line) remains well below 75% of the permit capacity of 9.38 mgd. The maximum rolling 3-month average flow over the previous 10 years was 8.95 mgd and was associated Hurricane Irma in the fall of 2017.

Based on the review of historical flows the WRF is currently well below its permit limits. Projected flows will be discussed in a later section of this report.

Reclaimed Water System

As previously described, the City of Altamonte Springs has established a reclaimed water distribution system (referred to as Project APRICOT) that extends throughout the City limits. Project APRICOT is currently operating under FDEP Permit Number FL 0033251 and has a permitted reuse capacity of 12.5 mgd.

The construction of Project APRICOT's reclaimed water distribution system began in 1988 and has continued each year since that time but was essentially completed in 1998. The AFIRST system, constructed in 2015, added the ability to retrieve, treat and reuse stormwater from Cranes Roost and divert excess reclaimed water and treated stormwater to the City of Apopka.

Flow History

Monthly Average Daily Influent Flow

Monthly average daily flows (ADFs) for the RWRF were compiled from the City's monthly operating reports (MORs & DMRs) and are presented in Table 5.

Annual Average Daily Influent Flow

The annual average daily flows (AADFs) for the RWRF are also presented in Table 5.

Table 5

Historical Monthly Average Daily Influent Flow (mgd)
City of Altamonte Springs RWRF

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual Average
2012	5.31	5.34	5.32	5.24	5.25	5.54	5.84	6.24	6.59	6.29	5.48	5.48	5.66
2013	5.50	5.35	5.40	5.39	5.94	7.20	6.43	6.52	6.60	5.80	5.56	5.37	5.92
2014	5.55	5.72	5.72	5.51	5.60	5.62	6.28	6.08	6.83	6.75	6.18	6.35	6.02
2015	6.36	6.43	6.24	6.00	5.62	5.66	6.21	6.78	7.74	6.68	6.19	5.89	6.31
2016	6.08	6.41	6.36	5.98	5.75	6.14	6.46	6.11	6.05	7.88	6.45	5.63	6.28
2017	5.76	5.58	5.37	5.43	5.53	5.67	6.40	6.51	9.98	9.06	7.81	7.09	6.69
2018	6.85	6.62	6.41	6.35	6.92	6.90	7.41	7.50	7.51	6.76	6.27	6.78	6.86
2019	6.69	6.71	6.34	6.34	7.25	7.02	7.42	7.37	6.96	6.84	6.42	6.73	6.84
2020	6.74	6.73	6.39	6.24	6.38	7.00	7.68	7.78	8.29	8.40	8.21	7.28	7.26
2021	6.95	6.83	6.32	6.51	7.00	7.18	7.75	7.71	7.65	7.04	7.43	7.00	7.12

Three-Month Average Daily Influent Flow

The running 3-month annual average daily flows are presented in Table 6. The average month, running 3-month and average annual historical flows to the RWRF are illustrated in Figure 6.

Table 6

Three-Month Average Daily Influent Flow (mgd)
City of Altamonte Springs RWRF

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Max 3 Month Flow
2012	5.51	5.40	5.32	5.30	5.27	5.34	5.54	5.87	6.23	6.37	6.12	5.75	6.37
2013	5.49	5.44	5.42	5.38	5.58	6.18	6.52	6.71	6.51	6.31	5.99	5.58	6.71
2014	5.49	5.55	5.66	5.65	5.61	5.58	5.83	5.99	6.40	6.55	6.58	6.42	6.58
2015	6.30	6.38	6.34	6.22	5.95	5.76	5.83	6.22	6.91	7.07	6.87	6.25	7.07
2016	6.06	6.13	6.28	6.25	6.03	5.96	6.12	6.24	6.21	6.68	6.79	6.65	6.79
2017	5.95	5.65	5.57	5.46	5.44	5.54	5.87	6.20	7.63	8.52	8.95	7.99	8.95
2018	7.25	6.86	6.63	6.46	6.56	6.72	7.07	7.27	7.47	7.26	6.85	6.60	7.47
2019	6.58	6.73	6.58	6.46	6.65	6.87	7.23	7.27	7.25	7.06	6.74	6.66	7.27
2020	6.63	6.73	6.62	6.45	6.34	6.54	7.02	7.49	7.92	8.16	8.30	7.96	8.30
2021	7.48	7.02	6.70	6.55	6.61	6.90	7.31	7.55	7.70	7.47	7.37	7.16	7.70

Seasonal Variations in Flow

The maximum three-month average daily flow, corresponding month, AADF and ratio of maximum three-month average daily flow to AADF are presented in Table 6 below. Over the past 10 years there are seasonal variations in flow that typically occur between August and October, near the end of the rainy season. The average ratio of maximum three-month average daily flow to AADF is 1.13 for the ten-year period of 2012 through 2021.

Table 6

Seasonal Variations in Influent Flow

Year	Max Three-Month Average Max Flow	Month Max Flow Occurred	AADF	Ratio of Three-Month Max to AADF
2012	6.37	October	5.66	1.13
2013	6.71	August	5.92	1.13
2014	6.58	November	6.02	1.09
2015	7.07	October	6.31	1.12
2016	6.79	November	6.28	1.08
2017	8.95	November	6.69	1.34
2018	7.47	September	6.86	1.09
2019	7.27	August	6.84	1.06
2020	8.30	November	7.26	1.14
2021	7.70	September	7.12	1.08
Average	7.32		6.50	1.13

Flow Projections

General

The City of Altamonte Springs RWRF receive flow from the City of Altamonte Springs wastewater service area as well as wholesale wastewater customers including portions of the cities of Longwood, Winter Park, Maitland, Eatonville, and parts of unincorporated Seminole County. Refer to Figure 1 for the extent of the City's local and wholesale wastewater service area.

Projection Based on Annual Water Flow

The potential for future increases in wastewater flows to the RWRF is dictated by increases in population within the City's wastewater service area, the current contracted capacities associated with wholesale wastewater customers, and potential future wholesale agreements or amendments to existing wholesale agreements.

Altamonte Springs Wastewater Service Area

The City of Altamonte Springs wastewater service area includes approximately 600 acres of vacant land which could be developed according to current zoning. Allowable densities on a given parcel are based on land use designations and zoning and are typically expressed as development units per acre (DU/ac) or floor area ratio (FAR) which is the fraction of the total parcel area which can be covered by a building. Potential wastewater flows per development unit or flows per 1,000 square feet of building are defined based on land use. The total area of developable parcels within the Altamonte Springs wastewater service area was combined with allowable development density according to current land use and potential flow based on development type to calculate the maximum, minimum and average future flows associated with vacant parcels. This information is summarized in Table 7. For the purposes of this CAR the average potential flow of 2.95 mgd will be used to estimate future flows due to development of vacant parcels. The projections will be revised as vacant land is developed and the potential flows based on land use and zoning transition into actual development with measurable flows.

Table 7

Potential Increased Wastewater Flow Generated within the Altamonte Springs Service Area

Land Use Status	Vacant Land Area (Acres)	Maximum Potential Flow (mgd)	Minimum Potential Flow (mgd)	Average Potential Flow (mgd
In Altamonte City Limits	405	2.36	1.11	1.73
Seminole County Parcels in AS Wastewater Service Area	194	1.6	0.78	1.21
Total	599	4.00	1.89	2.95

Existing Wholesale Agreements

Table 8 provides an inventory of the City's current wholesale agreements consisting of the customer name,

volume of wastewater specified in the existing agreement, estimated flows currently being delivered to the City and the increased flows each customer can sent to the City's WRF to reach the upper limit of their current agreement. An additional 1.2935 mgd of flow could come to the City's RWRF based on the capacities in the existing agreements and current flows from the wholesale customers.

Table 8

Summary of City of Altamonte Springs
Wholesale Wastewater Agreements and
Current Flows

Customer	Bases of Flow	Capacity per Agreement (mgd)	Current Flow to City (mgd)	Future Flow per Agreement (mgd)
City of Maitland	Metered	0.8933(1)	0.7930	0.1000
Utilities Inc.	70% of Water Usage	0.3600	0.1500	0.2100
Eatonville	Metered	0.3000(2)	0.1760	0.1240
Seminole County	70% of Water Usage	0.5000	0.2500	0.2500
Longwood	Metered	0.5000	0.4190	0.0810
Winter Park	Metered	0.7135	0.1850	0.5285
Total		2.7269	1.9730	1.2935

(1) Includes an additional 0.1 mgd of flow over current contract limit
(2) No volume is specified in the agreement with Eatonville. 0.30 mgd is an estimated volume of potential need of this customer.

Other Sources of Additional Flow

Potential development of vacant parcels within the City's wastewater service area plus the outstanding commitments contained in wholesale agreements constitute the extent of the City's obligations with respect to future wastewater treatment. A brief discussion of other sources of additional flow is included to recognize that development and environmental pressures on properties adjacent to the City's current retail and wholesale service areas could result in additional flow coming to the RWRF. Specifically, there are numerous parcels surrounding the current service area utilizing septic tanks. Furthermore, a high percentage of these properties on septic are within areas already identified as experiencing excess nutrient loading. While there are no formal plans to connect these properties to a centralized wastewater treatment system, conceptual level investigations in this area have been conducted by Seminole County. These investigations suggest that there is an additional 0.9 mgd of wastewater currently on septic tanks within one half mile of the City's service area boundaries. This additional flow is not included in the future flow projects at this time but is noted as a potential consideration for future planning efforts.

Schedule

Treatment Plant

As discussed in the previous section the maximum known potential future flows to the plant consist of 2.95 mgd from the development of vacant land within the City's wastewater service area and 1.29 mgd as existing bulk customers increasing their wastewater flows up to the current contract limits. Combining this with the most recent 12 months of average influent flow to the RWRF results in a potential future flow of 11.39 mgd. The rate at which these potential increases are realized will depend on several factors including the future state of the economy. Figure 7 projects future flows based on the historical rate of increase seen at the RWRF in the previous 10 years. Based on these projections a potential future flows of 11.39 mgd would not be reached until 2041, approximately 21 years from now. The plant capacity of 12.5 mgd will not be exceeded for approximately 28 years; therefore, expansion plans are not required at this time. A capacity analysis will be required in 5 years with the next permit renewal per FDEP regulation 62-600.405(5), F.A.C. The City does not anticipate a need for plant expansion in the next 10 years.

Residuals

Presently, the residuals treatment system can be operated to meet the 1988 design criteria capacity of 12.5 mgd. As such, the residuals treatment capacity matches plant capacity.

Reuse and Effluent Disposal

The City's reuse service area has a permitted capacity of 12.5 mgd, matching the permitted wastewater treatment capacity. The City's reuse distribution system extends throughout the City. Any new customers or newly developed properties within the City utility service area are required to connect to the reuse system. Significant additional operational flexibility and effluent management capacity was created with the 2015 addition of the AFIRST project which extended a pipeline to the City of Apopka with a reuse agreement that allows for an annual average 4.5 mgd, with a single day maximum flow of 7 mgd. The City is currently in negotiation with the City of Apopka to increase the annual average and maximum day deliveries allowed to 6.0 and 8.0 mgd, respectively.

CAR Figures

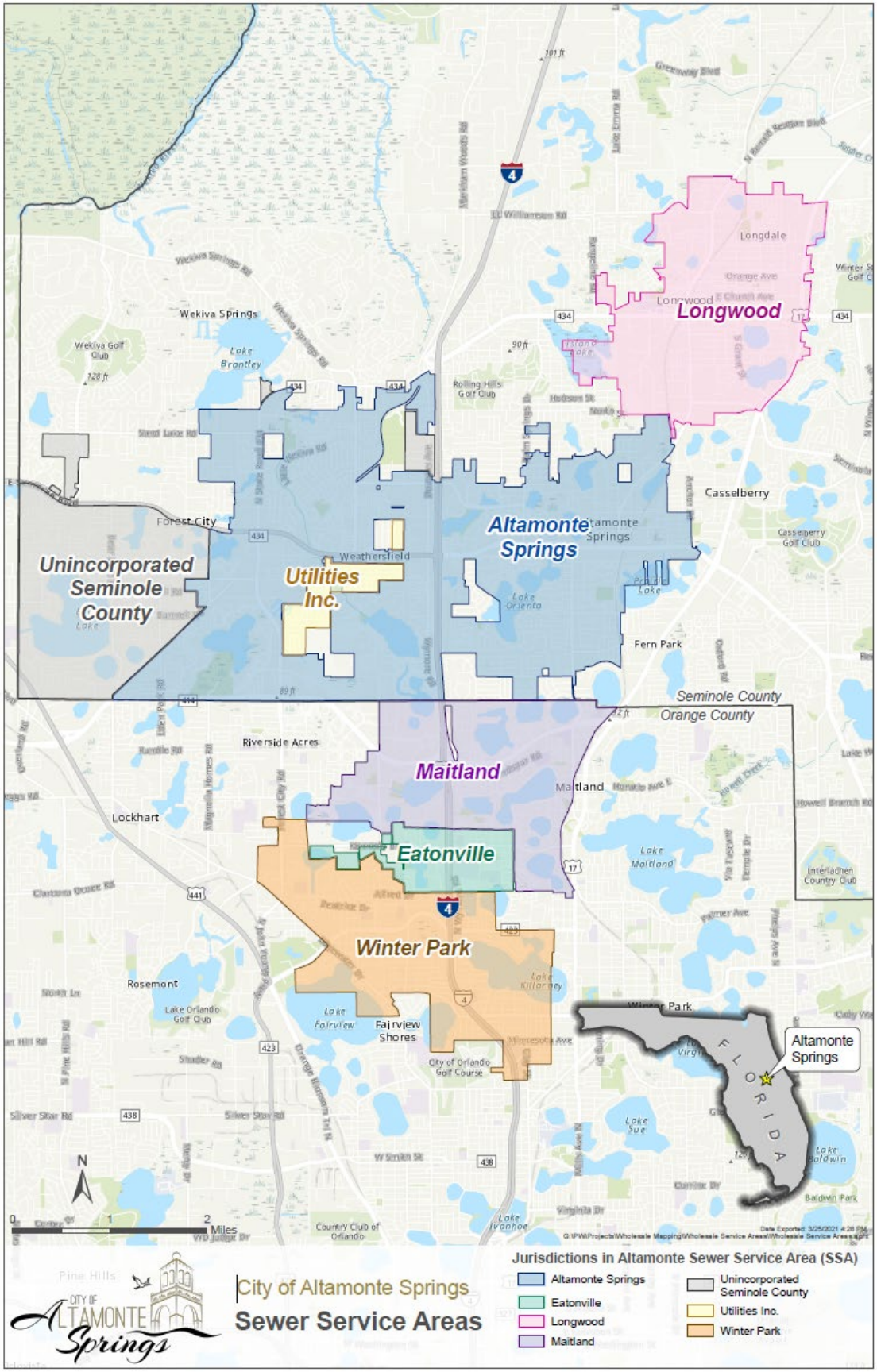


Figure 1 City of Altamonte Springs Wastewater Service Area and Wholesale Customers

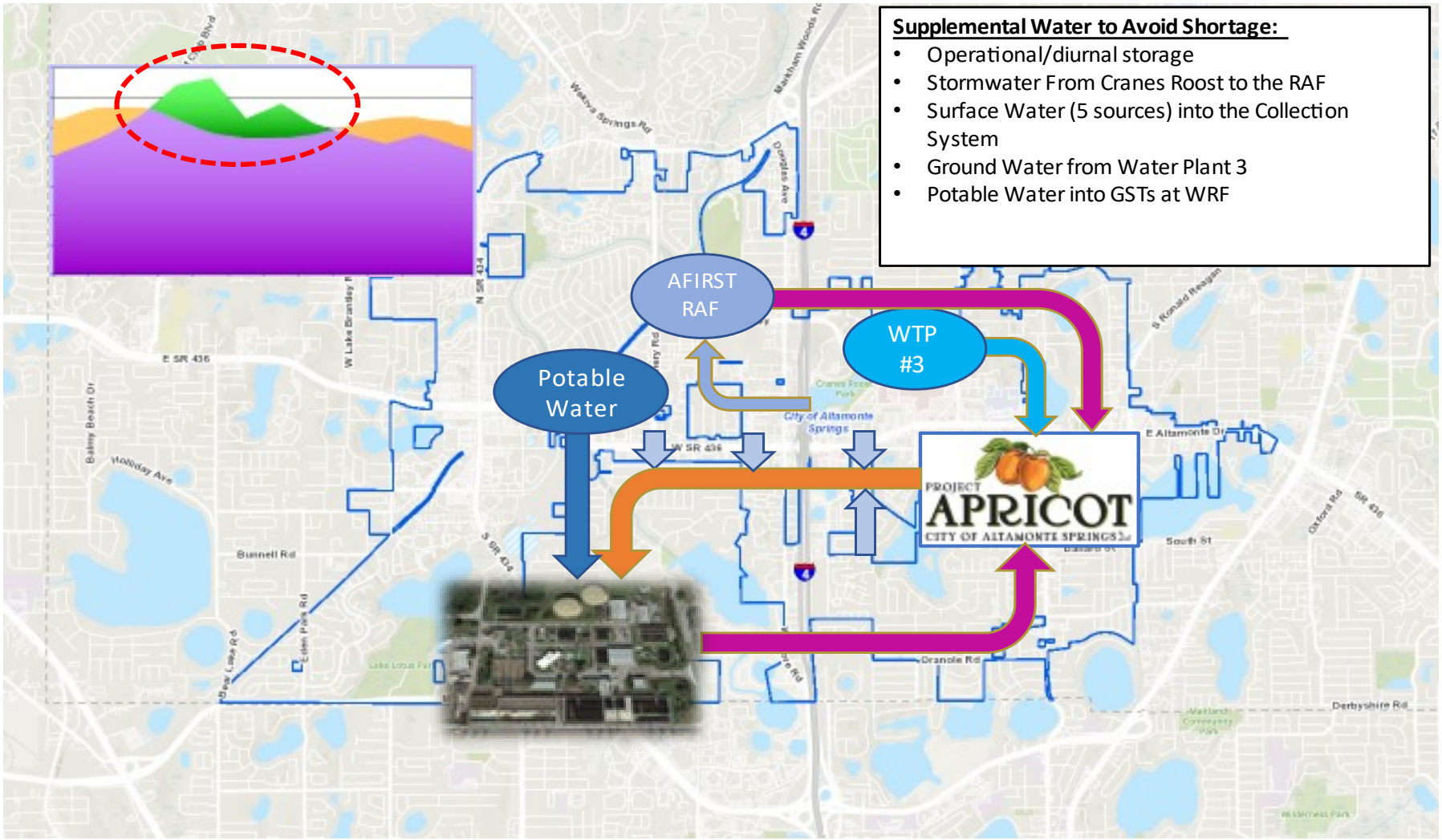


Figure 2 Managing in Periods of High Demand

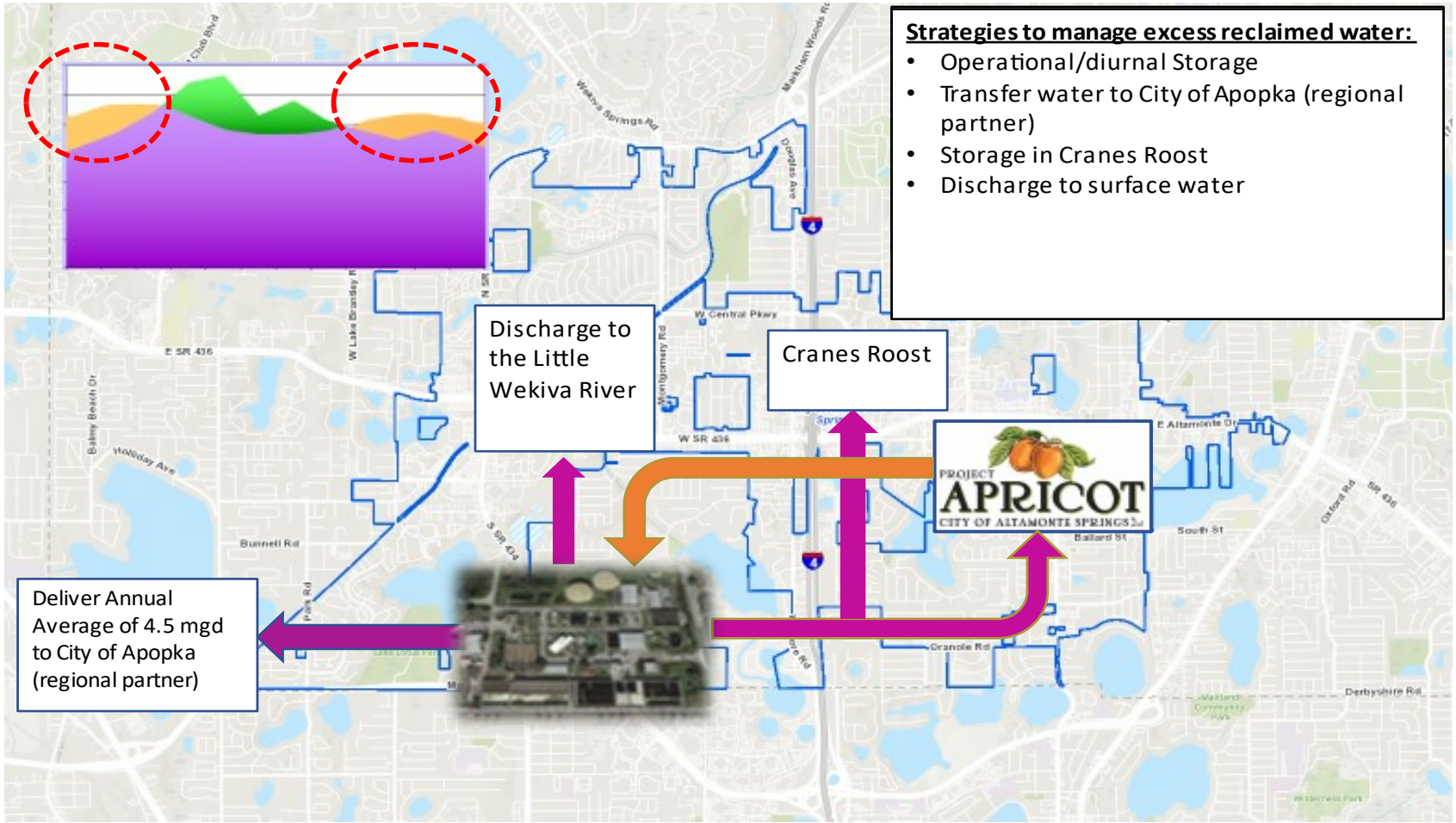


Figure 3 Managing in Periods of Low Demand

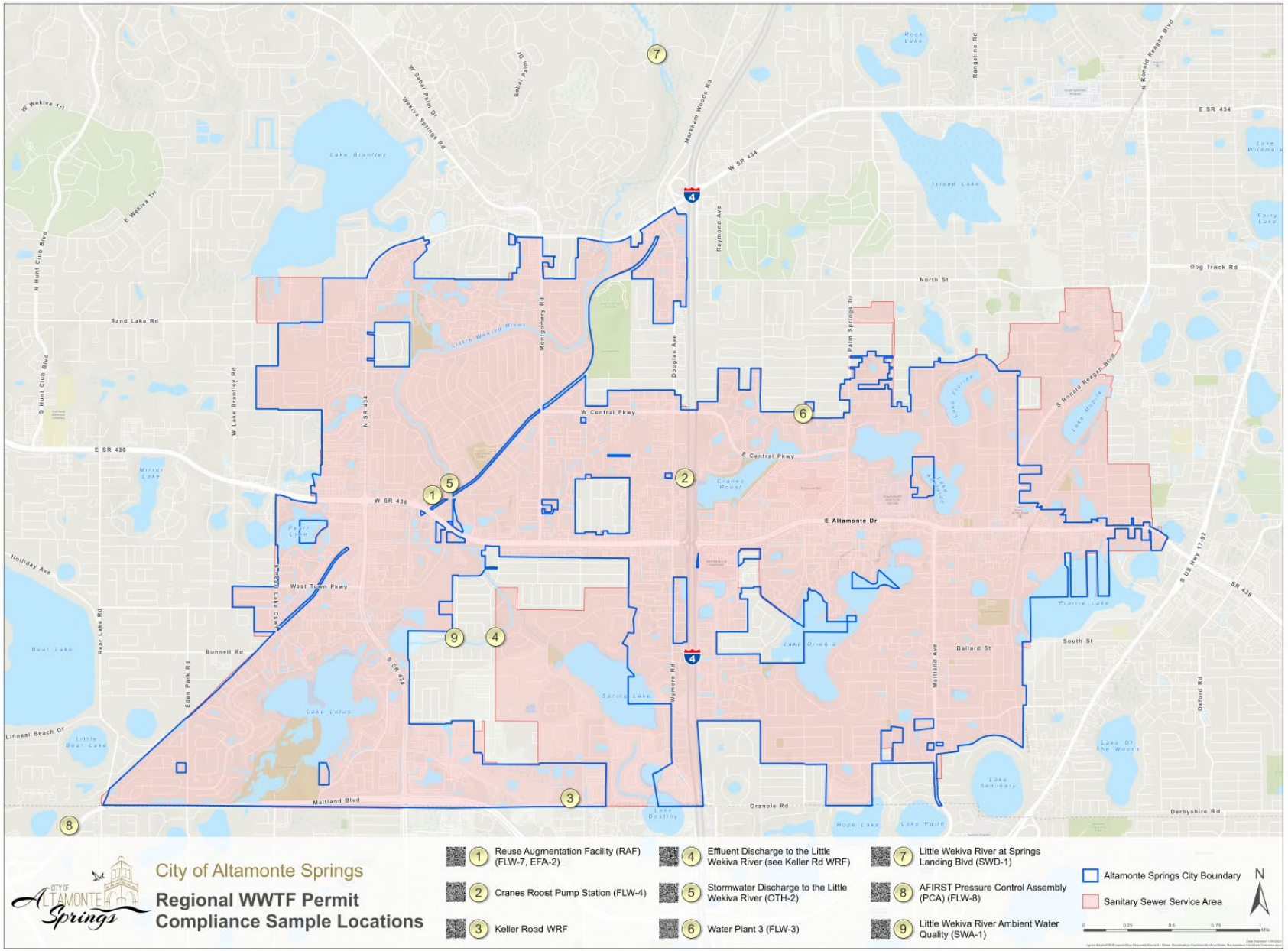


Figure 4 Summary of the Altamonte Springs RWRF Compliance Monitoring Points

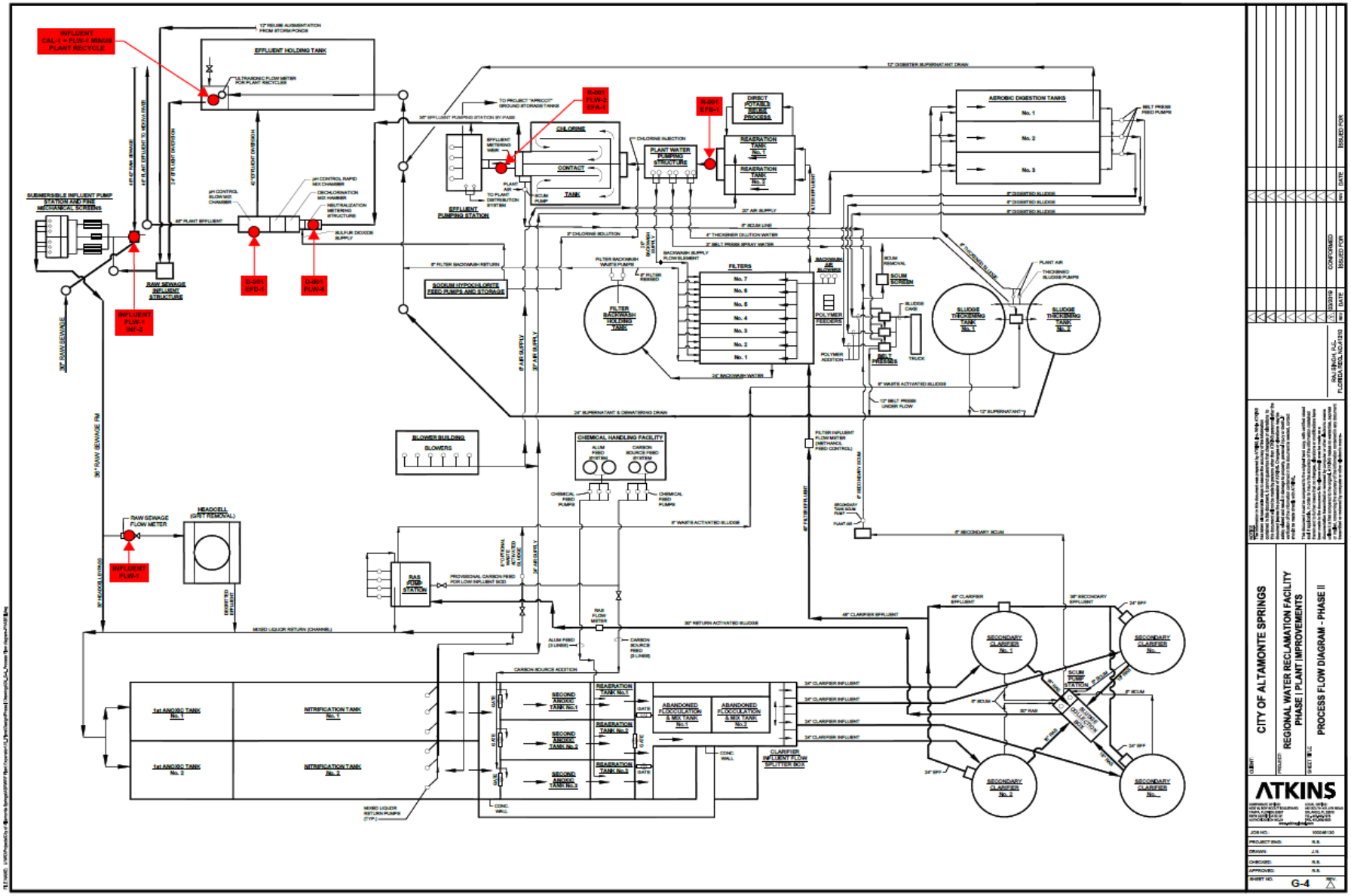


Figure 5 Summary of the Altamonte Springs RWRF Compliance Monitoring Points within the RWRF

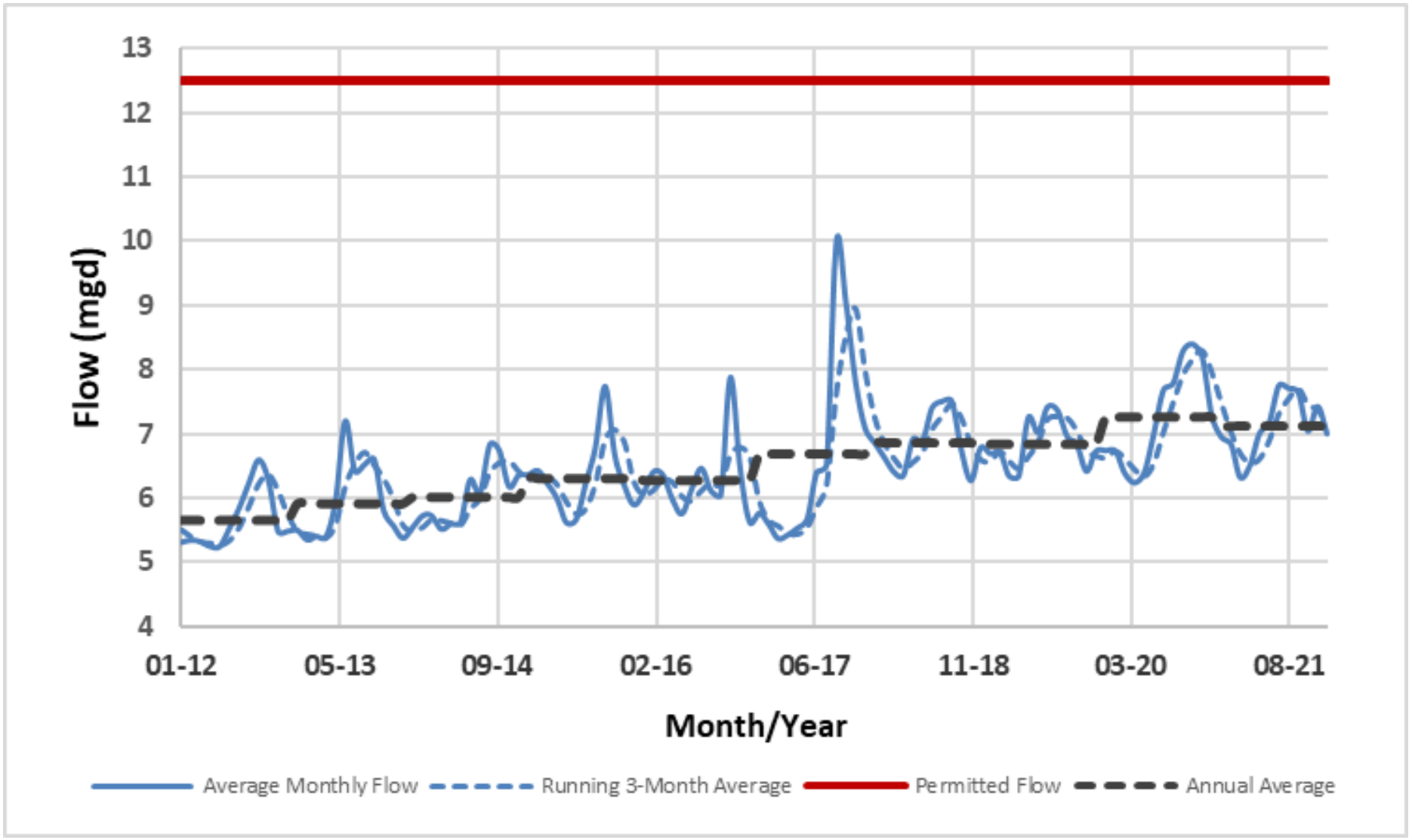


Figure 6 Historical Flows to the RWRF

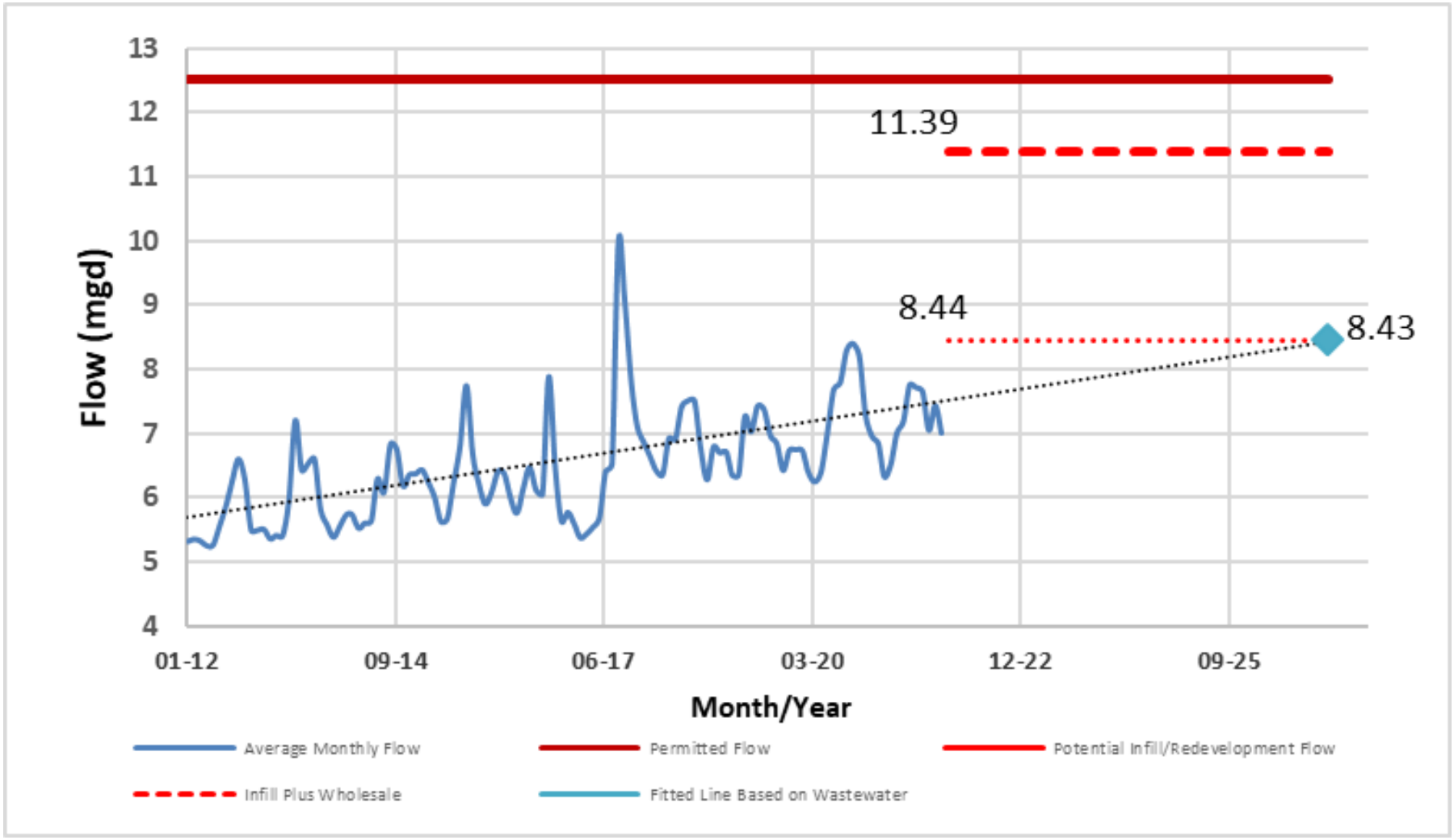


Figure 7 Historical and Projected Wastewater Flows

City of Altamonte Springs

Regional Water Reclamation Facility

Permit Renewal No FL0033251

Appendix A

Altamonte Apopka Agreement

MARYANNE MORSE, CLERK OF CIRCUIT COURT SEMINOLE COUNTY
CFN 2013092475 BK 08081 Pgs 0393 - 401; (9pgs) RECD 07/15/2013 03:02:02 PM 07-30-13A08:38 RCVD
REC FEES 78.00, RECD BY T Van Nuys

ALTAMONTE SPRINGS/APOPKA

AGREEMENT FOR THE DELIVERY OF RECLAIMED WATER

THIS RECLAIMED WATER AGREEMENT (this "Agreement"), made this 19th day of June, 2013, by and between the CITY OF ALTAMONTE SPRINGS, a municipal corporation organized and existing under the laws of the State of Florida, hereinafter referred to as "Altamonte", and the CITY OF APOPKA, FLORIDA, also a municipal corporation organized and existing under the laws of the State of Florida, hereinafter referred to as "Apopka". Altamonte and Apopka may also be referred to as "Party" or together as "Parties" herein.

WITNESSETH:

WHEREAS, Apopka owns and operates a wastewater treatment facility, which include, but are not limited to, treatment, transmission, and reclaimed water facilities located in Orange County, Florida; and

WHEREAS, Apopka is desirous of augmenting the volume of reclaimed water produced at its reclaimed water treatment facilities in order to meet the needs of its present and future reclaimed water customers; and

WHEREAS, Apopka is desirous of reducing the volume of groundwater used to augment its current reclaimed water production in conformance with the conditions contained in its Consumptive Use Permit authorized by the St. Johns River Water Management District; and

WHEREAS, Altamonte owns and operates reclaimed water treatment and disposal facilities that include, but are not limited to, the Altamonte Springs Regional Water Reclamation Facility, hereinafter referred to as the "ASRWRF", located in Seminole County; and

WHEREAS, the Wekiva River Protection Act provides for a reduction in the amount of nutrients added to the Wekiva River Basin from the ASRWRF; and

WHEREAS, the Parties hereto wish to enter into an agreement by which Altamonte delivers to Apopka reclaimed water produced by Altamonte suitable for the irrigation of residences, rights-of-way, and other similar lands and by which Apopka agrees to accept, and properly utilize or dispose of such reclaimed water; and

WHEREAS, it is the desire and intent of the Parties to memorialize by this Agreement the general terms and conditions for the delivery of reclaimed water from the ASRWRF to Apopka:

NOW, THEREFORE, in consideration of the premises and the covenants of each Party for the benefit of the other set forth below, the Parties hereunder agree as follows:

1. **WATER QUANTITY:** Altamonte agrees to provide from the ASRWRF, and the Apopka agrees to routinely receive and accept, up to 4.5 million gallons per day (MGD) of reclaimed water on an annual average daily basis at the Apopka wastewater treatment facility at the point of delivery as shown on the attached Exhibit "A." The maximum daily

CITY CLERK'S OFFICE
CITY OF ALTAMONTE SPRINGS
225 Newburyport Avenue
Altamonte Springs, Florida 32701

flow from Altamonte on any given day is not to exceed 7 MGD without prior approval from Apopka. Additionally, Altamonte agrees to make its best efforts to deliver reclaimed water to Apopka at a relatively even pumping rate over a 24-hour period. It is further agreed and understood between the Parties that Altamonte is obligated to obtain any and all Florida Department of Environmental Protection or other applicable regulatory approvals required for the delivery of reclaimed water to the Apopka. Estimated flow pattern from Altamonte to Apopka is shown on the attached Exhibit "B."

2. **WATER QUALITY**: The Parties recognize that production of public access reuse water is subject to higher standards than normal treated wastewater. It is the understanding of both Parties that Altamonte and Apopka shall meet all current and future federal and state regulatory requirements for reclaimed water treatment and distribution. Altamonte shall construct, at its sole cost and expense, any modifications to the ASRWRF necessary to produce reclaimed water for supply hereunder necessary to meet said requirements, and Apopka shall construct, at its sole cost and expense, any modifications to its facilities necessary to receive reclaimed water hereunder in compliance with such requirements.
3. **CONSTRUCTION OF AND RESPONSIBILITY FOR FACILITIES**: Apopka and Altamonte agree that Altamonte shall, at its sole cost and expense, design, obtain necessary permits for, and construct a reclaimed water transmission main from the ASRWRF to the two (2) agreed points of connection to Apopka's wastewater treatment facility as shown on the attached Exhibit "A." Altamonte agrees to own, operate and maintain in good working order the ASRWRF and the off-site reclaimed water transmission main to the point of delivery. Apopka agrees to own, operate and maintain in good working order its facilities, and upon inspection and acceptance by Apopka, those facilities that are constructed by Altamonte on Apopka's property between the point of delivery and the points of connection as shown on the attached Exhibit "A." Apopka shall be provided a plan set for review and approval for those facilities to be constructed under this Agreement within Apopka's corporate limits, which approval shall not be unreasonably withheld. Any necessary repairs by either Party will be made in a prompt fashion so as not to impede the delivery of reclaimed water from the ASRWRF to Apopka. Altamonte proposes to begin design, permitting and construction of the project within ninety (90) days following the execution of this Agreement and the required Funding Agreements, with substantial completion of the project to occur within two (2) years of the start of construction.
4. **RATE**: Apopka and Altamonte agree there shall be no charges to Apopka for reclaimed water transferred from Altamonte to Apopka.
5. **INSPECTION AND ACCESS**: The Parties shall have the right, upon notice to the other Party, and when reasonably necessary to enter upon the other Party's property, to review and inspect the operating practices as they relate to this Agreement.
6. **USE OF RECLAIMED WATER**: Apopka shall use reclaimed water delivered by Altamonte in a manner that shall be consistent with state and federal regulations.
7. **NOTICE:** Any notice to be given to Altamonte or Apopka by the other Party shall be sent by either hand delivery, registered or certified mail to the respective addresses shown

below. Either Party may change its notice address by giving proper written notice to the other as provided herein:

If to Apopka:

City of Apopka
120 East Main Street
Apopka, FL 32703
Attention: Chief Administrative Officer

With a copy to:

City of Apopka
120 East Main Street
Apopka, FL 32703
Attention: Apopka Attorney
Attention: Public Services Director

If to Altamonte:

City of Altamonte Springs
225 Newburyport Avenue
Altamonte Springs, Florida 32701
Attention: City Manager

With a copy to:

City of Altamonte Springs
225 Newburyport Avenue
Altamonte Springs, Florida 32701
Attention: Public Works & Utilities Director

8. **TERM:** This Agreement shall continue in effect for fifty years (50) years from the date of execution hereof by the Parties. This Agreement shall automatically renew for additional periods of ten (10) years each unless either Party provides written notice to the other Party of its intention to terminate, which notice must be given one (1) year prior to the date of the automatic renewal.
9. **BINDING AGREEMENT:** The terms and conditions of this Agreement constitute the entire agreement between the Parties in respect to the subject matter hereof and supersede all previous communications, representations or agreements, whether oral or written, between the Parties, No agreement or understanding, amending, varying or waiving any provision of this Agreement, will be binding upon either Party unless in writing and signed by duly authorized representatives of both Parties specifically referring to this Agreement.
10. **EXCUSE FROM PERFORMANCE BY GOVERNMENTAL ACTS:** If for any reason during the term of this Agreement local, regional, state, or federal governments or agencies shall fail to issue necessary permits, or grant necessary approvals, or shall require any change in the operation of the treatment, transmission, and delivery systems

then to the extent that such requirements shall affect the ability of Altamonte to perform any of the terms of this Agreement, Altamonte shall be excused from the performance thereof.

11. **ASSIGNMENT:** Apopka shall not assign or transfer all or any part of its rights to receive and use reclaimed water from Altamonte. Apopka may give, sell and convey reclaimed water received from Altamonte to end users within Apopka's service area and such transactions shall not require the consent of Altamonte.
12. **FUNDING AGREEMENTS**: Apopka recognizes that Altamonte is receiving funding for the facilities discussed in this Agreement and therefore Altamonte will be a party to agreements with and between such sources, including but not limited to Florida Department of Environmental Protection, St. John's Water Management District and Florida Department of Transportation. This Agreement is subject to those funding agreements.
13. **FORCE MAJEURE:** Neither Party will be responsible for any delay or failure of performance of this Agreement, other than to make payments due hereunder, if such delay or nonperformance is caused by acts of God, floods, fires, explosions, storms, transportation difficulties, strikes, lockouts, or other labor or industrial disturbances; wars, voluntary or involuntary compliance with any law, rule, order, or action of any court, agency or other instrumentality of the federal or any state or local government; exhaustion, reduction, or unavailability of reclaim water at the source of supply from which supply is normally made hereunder; or exhaustion or unavailability or delay in shipment of any material necessary in the manufacture of reclaimed water to be supplied hereunder (regardless of whether or not such exhaustion, reduction, unavailability or delay is beyond Party's control, provided only that the same is not willfully done or brought about for the purpose of excusing failure or omission to perform under this Agreement); failure or presupposed conditions, commercial impracticability, or any other cause or causes beyond a Party's control whether similar or dissimilar to those stated above. In the event that either Party is prevented by any of the foregoing force majeure events from performing its obligations hereunder, said Party shall promptly provide written notice to the other Party specifying the reason therefore, whereupon that Party's obligations shall be reduced to the extent its performance is adversely affected by such force majeure event. Both Parties shall use their best efforts to resume full performance as promptly as possible and shall suspend or reduce its performance only for such a period of time as is necessary as a result of such force majeure event. If a force majeure lasts more than thirty (30) days, either Party shall have the right to terminate this Agreement upon written notice to the other Party.
14. **DEFAULT REMEDIES:** In the event that either Party finds it necessary to commence an action against the other Party to enforce a provision of this Agreement or because of a breach by the other Party of any of the terms hereof, the prevailing Party shall be entitled to recover from the other Party its reasonable attorneys' fees, paralegal fees, and damages resulting from said breach, at both trial and appellate levels, including bankruptcy proceedings. The failure of a Party to object or take action for a breach of this Agreement shall not constitute a waiver of rights to object to a future breach of this Agreement.

15. **DISCLAIMER OR THIRD PARTY BENEFICIARIES:** This Agreement is solely for the benefit of the formal Parties hereto and no right of cause of action shall accrue upon or by reason hereof, to or for the benefit of any third party not a formal Party hereto.
16. **SEVERABILITY:** If any part of this Agreement is found invalid or unenforceable by any court or by reason of changes in federal or state laws or rules and regulations, such invalidity or unenforceability shall not affect the other parts of this Agreement if the rights and obligations of the Parties contained therein are not materially prejudiced, and if the intentions of the Parties can continue to be effectuated. To that end, this Agreement is declared severable.
17. **INDEMNIFICATION:** To the extent permitted by law, to include without limitation Florida Statutes 768.28, Altamonte shall indemnify and hold harmless Apopka from and against all damages incurred by Apopka as a result of Altamonte's negligence related to: (i) failure to maintain the reclaimed water transmission main up to the point of delivery; or (ii) failure to ensure the water quality (as set forth in Paragraph 2). Notwithstanding the foregoing, Altamonte shall not indemnify Apopka for those claims or liabilities caused by or arising from the negligence of Apopka, its employees or agents.
18. **EQUALITY:** All of the rights and terms granted by either Party to the other are at least as favorable as the rights and terms granted or to be granted or enjoyed by others with respect to the topic hereof. In the event a Party hereto enters or entered into a comparable agreement with another, which provides for more favorable term(s) than those which are set forth in this Agreement, the respective Party shall notify the other Party, who reserves the right to amend this Agreement to incorporate the more favorable term(s). Any amendment to incorporate the more favorable term(s) shall be retroactive to the date granted or provided to such other Party.
19. **EARLY TERMINATION:** Should the authority of Apopka to perform this Agreement become impaired or superseded by any other authority, or if Apopka fails to perform each and every obligation hereunder taken on its part to be performed, then Altamonte shall have the right immediately to discontinue performance of services hereunder. However, this right shall only be available to Altamonte in emergencies or after Altamonte has provided Apopka with written notice of the alleged violations of this Agreement and Apopka has failed to cure such violations within thirty (30) days of receipt of such notice.
20. **COMMENCEMENT OF DELIVERY OF RECLAIMED WATER:** Altamonte shall commence delivering and Apopka shall accept delivery of reclaimed water in accordance with this Agreement within ninety (90) days after completion of the transmission main to the point of connection at Apopka in the vicinity of as depicted in Exhibit "A."
21. **APPLICABLE LAW:** This Agreement and the provisions contained herein shall be construed, controlled, and interpreted according to the laws of the State of Florida.
22. **EXHIBITS AND ADDENDA:** This Agreement incorporates the following exhibits and addenda which are specifically made a part hereof:

    Exhibit "A" - Reclaimed water transmission line to the Apopka point of connection.
    Exhibit "B" – Estimated flow pattern from Altamonte to Apopka

23. **EXECUTION:** This Agreement may be executed in counterparts, each of which shall be deemed to be an original, but all of which, taken together, shall constitute one and the same agreement.

24. **CAPTIONS:** The captions used herein are for convenience only and shall not be relied upon in construing this Agreement.

THIS WRITTEN AGREEMENT constitutes the entire agreement between the Parties and has been entered into voluntarily and with independent advice and legal counsel and has been executed by the authorized representative of each Party on the date written above. Upon execution by all Parties, this Agreement shall be recorded in the public records of Seminole County, Florida. Amendment to, modification to, and waivers of the provisions herein, shall only be made in writing by the Parties hereto.

IN WITNESS WHEREOF, the Parties have executed this Agreement as of the day and year first above written.

CITY OF ALTAMONTE SPRINGS,
a municipality of the State of Florida

By: Pat Bates

Name: PAT BATES

Title: MAYOR

ALTAMONTE SPRINGS INCORPORATED 1920 SEMINOLE COUNTY, FLORIDA

Approved as to Form and Legality (for the use and reliance of the City of Altamonte Springs, Florida only)

May 21, 2013

Attest:

Erin Dunnell
City Clerk

James A. Fowler, City Attorney

STATE OF FLORIDA
COUNTY OF SEMINOLE

The foregoing instrument was acknowledged before me this 21 day of May, 2013 by Pat Bates, as Mayor of the CITY OF ALTAMONTE SPRINGS, a Florida municipality, on behalf of the municipality. He/She is personally known to me or has produced _____ as identification.

LISA HANSON
MY COMMISSION # EE 081167
EXPIRES: August 5, 2015
Bonded Thru Notary Public Underwriters

Lisa Hanson
Print Name: Lisa Hanson
Notary Public - State of Florida
Commission No.: 081167
Commission Expires: 8/5/15

CITY OF APOPKA,
a municipality of the State of Florida

By: _____

Name: Richard Anderson

Title: Chief Administrative Officer

Approved as to Form and Legality (for the use and reliance of the City of Apopka, Florida only)

Attest:

June 19, 2013

_____
City Clerk - Janice G. Goebel

_____
Frank C. Kruppenbacher, City Attorney

STATE OF FLORIDA
COUNTY OF ORANGE

The foregoing instrument was acknowledged before me this 19th day of June, 2013 by Richard D. Anderson, as CAO of the CITY OF APOPKA, a Florida municipality, on behalf of the municipality. He/She is personally known to me or has produced _____ as identification.

_____
Print Name: Linda F Goff
Notary Public - State of FL
Commission No.: EE 205044
Commission Expires: 7/4/2016

LINDA F GOFF
Notary Public - State of Florida
My Comm. Expires Jul 4, 2016
Commission # EE 205044
Bonded Through National Notary Assn.

LEGIBILITY UNSATISFACTORY
FOR SCANNING

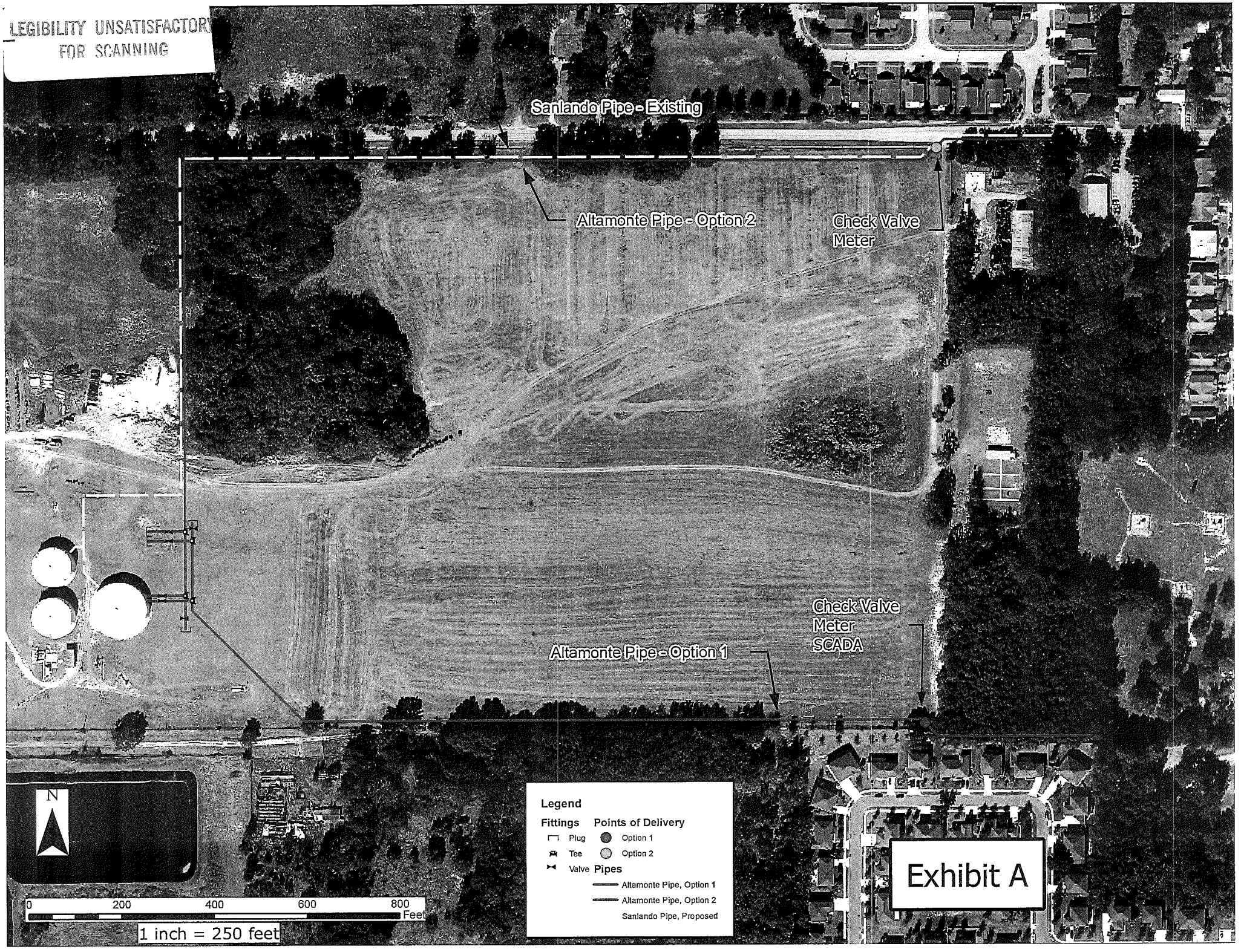


EXHIBIT B - Estimated Flow Pattern from Altamonte to Apopka (as of 4-2013)

	Total flow in near term		Future Flow	
Month	MG	MGD	MG	MGD
Jan	59.0	1.9	104.6	3.4
Feb	45.5	1.5	91.1	3.0
Mar	69.7	2.3	115.3	3.8
Apr	40.4	1.3	86.0	2.8
May	32.0	1.1	77.6	2.6
Jun	64.9	2.1	110.5	3.6
Jul	92.7	3.0	138.3	4.5
Aug	127.9	4.2	173.5	5.7
Sep	140.5	4.6	186.1	6.1
Oct	103.1	3.4	148.7	4.9
Nov	39.5	1.3	85.1	2.8
Dec	68.4	2.3	114.0	3.8
TOTALs	**883.5**	**2.4**	**1430.7**	**3.9**

City of Altamonte Springs

Regional Water Reclamation Facility

Permit Renewal No FL0033251

Appendix B

Summary of Compliance Monitoring Requirements

						Limit						
Location	**Discharge Point**	**Monitoring Site Number**	**Description of Monitoring Site**	**Parameter**	**Units**	**Annual Average**	**Monthly Average**	**Weekly Average**	**Single Sample**	**Monthly Geometric Mean**	**Min**	**Max**
Keller Road WRF	In to Treatment Plant	FLW-1	Ultrasonic flow meter at grit chamber	Flow	mgd	12.50	Report	Report				X
		CAL-1	Calculated using FLW-1	Percent Capacity	percent		Report					X
		INF-2	Automatic sampler at the headworks	BOD	mg/L				Report			X
				TSS	mg/L				Report			X
	D-001	FLW-5	Ultrasonic flow meter at influent pipe to neutralization tank	Flow	mgd	3.75	Report					X
		EFD-1	Discharge from neutralization tank	BOD	mg/L	5.0	5.0	7.5	10.0			X
				TSS	mg/L	20.0	30.0	45.0	60.0			X
				F. Coliform	#/100mL	200			800	200		X
				pH	s.u.						6.0	8.5
				Chlorine Residual for Disinfection	mg/L				0.50		X	
				Chlorine Residual for Discharge	mg/L				0.01			X
				Acute Whole Effluent Toxicity,	percent				100		X	
				Ammonia (as NH_4)	mg/L		1.0					X
				Nitrate (as N)	mg/L		Report					X
				Nitrate (as N)	lb/Month		Report					X
				Nitrate (as N)	Lb/Year	26,640						X
				Phosphorus (as P)	mg/L		Report					X
				Phosphorus (as P)	lb/Month		Report					X
				Phosphorus (as P)	Lb/Year	3,252						X
				Total Nitrogen	mg/L		Report					X
				Dissolved Oxygen	mg/L				6.0		X	
				Dichlorobromometh	mg/L				Report			X
	R00-1	FLW-2	Ultrasonic flow meter at discharge from chlorine contact chamber	Flow	mgd	12.50	Report					X
		FLW-6	Supplemental drinking water	Flow	mgd	Report	Report					X
		EFA-1	Discharge from chlorine contact chamber	BOD	mg/L	20.0	30.0	45.0	60.0			X
				F. Coliform	#/100mL				25			X
				F. Coliform	% Less than		75				X	
				pH	s.u.						6.0	8.5

			Chlorine Residual	mg/L				1.0		X	
			Turbidity	NTU				Report			X
			Giarida	oocycts/1				Report			X
			Cryptosporidium	oocycts/1				Report			X
			Total Nitrogen (as N)	mg/L	10.0	Report					X
			Total Phosphorus (as	mg/L	Report	Report					X
	EFB-1	Discharge from reaeration tank (prior to chlorination).	TSS	mg/L				5.0			X
Reuse Augmentation Facility	FLW-7	Supplemental treated stormwater from the AFIRST Reuse Augmentation Facility (RAF)	Flow	mgd	3.0	Report					X
	EFA-2	Discharge from AFIRST augmentation treatment facility	TSS	mg/L				5.0			X
			F. Coliform	#/100mL				25			X
			F. Coliform	% Less than		75				X	
			Chlorine Residual for Disinfection	mg/L					1.0	X	
			Giardia	oocysts/1				Report			X
			Cryptosporidium	oocysts/1				Report			
AFRIST Control Valve (PCA)	FLW-8	Public Access Reuse to Apopka	Flow	mgd	Report	Report					X
Water Plant #3	FLW-3	Supplemental groundwater supply well flow	Flow	mgd	Report	Report					X
	OTH-1	Supplemental ground water supply	F. Coliform	#/100mL				Report			X
Little Wekiva River (Outfall)	OTH-2	Outfall from Crane's Roost transmission main to Little Wekiva River	Overflow Use	#/Month		Report					X
			Duration of	hr/Month		Report					X
Little Wekiva River (Ambient)	SWA-1	Ambient surface water sampling location upstream of discharge D-001 at bridge on Northeastern Avenue	Nitrate (as N)	mg/L				Report			X
			Total Nitrogen (as N)	mg/L				Report			X
			Total Phosphorus (as	mg/L				Report			X
Little Wekiva River (Confluence)	SWD-1	Surface water sampling location near the confluence of the Little Wekiva River and the Wekiva River (sampling point will be at Springs Landing Boulevard Bridge which is three miles upstream of the confluence, closer to the outfall)	Nitrate (as N)	mg/L				Report			X
			Total Nitrogen (as N)	mg/L				Report			X
			Total Phosphorus (as	mg/L				Report			X
Cranes Roost	FLW-4	Supplemental surface water flows from Cranes Roost	Flow	mgd	Report	Report					X

City of Altamonte Springs

Regional Water Reclamation Facility

Permit Renewal No FL0033251

Appendix C-1

Water Reclamation Facility

Operating Protocol

City of Altamonte Springs
Water Reclamation Facility
FL 00033521

REUSE MONITORING AND OPERATING PROTOCOL

Effective Date: January 10, 1997

Revision Date: June 5 1998 (FDEP approved 6/18/98)

Revision Date: May 12, 1999

Revision Date: January 13, 2000

Revision Date: March 21, 2001- Submitted w/FDEP permit renewal application, May 29, 2001

Revision Date: February 12, 2002

Revision Date: January 16, 2003

Revision Date: June 6, 2003 (per FDEP letter dated 5/16/03)

Revision Date: June 1, 2004

Revision Date: May 31, 2005

Revision Date: May 31, 2006

Revision Date: May 14, 2007

Revision Date: May 14, 2008

Revision Date: May 14, 2009

Revision Date: May 14, 2010

Revision Date: November 2, 2011 (address change in disinfectant)

Revision Date: March 13, 2012 (address change requested by FDEP during RAI#1)

Revision Date: October 30, 2013

Revision Date: September 30, 2014

Revision Date: November 3, 2015

Revision Date: December 14, 2016

Revision Date: November 11, 2017

Revision Date: December 5, 2018

REUSE MONITORING AND OPERATING PROTOCOL

1. Introduction

The purpose of the monitoring and operating protocol is to reduce the possibility of the use of substandard reclaimed water for irrigation in areas that have public access. Substandard reclaimed water is defined as reclaimed water that is not in compliance with the total chlorine residual and total suspended solids (TSS) regulations specified in the Water Reclamation Facility's FDEP operating permit. The protocol contains procedures to be followed by operational staff when substandard reclaimed water is detected. A monitoring and operating protocol is required for water reclamation plants by the Florida Department of Environmental Protection (FDEP) under Rule 62-610.463, Florida Administrative Code (F.A.C.).

The FDEP initially reviewed and approved the protocol as part of the Operating Permit Renewal process for the permit that became effective on January 10, 1997. The protocol was resubmitted to the FDEP as a part of the 2001/2002 and 2006/2007 permit renewal processes and no comments were received by the City.

The FDEP requires the Protocol to be reviewed and updated at least once each year. Since that time, there have been no changes to maximum allowable concentration of 5.0 mg/L of TSS in the reclaimed water (FDEP 62-610.460(1) FAC) or minimum requirement for high level disinfection of 1.0 mg/L (FDEP 62-610.460(1) FAC & FDEP 62-600.440(5)(b) FAC)

2. Process Schematic

The City of Altamonte Springs Regional Water Reclamation Facility (RWRF) is designed to treat an average daily flow (ADF) of 12.5 MGD. The influent pump station pumps the raw wastewater to the headworks structure for coarse screening. The wastewater then flows through a Parshall flume for flow measurement and then to the grit tank for grit removal. From the grit tank, the wastewater flows through the fine bar screens. After screening, the wastewater flows to the primary clarifiers. Effluent from the primary clarifiers (or flow bypassed around the primary clarifiers) is combined with secondary clarifier sludge and pumped to the secondary treatment process.

The secondary treatment process consists of anoxic tanks; a diffused air activated sludge process with mixed liquor suspended solids (MLSS) return pumps, and secondary clarifiers. After secondary treatment, the water passes through filters (which can be operated as denitrification filters), reaeration tanks (presently off-line) and chlorine contact tanks to a Low Head Transfer pump station. At this pump station the effluent is either pumped to the reclaimed water ground storage tanks or overflows by gravity to the Dechlorination/ Neutralization Tank for dechlorination and supplemental aeration before discharge through the effluent line to the Little Wekiva River (LWR). Exhibit 1 is a schematic diagram of the effluent monitoring system at the Water Reclamation Facility.

The RWRF has the capability to bypass effluent that doesn't meet the FDEP/NPDES permit requirements to the Effluent Holding Tank prior to discharge to the LWR. This bypassed flow is returned to the Influent Pump Station by gravity.

When effluent fails to meet the necessary criteria for use as reclaimed water (see additional description of criteria following this section); the pumps at the Low Head Transfer Pump Station will automatically be stopped. **These pumps must be manually restarted once the problem has cleared; they will not start automatically.** Once the pumps have been stopped, as noted above, the effluent at the Low Head Transfer Pump Station overflows to the Neutralization/Dechlorination Tank where it is either discharged to the Little Wekiva River, or discharged to the Effluent Holding Tank for recycling to the influent.

Reclaimed water from the Chlorine Contact Tanks is pumped by the Low Head transfer pumps to the reclaimed water ground storage tanks. The High Service Pumps draw from these ground storage tanks for distribution to the reclaimed water distribution system.

3. Chlorine Contact Tanks

Bacteria in wastewater can cause diseases such as cholera, dysentery, typhoid, and tuberculosis. Viruses in wastewater can cause such diseases as polio and hepatitis. Disease-causing microorganisms can cause health problems. As a result, reclaimed water is disinfected with chlorine to prevent the spread of these disease-causing microorganisms.

At the RWRF, sodium hypochlorite (bleach) is used to disinfect the reclaimed water supply. A solution of hypochlorite is added to the reclaimed water at the entrance into the chlorine contact tanks. The tanks provide "reaction time" for disinfection to occur. The chemical reactions are described in Chapter 3 of the Reuse O & M Manual.

SCHEMATIC DIAGRAM OF EFFLUENT MONITORING SYSTEM
ALTAMONTE SPRINGS REGIONAL WATER RECLAMATION FACILITY

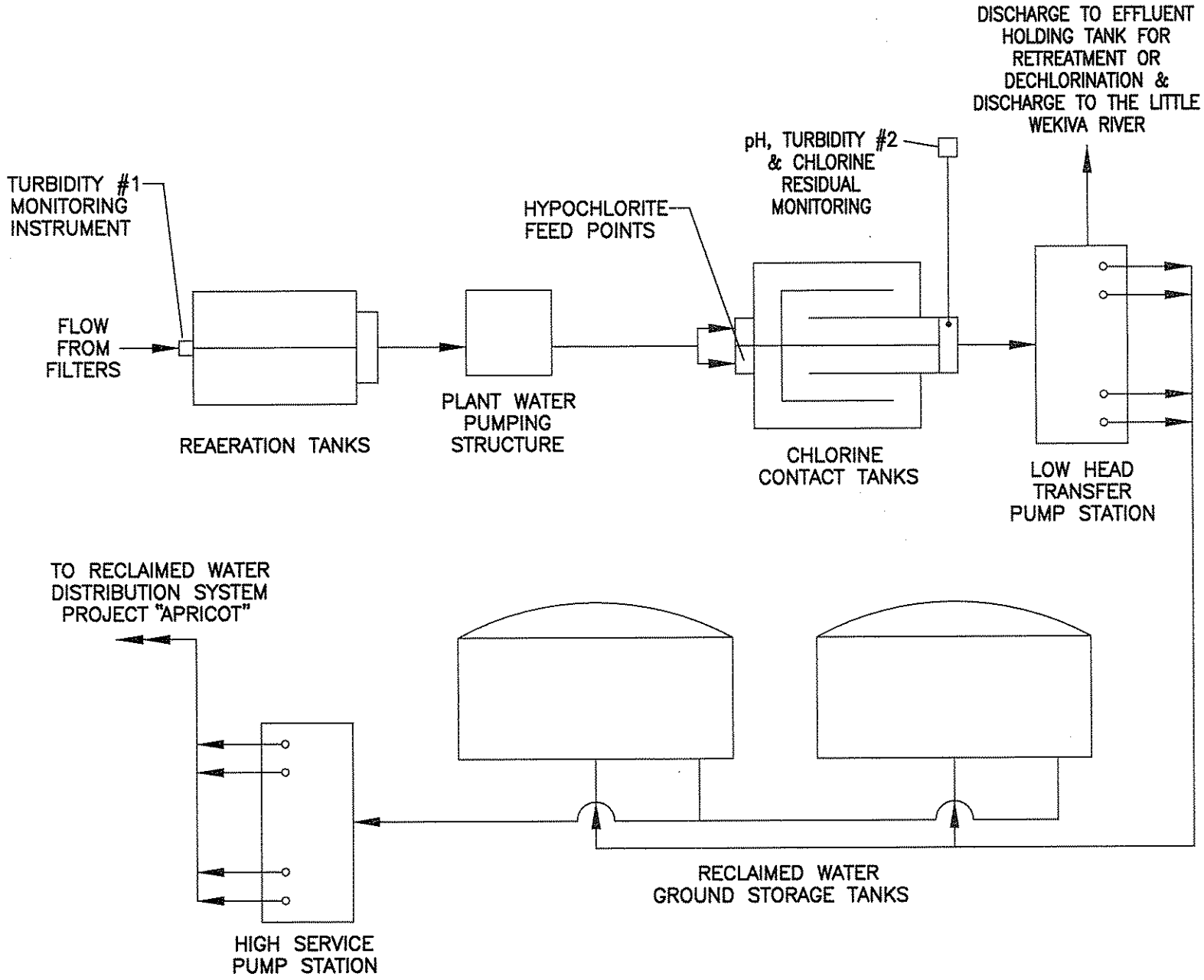


EXHIBIT 1

AECOM PROJECT NO. 60187802

CITY OF ALTAMONTE SPRINGS PROJECT APRICOT
REUSE MONITORING AND OPERATING PROTOCOL 3/2012

AECOM

AECOM TECHNICAL SERVICES, INC.
320 NORTH ORANGE AVENUE
SUITE 300
ORLANDO, FLORIDA 32801
PHONE 407.843.6600

CERTIFICATE OF AUTHORIZATION NO. EB-8115

DWG: X:\Altamonte Springs\60237569_AS_AnSrv_FY12\001 Archived Information\000Archived Projects\Permitting Issues\Reuse Protocol\Altaflow.dwg
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The effectiveness of a disinfection process is measured by the presence or absence of fecal coliforms, which are part of the coliform bacteria group. Coliform organisms are hardier than most disease causing organisms. For this reason, the absence of fecal coliform bacteria is used to indicate that other disease causing organisms are also absent. The presence of fecal coliform bacteria indicates that disease-causing bacteria may be present in the effluent.

Testing for the presence of fecal coliforms, however, requires two days to complete. As a result, to continually measure the effectiveness of a disinfection process, another method must be used. The FDEP has determined that chlorination resulting in a residual of 1.0 mg/L chlorine or greater following a minimum contact time of 15 minutes at the peak hourly flow rate will result in satisfactory high level disinfection. High-level disinfection criteria also require a total suspended solids (TSS) concentration of 5 mg/L or less in the reclaimed water. The RWRF was designed to produce an effluent that has a total chlorine residual of 1.0 mg/L or greater following the appropriate contact time.

The filter effluent turbidity analyzer #1 receives a sample from a sample pump located at the influent end of the reaeration tanks. This is the sampling location required by the FDEP for turbidity. Turbidity is measured continuously and serves as an indicator of effluent quality. TSS tests require more time to evaluate than turbidity tests and TSS tests are, therefore, not used to evaluate daily operations.

The contact tank effluent turbidity analyzer #2 and chlorine residual are monitored continuously by a turbidity analyzer and a chlorine residual analyzer, respectively. This is a additional location for "in-house only" turbidity monitoring that the City uses to ensure the turbidity of the contact tank effluent being pumped to reuse meets FDEP guidelines. Both turbidity analyzer #2 and the chlorine residual analyzer receive a continuous sample from a sample pump located in the contact tank effluent tank (APRICOT tank) prior to the overflow weir.

4. Equipment Characteristics

FILTER EFFLUENT MONITORING AT THE REAERATION TANKS

a. Turbidity Analyzer #1

Number of Units	1
Manufacturer	Hf Scientific
Model	Microtol
Type	Flow through sensor
Range, NTU	0-1000
Voltage	120 VAC

b. Turbidity Analyzer (#1 – back-up)

Number of Units	1
Manufacturer	Hf Scientific
Model Number	Microtol
Type	Flow through sensor
Range, NTU	0-1000
Voltage	120 VAC

c. Sample Pump

Number of Units	1
Manufacturer	Little Giant
Model Number	NK-2
Type	Submersible
Flow, gpm	4.5
Head, ft	5
Voltage	120 VAC

CONTACT TANK EFFLUENT MONITORING AT LOW HEAD TRANSFER PUMPS

a. Chlorine Contact System

Number of Tanks	2
Total Volume, gallons	502,700
Side Water Depth, ft.	8.0
Design Detention Time @ 12.5 mgd ADF (min)	30
Design Detention Time @ 25 mgd PDF (min)	15

b. Sample Transfer Pump

Number of Units	1
Manufacturer	Flotec
Model	FPOS1200X
Flow, gph	675
Head, ft	10
Motor	1/6 HP
Type	Submersible
Voltage	120 VAC

c. Chlorine Residual Analyzer

Number of Units	1
Manufacturer	Hach
Model Number	CL-17
Range, units	0-5.0 mg/L
Voltage	120 VAC

d. Chlorine Residual Analyzer (backup)

Number of Units	1
Manufacturer	Hach
Model Number	CL-17
Range, units	0-5.0 mg/L
Voltage	120 VAC

e. Chlorine Residual Analyzer Sample Pump

Number of Units	1
Manufacturer	Little Giant
Model Number	NK-2
Type	Submersible
Flow, gpm	4.5
Head, ft	5
Voltage	120 VAC

f. Contact Tank Turbidity Analyzer #2

Number of Units	1
Manufacturer	Hf Scientific
Model	Microtol
Type	Flow through sensor
Range, NTU	0-1000
Voltage	120 VAC

g. Turbidity Analyzer Sample Pump

Number of Units	1
Manufacturer	Little Giant
Model Number	NK-2
Type	Submersible
Flow, gpm	4.5
Head, ft	5
Voltage	120 VAC

h. pH Analyzer

Number of Units	1
Manufacturer	Signet
Model Number	8750-1
Range, units	0-14
Voltage	24 DC

i. Spare Parts Inventory for Monitoring Equipment

Turbidity Analyzer	Back-up analyzer
Chlorine Residual Analyzer	Back-up analyzer
pH Analyzer	Back-up analyzer
Sample Pumps	Back-up pumps

Circuit cards, electronic components and tubing are also kept in stock for all analyzers.

5. Operating Protocol for Turbidity Monitoring

The total suspended solids (TSS) criterion for reclaimed water is 5 mg/L or less as specified in the FDEP operating permit for the RWRF. Since the regulatory required analytical procedure for total suspended solids requires approximately 2 hours, continuous turbidity monitoring is used only as an "indicator" parameter. The operating protocol for turbidity monitoring at the RWRF is as follows:

- The filter effluent from the filtration process is continuously monitored by the automatic turbidity analyzer #1 located at the reaeration basin upstream of the chlorine contact tank.

- Reclaimed water with a turbidity reading of 2 Nephelometric turbidity units (NTU) or less will be considered suitable for reuse.

- When the momentary turbidity analyzer #1 reading reaches a value of 1.9 units (+ or -) an alarm will be issued. The intent of this alarm is to advise the operating staff that turbidity is approaching 2.0 NTU. The staff will acknowledge the alarm by making observations of treatment processes and equipment. Adjustments will be made as necessary to help prevent further increases in turbidity. Potential adjustments might include, putting additional filtration on-line, add coagulant (alum) at the floc tanks to enhance filtration (per 62-610.460(3) F.A.C)., modifying filter backwash procedures, briefly stop cleaning weirs until the turbidity has cleared, or removing debris (such as lawn clippings being blown into tanks).

- Reclaimed water with a turbidity analyzer #1 reading greater than 2.0 NTUs may indicate declining treatment efficiency. At this point, the SCADA computer control system will automatically lock out the Low Head Transfer Pumps, diverting the effluent flow to the Neutralization/Dechlorination Tank, if the reading exceeds 2.0 NTU for greater than 30 seconds. To the extent possible, the operator will divert this flow to the Effluent Holding Tank for eventual retreatment.

- A second turbidity analyzer #2 located downstream of the chlorine contact tank receives a sample from a sample pump located at the Low Head Transfer Pump Station. This analyzer solely provides for turbidity monitoring post-disinfection and will not lock-out the pumps.

- When a turbidity analyzer #1 lock-out of the pumps occurs, the operator will investigate the cause of the lock-out.

    1. If the turbidity analyzer #1 reading has dropped below 2.0 NTUs (for example, this could happen if a clump of algae passed through the turbidity meter and adhered to the device for a short period of time), the Low Head pumps can be manually restarted to pump reclaimed water over to the Reclaimed Water Ground Storage Tanks. Restart the pumps by pressing the reset button located on the exterior of the Low Head pump control building.

    2. If the turbidity analyzer #1 reading remains above 2.0 NTUs, the operator will observe a grab sample of the filter effluent. If it appears to have a low turbidity (on the presumption of fouling or loss of calibration of the permanent turbidity analyzer), the operator will take a sample to the laboratory for turbidity analysis

(if laboratory personnel are on-site) to obtain a turbidity reading, otherwise the operator will take a turbidity reading with a portable turbidity analyzer (Note: the operator must calibrate the portable turbidity analyzer prior to its use). If the reading from the laboratory or from the portable turbidity analyzer unit is equal to or less than 2.0 NTUs, the operator will clean the permanent turbidity analyzer #1. The operator will observe the turbidity analyzer #1 readings over the next 15 minutes to verify that this was a momentary excursion, and that the turbidity reading is below 2.0 NTUs. If so, the operator will then restore the Low Head Transfer pumps to operation to pump reclaimed water over to the Reclaimed Water Ground Storage Tanks. Restart the pumps by pressing the reset button located on the exterior of the Low Head pump control building.

3. If the turbidity reading remains above 2.0 NTUs, the operator will observe a grab sample of the filter effluent. If it appears to have a low turbidity, the operator will take a sample to the laboratory for turbidity analysis (if laboratory personnel are on-site) otherwise the operator will take a turbidity reading with a freshly calibrated portable turbidity analyzer. If the reading from the laboratory or from the portable unit is greater than 2:0 NTUs, the operator will take a sample from the filter effluent for laboratory analysis of total suspended solids (TSS).

If the laboratory analysis shows that the TSS concentration is in compliance with the operating permit (less than or equal to 5 mg/L), then the operational staff will do the following:

- Resume flow to the reclaimed water storage tanks. This must be done by manual control of the Low Head pumps until turbidity analyzer #1 reading falls below 2.0 NTUs. This approach is required because the SCADA will hold the lock-out until turbidity analyzer #1 reading is less than 2.0 NTUs.
- Continue collecting and analyzing grab samples of filter effluent for measurement of TSS/ turbidity in the laboratory every 15 minutes.
- Check the permanent turbidity analyzer #1, correct any malfunctions and recalibrate the analyzer.
- Discontinue grab sampling when the turbidity analyzer #1 reading measured by the analyzer corresponds to values measured in the laboratory. If the turbidity analyzer #1 reading is less than 2.0 NTUs, the Low Head pumps can

be operated in automatic mode. To reset the lock-out condition, the operator must press the reset button located on the exterior of the Low Head pump building.

If the laboratory analysis shows that the TSS concentration is not in compliance with the operating permit, then the staff will do the following:

- Check treatment processes, correct any problems and re-sample for TSS.
- Resume flow to reclaimed water storage tanks when the total suspended solids concentration is in compliance with the operating permit. This must be done by manual control of the Low Head pumps until turbidity analyzer #1 reading is less than 2.0 NTUs. If turbidity analyzer #1 reading is less than 2.0 NTUs the Low Head pumps can be operated in automatic mode. To reset the lock-out condition, the operator must press the reset button located on the exterior of the Low head pump control building.

Exhibit 2 presents the monitoring and operation protocol for turbidity.

Lock-outs of the Low Head Transfer Pump Station for high turbidity #1 shall be recorded in the Operation and Maintenance Log for the facility.

If reclaimed water was not discharged to the Ground Storage Tanks, no violation or noncompliance issue has occurred. There is no requirement to inform the FDEP. A notation shall be placed on the DMR (Part B) regarding this occurrence. However, if substandard water is discharged to the Ground Storage Tanks, the operator shall notify the FDEP of the excursion by telephone. If required by the FDEP, the operator shall prepare a follow-up letter.

Should the turbidity meter fail, the operator shall initiate collecting and analyzing samples for turbidity with the portable turbidity analyzer every 15 minutes until the permanent turbidity analyzer is operating again.

Operational staff should review trends of fecal coliform levels in the reclaimed water.

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RECLAIMED WATER
MONITORING AND OPERATING PROTOCOL
TURBIDITY
CITY OF ALTAMONTE SPRINGS WATER RECLAMATION FACILITY

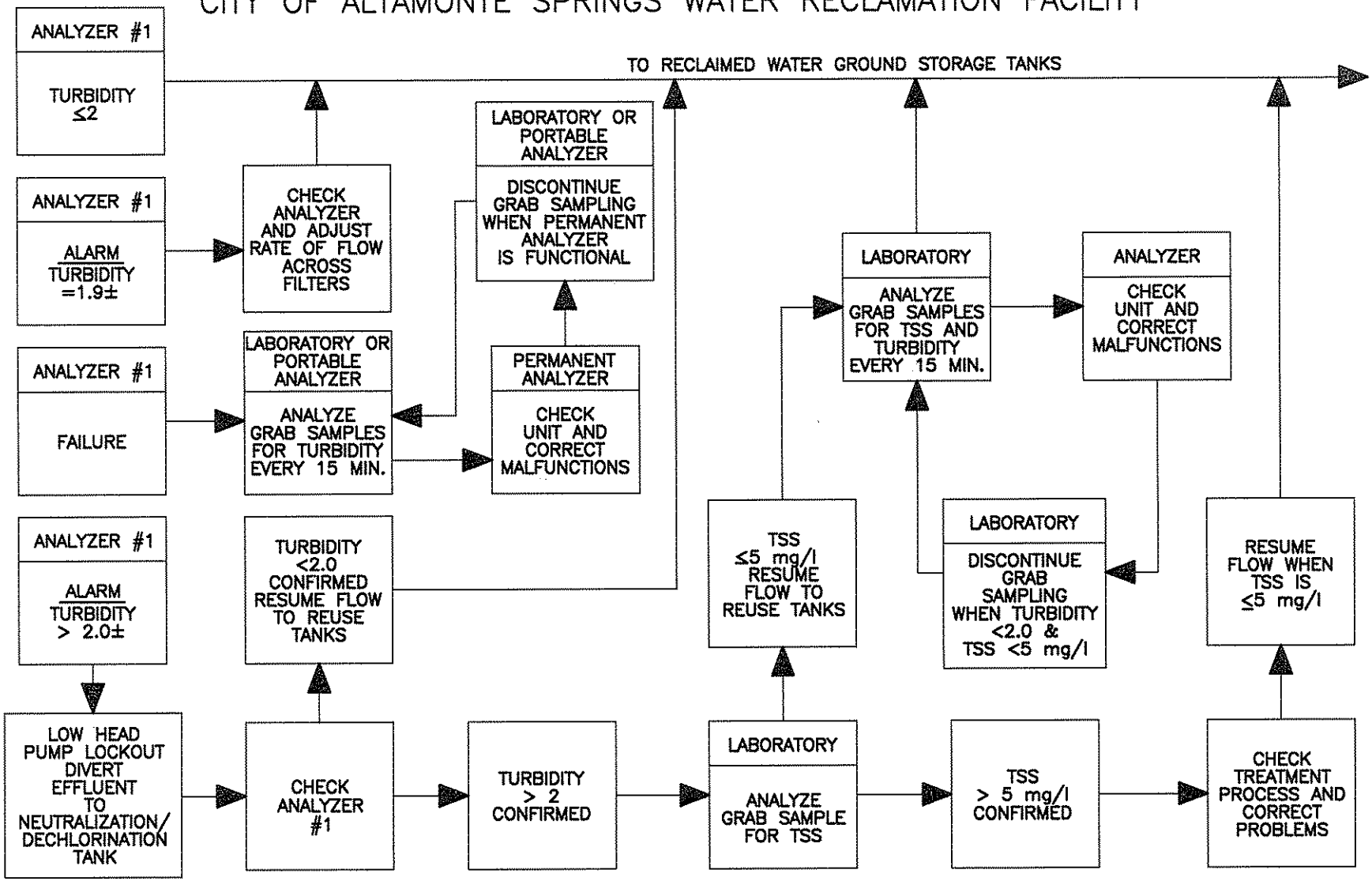


EXHIBIT 2	AECOM PROJECT NO. 60187802	CITY OF ALTAMONTE SPRINGS PROJECT APRICOT REUSE MONITORING AND OPERATING PROTOCOL 8/2011	AECOM

Operation and Maintenance/Calibration of Turbidity Analyzers

Plant operating staff will operate and maintain the analyzers as recommended by the manufacturer. The plant utility operator checks the turbidity analyzers once daily. The turbidity analyzers are calibrated every quarter (or if the daily comparison is outside the 20% tolerance range) by the plant utility operator. The standards must be checked quarterly by the laboratory and a certificate prepared for documentation.

6. Operating Protocol for Chlorine Residual Monitoring

The fecal coliform criteria for reclaimed water are as follows (FDEP Chapter 62-600.440(5)(f), F.A.C.):

> To determine compliance with the high-level disinfection level, the following operational criteria (using MF or equivalent MPN methods) shall be applicable.
>
> 1. Fecal coliform samples shall be obtained as specified in Chapter 62-601, F.A.C. Over a 30 day period, 75 percent of the fecal coliform values shall be below the detection limits.
> 2. Any one sample shall not exceed 25 fecal coliform values per 100 mL of sample.
> 3. Any one sample shall not exceed 5.0 milligrams per liter of TSS at a point before application of the disinfection.

Periodic fecal coliform tests are required (per FDEP Chapter 62-601.500(1), F.A.C. and the NPDES Permit). Since the analytical procedure for fecal coliform requires several days, continuous monitoring of total chlorine residual is used as an "indicator" parameter (in addition to the regulatory requirements of maintaining 1.0 mg/L per FDEP Chapter 62-600.440(5)(b), F.A.C.).

The operating protocol for total chlorine residual monitoring at the RWRF is as follows:

- The effluent from the chlorine contact tanks is continuously monitored by a total chlorine residual analyzer. These data will be used to establish the operating protocol. When the main chlorine residual analyzer is being calibrated, or otherwise undergoing maintenance, the operator is to switch the signal to the back-up chlorine residual analyzer. This is necessary for the RWRF to be able to verify to the FDEP that the minimum chlorine residual requirements are being maintained at all times. Once the main chlorine residual analyzer is ready to return to service, the signal from this unit should be engaged again.
- Reclaimed water with a chlorine residual reading of 1.0 mg/L or greater is considered suitable for reuse and in compliance with the RWRF's operating permit.

- When the total chlorine residual reaches a value of 1.2 mg/L (+ or -), an alarm will be issued to the operational staff by the SCADA computer control system. The intent of this alarm is to advise the operating staff that the total chlorine residual of the reclaimed water at the plant is approaching the limit of 1.0 mg/L. The staff will acknowledge the alarm by making observations of treatment processes and equipment. The operator will make adjustments as necessary to help prevent a decline in total chlorine residual below the limit of 1.0 mg/L.
- Reclaimed water with a total chlorine residual reading below 1.0 mg/L for greater than 30 seconds indicates declining treatment efficiency. At this point, the SCADA system will automatically lock-out the Low Head Transfer Pumps diverting the effluent flow to the Neutralization/Dechlorination Tank.
- The operator will take a sample of reclaimed water for analysis of total chlorine residual using a test kit.
- Operational staff should review trends of fecal coliform levels in the reclaimed water.

If the analysis shows that total chlorine residual in the effluent is in compliance with the operating permit, then the operating staff will do the following:

- Resume flow to the reclaimed water storage tanks.
- Continue collecting and analyzing grab samples to measure total chlorine residual using a test kit every 15 minutes. Use the FDEP approved calibration procedure DR 850 standard for daily calibration confirmation.
- Check the total chlorine residual analyzer, correct any malfunctions and recalibrate the analyzer.
- Discontinue grab sampling when the total chlorine residual measured by the analyzer corresponds to values measured by the test kit.

If the laboratory analysis shows that the total chlorine residual levels are <u>not</u> in compliance with the criteria outlined in the RWRF's operating permit, then the staff will do the following:

- Check sodium hypochlorite feed system and correct any malfunctions.
- Resume flow to the reclaimed water storage tanks when total chlorine residual is in compliance with the operating permit.

Exhibit 3 presents the operating protocol for total chlorine residual.

Lock-outs of the Low Head Transfer Pump Station for low chlorine residual shall be recorded in the Operation and Maintenance Log for the facility.

If reclaimed water was not discharged to the Ground Storage Tanks, no violation or noncompliance issue has occurred. There is no requirement to inform the FDEP. A notation shall be placed on the DMR (Part B) regarding this occurrence. However, if substandard water is discharged to the Ground Storage Tanks, the operator shall notify the FDEP of the excursion by telephone. If required by the FDEP, the operator shall prepare a follow-up letter.

If the chlorine residual analyzer fails, the operator shall switch system operation to the back-up chlorine residual analyzer. Should the back-up unit also fail, the operator must initiate sampling of chlorine residual every 15 minutes until the analyzers are functional again.

Operation and Maintenance/Calibration of Total Chlorine Residual Analyzer

Plant operating staff will operate and maintain the analyzers as recommended by the manufacturer including a daily operational check. The plant utility operator checks the chlorine residual analyzers once daily. Use the gel standard with the Hach DR 850 to calibrate the Hach CL-17 (Note: FDEP approved calibration procedure using potassium permanganate with the DR 850 is for dechlorinated (very low concentration) effluent) for daily calibration confirmation. The chlorine residual analyzers are calibrated quarterly by the plant utility operator (or if the daily comparison is outside the 20% tolerance range). Gel standards are checked against primary standards quarterly. The DR 850 must undergo laboratory verification on a quarterly basis (minimum). A certificate must be prepared for documentation of the standards check as well as the instrument (DR 850) calibration.

7. Monitoring and Operating Protocol Update

Under the FDEP permit, the monitoring and operating protocol for the RWRF will need to be evaluated and modified periodically (traditionally on an annual basis) based on actual plant operational experience. Based on a letter from the FDEP dated 6/18/98, only

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RECLAIMED WATER
MONITORING AND OPERATING PROTOCOL
TOTAL CHLORINE RESIDUAL
CITY OF ALTAMONTE SPRINGS WATER RECLAMATION FACILITY

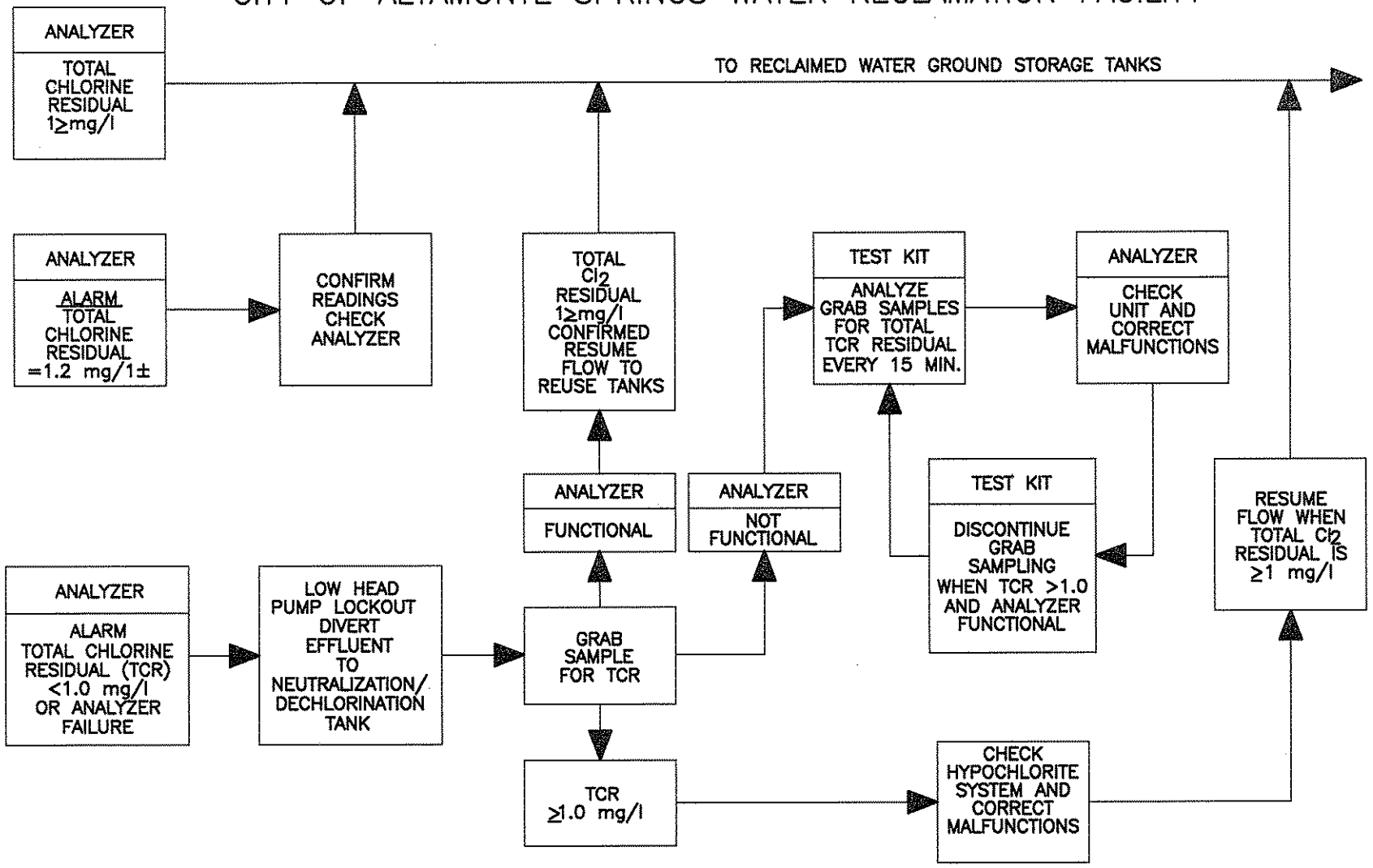


EXHIBIT 3	AECOM PROJECT NO. 60187802	CITY OF ALTAMONTE SPRINGS PROJECT APRICOT REUSE MONITORING AND OPERATING PROTOCOL 8/2011	AECOM

significantly revised changes to the monitoring and operating protocol for the RWRF must be submitted to the Central District office of FDEP for review prior to implementation.

Ideally, TSS test results and turbidity data should be compared to identify a correlation between TSS and turbidity readings for the RWRF. Also, fecal coliform test data should be compared to chlorine residual concentrations to identify a correlation between those two parameters. It may prove necessary to maintain a total chlorine residual greater than 1.0 mg/L to reduce the fecal coliform to the non-detectable limits.

City of Altamonte Springs

Regional Water Reclamation Facility

Permit Renewal No FL0033251

Appendix C-2

Reuse Augmentation Facility

Operating Protocol

City of Altamonte Springs
Water Reclamation Facility

REUSE MONITORING AND OPERATING PROTOCOL

Effective Date: August 5th, 2015

REUSE MONITORING AND OPERATING PROTOCOL

1. Introduction

The purpose of the monitoring and operating protocol is to reduce the possibility of the use of substandard reclaimed water for irrigation in areas that have public access. Substandard reclaimed water is defined as reclaimed water that is not in compliance with the total chlorine residual and total suspended solids (TSS) regulations specified in the Water Reclamation Facility's FDEP operating permit. The protocol contains procedures to be followed by operational staff when substandard reclaimed water is detected

The City requires the RAF Protocol to be reviewed and updated at least once each year.

2. Process Schematic

The City of Altamonte Springs Reclaimed Augmentation Facility is designed to treat an average daily flow (ADF) of 3.0 MGD. Cranes Roost Stormwater Pump Station (SWPS) pumps stormwater to the RAF for treatment. Stormwater is filtered through Iso-Disk Cloth Media Filters, disinfected with bleach and stored in a 250,000 gallons ground storage tank (GST). Flow measurements are taken by mag meters at the filter effluent and high service pump discharge.

Exhibit 1 is a schematic diagram of the effluent monitoring system at the Water Reclamation Facility.

The RWRF has the capability to bypass effluent that doesn't meet the FDEP/NPDES permit requirements to the Effluent Holding Tank. This bypassed flow is returned to the Influent Pump Station by gravity.

When effluent fails to meet the necessary criteria for use as reclaimed water (see additional description of criteria following this section); the pumps at the Low Head Transfer Pump Station will automatically be stopped. **These pumps must be manually restarted once the problem has cleared; they will not start automatically.** Once the pumps have been stopped, as noted above, the effluent at the Low Head Transfer Pump Station overflows to the Neutralization/Dechlorination Tank where it is either discharged to the Little Wekiva River, or discharged to the Effluent Holding Tank for recycling to the influent.

Reclaimed water from the Chlorine Contact Tanks is pumped by the Low Head transfer pumps to the reclaimed water ground storage tanks. The High Service Pumps draw from these ground storage tanks for distribution to the reclaimed water distribution system.

3. Chlorine Contact Tanks

Bacteria in wastewater can cause diseases such as cholera, dysentery, typhoid, and tuberculosis. Viruses in wastewater can cause such diseases as polio and hepatitis. Disease-causing microorganisms can cause health problems. As a result, reclaimed water is disinfected with chlorine to prevent the spread of these disease-causing microorganisms.

At the RWRF, chlorine is used to disinfect the reclaimed water supply. A water and chlorine solution is added to the reclaimed water prior to its entrance into the chlorine contact tanks. The tanks provide "reaction time" for disinfection to occur. The chemical reactions are described in Chapter 3 of the Reuse O & M Manual.

The effectiveness of a disinfection process is measured by the presence or absence of fecal coliforms, which are part of the coliform bacteria group. Coliform organisms are hardier than most disease causing organisms. For this reason, the absence of fecal coliform bacteria is used to indicate that other disease causing organisms are also absent. The presence of fecal coliform bacteria indicates that disease-causing bacteria may be present in the effluent.

Testing for the presence of fecal coliforms, however, requires two days to complete. As a result, to continually measure the effectiveness of a disinfection process, another method must be used. The FDEP has determined that chlorination resulting in a residual of 1.0 mg/L chlorine or greater following a minimum contact time of 15 minutes at the peak hourly flow rate will result in satisfactory high level disinfection. High-level disinfection criteria also require a total suspended solids (TSS) concentration of 5 mg/L or less in the reclaimed water. The RWRF was designed to produce an effluent that has a total chlorine residual of 1.0 mg/L or greater following the appropriate contact time.

The filter effluent turbidity analyzer #1 receives a sample from a sample pump located at the influent end of the reaeration tanks. This is the sampling location required by the FDEP for turbidity. Turbidity is measured continuously and serves as an indicator of effluent

quality. TSS tests require more time to evaluate than turbidity tests and TSS tests are, therefore, not used to evaluate daily operations.

The contact tank effluent turbidity analyzer #2 and chlorine residual are monitored continuously by a turbidity analyzer and a chlorine residual analyzer, respectively. This is a additional location for “in-house only” turbidity monitoring that the City uses to ensure the turbidity of the contact tank effluent being pumped to reuse meets FDEP guidelines. Both turbidity analyzer #2 and the chlorine residual analyzer receive a continuous sample from a sample pump located in the contact tank effluent tank (APRICOT tank) prior to the overflow weir.

4. Equipment Characteristics

FILTER EFFLUENT MONITORING AT THE REAERATION TANKS

a. Turbidity Analyzer #1

Number of Units	1
Manufacturer	Hf Scientific
Model	Microtol
Type	Flow through sensor
Range, NTU	0-1000
Voltage	120 VAC

b. Turbidity Analyzer (#1 – back-up)

Number of Units	1
Manufacturer	Hf Scientific
Model Number	Microtol
Type	Flow through sensor
Range, NTU	0-1000
Voltage	120 VAC

c. Sample Pump

Number of Units	1
Manufacturer	Little Giant
Model Number	NK-2
Type	Submersible
Flow, gpm	4.5
Head, ft	5
Voltage	120 VAC

CONTACT TANK EFFLUENT MONITORING AT LOW HEAD TRANSFER PUMPS

a. Chlorine Contact System

Number of Tanks	2
Total Volume, gallons	502,700
Side Water Depth, ft.	8.0
Design Detention Time @ 12.5 mgd ADF (min)	30
Design Detention Time @ 25 mgd PDF (min)	15

b. Sample Transfer Pump

Number of Units	1
Manufacturer	Flotec
Model	FPOS1200X
Flow, gph	675
Head, ft	10
Motor	1/6 HP
Type	Submersible
Voltage	120 VAC

c. Chlorine Residual Analyzer

Number of Units	1
Manufacturer	Hach
Model Number	CL-17
Range, units	0-5.0 mg/L
Voltage	120 VAC

d. Chlorine Residual Analyzer (backup)

Number of Units	1
Manufacturer	Hach
Model Number	CL-17
Range, units	0-5.0 mg/L
Voltage	120 VAC

e. Chlorine Residual Analyzer Sample Pump

Number of Units	1
Manufacturer	Little Giant
Model Number	NK-2
Type	Submersible
Flow, gpm	4.5
Head, ft	5
Voltage	120 VAC

f. Contact Tank Turbidity Analyzer #2

Number of Units	1
Manufacturer	Hf Scientific
Model	Microtol
Type	Flow through sensor
Range, NTU	0-1000
Voltage	120 VAC

g. Turbidity Analyzer Sample Pump

Number of Units	1
Manufacturer	Little Giant
Model Number	NK-2
Type	Submersible
Flow, gpm	4.5
Head, ft	5
Voltage	120 VAC

h. pH Analyzer

Number of Units	1
Manufacturer	Signet
Model Number	8750-1
Range, units	0-14
Voltage	24 DC

i. Spare Parts Inventory for Monitoring Equipment

Turbidity Analyzer	Back-up analyzer
Chlorine Residual Analyzer	Back-up analyzer
pH Analyzer	Back-up analyzer
Sample Pumps	Back-up pumps

Circuit cards, electronic components and tubing are also kept in stock for all analyzers.

5. Operating Protocol for Turbidity Monitoring

The total suspended solids (TSS) criterion for reclaimed water is 5 mg/L or less as specified in the FDEP operating permit for the RWRF. Since the regulatory required analytical procedure for total suspended solids requires approximately 2 hours, continuous turbidity monitoring is used only as an "indicator" parameter. The operating protocol for turbidity monitoring at the RWRF is as follows:

- The filter effluent from the filtration process is continuously monitored by the automatic turbidity analyzer #1 located at the reaeration basin upstream of the chlorine contact tank.

- Reclaimed water with a turbidity reading of 2 Nephelometric turbidity units (NTU) or less will be considered suitable for reuse.

- When the momentary turbidity analyzer #1 reading reaches a value of 1.9 units (+ or -) an alarm will be issued. The intent of this alarm is to advise the operating staff that turbidity is approaching 2.0 NTU. The staff will acknowledge the alarm by making observations of treatment processes and equipment. Adjustments will be made as necessary to help prevent further increases in turbidity. Potential adjustments might include, putting additional filtration on-line, modifying filter backwash procedures, briefly stop cleaning weirs until the turbidity has cleared, or removing debris (such as lawn clippings being blown into tanks).

- Reclaimed water with a turbidity analyzer #1 reading greater than 2.0 NTUs may indicate declining treatment efficiency. At this point, the SCADA computer control system will automatically lock out the Low Head Transfer Pumps, diverting the effluent flow to the Neutralization/Dechlorination Tank, if the reading exceeds 2.0 NTU for greater than 30 seconds. To the extent possible, the operator will divert this flow to the Effluent Holding Tank for eventual retreatment.

- A second turbidity analyzer #2 located downstream of the chlorine contact tank receives a sample from a sample pump located at the Low Head Transfer Pump Station. This analyzer solely provides for turbidity monitoring post-disinfection and will not lock-out the pumps.

- When a turbidity analyzer #1 lock-out of the pumps occurs, the operator will investigate the cause of the lock-out.

    1. If the turbidity analyzer #1 reading has dropped below 2.0 NTUs (for example, this could happen if a clump of algae passed through the turbidity meter and adhered to the device for a short period of time), the Low Head pumps can be manually restarted to pump reclaimed water over to the Reclaimed Water Ground Storage Tanks. Restart the pumps by pressing the reset button located on the exterior of the Low Head pump control building.

    2. If the turbidity analyzer #1 reading remains above 2.0 NTUs, the operator will observe a grab sample of the filter effluent. If it appears to have a low turbidity (on the presumption of fouling or loss of calibration of the permanent turbidity analyzer), the operator will take a sample to the laboratory for turbidity analysis (if laboratory personnel are on-site) to obtain a turbidity reading, otherwise the

operator will take a turbidity reading with a portable turbidity analyzer (Note: the operator must calibrate the portable turbidity analyzer prior to its use). If the reading from the laboratory or from the portable turbidity analyzer unit is equal to or less than 2.0 NTUs, the operator will clean the permanent turbidity analyzer #1. The operator will observe the turbidity analyzer #1 readings over the next 15 minutes to verify that this was a momentary excursion, and that the turbidity reading is below 2.0 NTUs. IF so, the operator will then restore the Low Head Transfer pumps to operation to pump reclaimed water over to the Reclaimed Water Ground Storage Tanks. Restart the pumps by pressing the reset button located on the exterior of the Low Head pump control building.

3. If the turbidity reading remains above 2.0 NTUs, the operator will observe a grab sample of the filter effluent. If it appears to have a low turbidity, the operator will take a sample to the laboratory for turbidity analysis (if laboratory personnel are on-site) otherwise the operator will take a turbidity reading with a freshly calibrated portable turbidity analyzer. If the reading from the laboratory or from the portable unit is greater than 2.0 NTUs, the operator will take a sample from the filter effluent for laboratory analysis of total suspended solids (TSS).

If the laboratory analysis shows that the TSS concentration is in compliance with the operating permit (less than or equal to 5 mg/L), then the operational staff will do the following:

- Resume flow to the reclaimed water storage tanks. This must be done by manual control of the Low Head pumps until turbidity analyzer #1 reading falls below 2.0 NTUs. This approach is required because the SCADA will hold the lock-out until turbidity analyzer #1 reading is less than 2.0 NTUs.
- Continue collecting and analyzing grab samples of filter effluent for measurement of TSS/ turbidity in the laboratory every 15 minutes.
- Check the permanent turbidity analyzer #1, correct any malfunctions and recalibrate the analyzer.
- Discontinue grab sampling when the turbidity analyzer #1 reading measured by the analyzer corresponds to values measured in the laboratory. If the turbidity analyzer #1 reading is less than 2.0 NTUs, the Low Head pumps can be operated in automatic mode. To reset the lock-out condition, the operator

must press the reset button located on the exterior of the Low Head pump building.

If the laboratory analysis shows that the TSS concentration is not in compliance with the operating permit, then the staff will do the following:

- Check treatment processes, correct any problems and re-sample for TSS..
- Resume flow to reclaimed water storage tanks when the total suspended solids concentration is in compliance with the operating permit. This must be done by manual control of the Low Head pumps until turbidity analyzer #1 reading is less than 2.0 NTUs. If turbidity analyzer #1 reading is less than 2.0 NTUs the Low Head pumps can be operated in automatic mode. To reset the lock-out condition, the operator must press the reset button located on the exterior of the Low head pump control building.

Exhibit 2 presents the monitoring and operation protocol for turbidity.

Lock-outs of the Low Head Transfer Pump Station for high turbidity #1 shall be recorded in the Operation and Maintenance Log for the facility.

If reclaimed water was not discharged to the Ground Storage Tanks, no violation or noncompliance issue has occurred. There is no requirement to inform the FDEP. A notation shall be placed on the DMR (Part B) regarding this occurrence. However, if substandard water is discharged to the Ground Storage Tanks, the operator shall notify the FDEP of the excursion by telephone. If required by the FDEP, the operator shall prepare a follow-up letter.

Should the turbidity meter fail, the operator shall initiate collecting and analyzing samples for turbidity with the portable turbidity analyzer every 15 minutes until the permanent turbidity analyzer is operating again.

Operational staff should review trends of fecal coliform levels in the reclaimed water.

Operation and Maintenance/Calibration of Turbidity Analyzers

Plant operating staff will operate and maintain the analyzers as recommended by the manufacturer. The plant utility operator checks the turbidity analyzers once daily. The

turbidity analyzers are calibrated every quarterly (or if the daily comparison is outside the 20% tolerance range) by the plant utility operator. The standards must be checked quarterly by the laboratory and a certificate prepared for documentation.

6. Operating Protocol for Chlorine Residual Monitoring

The fecal coliform criteria for reclaimed water are as follows (FDEP Chapter 62-600.440(5)(f), F.A.C.):

> To determine compliance with the high-level disinfection level, the following operational criteria (using MF or equivalent MPN methods) shall be applicable.
>
> 1. Fecal coliform samples shall be obtained as specified in Chapter 62-601, F.A.C. Over a 30 day period, 75 percent of the fecal coliform values shall be below the detection limits.
> 2. Any one sample shall not exceed 25 fecal coliform values per 100 mL of sample.
> 3. Any one sample shall not exceed 5.0 milligrams per liter of TSS at a point before application of the disinfection.

Daily fecal coliform tests are required (per FDEP Chapter 62-601.500(1), F.A.C.). Since the analytical procedure for fecal coliform requires several days, continuous monitoring of total chlorine residual is used as an "indicator" parameter (in addition to the regulatory requirements of maintaining 1.0 mg/L per FDEP Chapter 62-600.440(5)(b), F.A.C.).

The operating protocol for total chlorine residual monitoring at the RWRF is as follows:

- The effluent from the chlorine contact tanks is continuously monitored by a total chlorine residual analyzer. This data will be used to establish the operating protocol. When the main chlorine residual analyzer is being calibrated, or otherwise undergoing maintenance, the operator is to switch the signal to the back-up chlorine residual analyzer. This is necessary for the RWRF to be able to verify to the FDEP that the minimum chlorine residual requirements are being maintained at all times. Once the main chlorine residual analyzer is ready to return to service, the signal from this unit should be engaged again.
- Reclaimed water with a chlorine residual reading of 1.0 mg/L or greater is considered suitable for reuse and in compliance with the RWRF's operating permit.
- When the total chlorine residual reaches a value of 1.2 mg/L (+ or -), an alarm will be issued to the operational staff by the SCADA computer control system. The intent of

this alarm is to advise the operating staff that the total chlorine residual of the reclaimed water at the plant is approaching the limit of 1.0 mg/L. The staff will acknowledge the alarm by making observations of treatment processes and equipment. The operator will make adjustments as necessary to help prevent a decline in total chlorine residual below the limit of 1.0 mg/L.

- Reclaimed water with a total chlorine residual reading below 1.0 mg/L for greater than 30 seconds indicates declining treatment efficiency. At this point, the SCADA system will automatically lock-out the Low Head Transfer Pumps diverting the effluent flow to the Neutralization/Dechlorination Tank.
- The operator will take a sample of reclaimed water for analysis of total chlorine residual using a test kit.
- Operational staff should review trends of fecal coliform levels in the reclaimed water.

If the analysis shows that total chlorine residual in the effluent is in compliance with the operating permit, then the operating staff will do the following:

- Resume flow to the reclaimed water storage tanks.
- Continue collecting and analyzing grab samples to measure total chlorine residual using a test kit every 15 minutes. Use the FDEP approved calibration procedure DR 850 standard for daily calibration confirmation.
- Check the total chlorine residual analyzer, correct any malfunctions and recalibrate the analyzer.
- Discontinue grab sampling when the total chlorine residual measured by the analyzer corresponds to values measured by the test kit.

If the laboratory analysis shows that the total chlorine residual levels are <u>not</u> in compliance with the criteria outlined in the RWRF's operating permit, then the staff will do the following:

- Check chlorination system and correct any malfunctions.
- Resume flow to the reclaimed water storage tanks when total chlorine residual is in compliance with the operating permit.

Exhibit 3 presents the operating protocol for total chlorine residual.

Lock-outs of the Low Head Transfer Pump Station for low chlorine residual shall be recorded in the Operation and Maintenance Log for the facility.

If reclaimed water was not discharged to the Ground Storage Tanks, no violation or noncompliance issue has occurred. There is no requirement to inform the FDEP. A notation shall be placed on the DMR (Part B) regarding this occurrence. However, if substandard water is discharged to the Ground Storage Tanks, the operator shall notify the FDEP of the excursion by telephone. If required by the FDEP, the operator shall prepare a follow-up letter.

If the chlorine residual analyzer fails, the operator shall switch system operation to the back-up chlorine residual analyzer. Should the back-up unit also fail, the operator must initiate sampling of chlorine residual every 15 minutes until the analyzers are functional again.

Operation and Maintenance/Calibration of Total Chlorine Residual Analyzer

Plant operating staff will operate and maintain the analyzers as recommended by the manufacturer including a daily operational check. The plant utility operator checks the chlorine residual analyzers once daily. Use the gel standard with the Hach DR 850 to calibrate the Hach CL-17 (Note: FDEP approved calibration procedure using potassium permanganate with the DR 850 is for dechlorinated (very low concentration) effluent) for daily calibration confirmation. The chlorine residual analyzers are calibrated quarterly by the plant utility operator (or if the daily comparison is outside the 20% tolerance range). Gel standards are checked against primary standards quarterly. The DR 850 must be undergo lab verification on a quarterly basis (minimum). A certificate must be prepared for documentation of the standards check as well as the instrument (DR 850) calibration.

7. Monitoring and Operating Protocol Update

Under the new FDEP permit, the monitoring and operating protocol for the RWRF will need to be evaluated and modified at least once per year based on actual plant operational experience. Based on a letter from the FDEP dated 6/18/98, only significantly revised changes to the monitoring and operating protocol for the RWRF must be submitted to the Central District office of FDEP for review prior to implementation.

Ideally, TSS test results and turbidity data should be compared to identify a correlation between TSS and turbidity readings for the RWRF. Also, fecal coliform test data should be compared to chlorine residual concentrations to identify a correlation between those two parameters. It may prove necessary to maintain a total chlorine residual greater than 1.0 mg/L to reduce the fecal coliform to the non-detectable limits.

City of Altamonte Springs

Regional Water Reclamation Facility

Permit Renewal No FL0033251

Appendix D

Additional Design Criteria



ATKINS

City of Altamonte Springs RWRF Process Improvements For Advanced Treatment

Preliminary Design Report

12 September 2017

Prepared for:

CITY OF ALTAMONTE Springs

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1. Introduction

The Altamonte Springs Regional Water Reclamation Facility (ASRWRF) is located at 950 Keller Road, north of the intersection of SR 414 and Keller Road, and is an advanced wastewater treatment facility with a Modified Ludzack Ettinger (MLE) process configuration which includes two biological treatment trains. The current plant configuration was constructed in the late 1980s as part of the City's APRICOT Project with a new headworks that is currently operating with final construction expected to be complete in the fall 2017. The major unit processes and/or improvements include a new headworks structure (two new mechanical screens, screenings washer and compactor, grit removing and classification system, screening and grit handling building, odor control system, influent pump station (six submersible pumps with VFD located in two wet wells), and return activated sludge (RAS) pump station, yard piping electrical/controls, instrumentation/SCADA, and new electrical building, Additionally, the project also included demolition of the former headworks (screenings and grit), raw influent pump station, primary effluent lift station and anoxic feed channel, dewatering (in-plant drain) station, underground piping and associated electrical systems. From the new headworks, the screened and de-gritted sewage flows to the influent channel for the anoxic basins. Treatment continues via anoxic/aeration activated sludge processes, clarification, filtration, and disinfection by chlorination. Effluent is beneficially reused for irrigation throughout the city limits via the reclaimed water system throughout the City (known as Project APRICOT), with almost every property connected to the system to irrigate lawns and landscaping.

In 2015, the City completed construction of the AFIRST (Altamonte-FDOT Integrated Reuse and Stormwater Treatment) Project. This project involves pumping stormwater from the City's Cranes Roost stormwater facility to a 3.0 mgd Reuse Augmentation Facility (RAF) consisting of prescreening, cloth media disk filters, 200,000-gallon ground storage tank, chlorine chemical feed system, and four high service pumps with a capacity of 3.0 mgd with one pump out of service. The RAF pumps water directly into the City's reuse distribution network. The AFIRST project also includes an interconnection of the City's reuse system with the City of Apopka via an approximate 6-mile 24-inch diameter pipeline. Excess reclaimed water that cannot be reused within the City of Altamonte Springs is sent to ground storage tanks at the City of Apopka water reclamation facility. These tanks are owned and operated by the City of Apopka where they can use the reclaimed water for reuse or groundwater recharge.

In 2016, the City began operating a 20-gallon per minute (gpm) potable reuse pilot demonstration project called pureALTA to evaluate the treatment of reclaimed water to drinking water quality. The pilot plant pumps filtered reclaimed water from the reaeration tank to the pureALTA room housed in the Chlorine Building. The reclaimed water is purified through a process consisting of the following treatment components: ozone, biofiltration, ultrafiltration, granular activated carbon, ultraviolet light disinfection, and advanced oxidation. The purified water is then returned to the reaeration tank downstream of the withdrawal point, where it is mixed with the City's reclaimed water for disinfection and reuse within the City's APRICOT reclaimed water system.

1.1. Background

Recently Atkins was retained to provide design and construction phase services for the Headworks Improvements project. Under the same contract, Atkins performed a process evaluation to determine maximum capacity of the plant with existing tankage that will meet 5 mg/l (BOD); 5 mg/l (TSS); 3 mg/l (N); 1 mg/l (P) effluent limit and alternatively developed recommendations for upgrade to meet these effluent limits at a defined minimum flow level. Project Description

1.2. Project Description

Under this amendment, Atkins will update the existing process model and develop a preliminary design report for reconfiguration of the existing plant without additional tankage to meet 5 mg/l (BOD); 5 mg/l (TSS); 3 mg/l (N); 1 mg/l (P) effluent limits for an 9.0 MGD ADF capacity in Phase I. The Phase II design will include the additional reactor volumes required and site layouts to meet the design criteria for 12.0 MGD ADF capacity.

The plant operating data from August 2014 through December 2016 will be reviewed and analyzed to develop influent loadings for use as the basis of design. This will be used to validate the previously calibrated model and identify potential alternatives to achieve the effluent quality for advanced treatment, and recommend a cost-effective alternative which can reliably treat the wastewater to effluent design criteria for the Phase I and Phase II improvements.

Based on the updated model, conceptual site layouts will be developed to show the process configuration to facilitate future improvements including process flow diagrams for each phase, plant hydraulic profile and site plans. The layouts developed for Phase I and Phase II improvements are considered at 30% design level and will serve the basis for the ultimate design. The existing site plan showing the improvements that are under construction as part of the Headworks Improvement Project is Illustrated in Figure 1-1.

1.3. Proposed Phasing Plan

The existing plant capacity of 12.5 MGD will remain unaffected and the plant will continue to operate per the operating permit limits as included in the 2017 permit renewal. The proposed improvements for the advanced treatment will be implemented in two phase as described below.

a) Phase I Improvements

The Phase I improvements will include minor modifications to the existing aeration reactors to achieve the effluent design criteria to treat an average daily flow of 9.0 mgd. A portion of the nitrification tank (existing aeration zone) will be modified to a 2nd anoxic and reaeration zones by partitioning the existing aeration tanks with baffle walls. Existing submersible mixers will be used for mixing in the 2nd anoxic zone. The existing internal recirculation pumps will be reused in their current location; however, a 48-inch suction pipe will be extended to the discharge end of the reconfigured aeration tanks. Existing clarifiers 1a, 1b and 1c will remain in service and existing clarifiers 2a, 2b and 2c will be replaced with two new 90-ft diameter circular clarifiers with 16-ft side water depth. A new chemical feed facility for Alum and Carbon Source will be provided.

b) Phase II Improvements

The Phase II improvements will include modifications to the existing plant and phase I improvements to provide reactors that will achieve the effluent design criteria to treat an average daily flow of 12.0 mgd. The baffle walls constructed inside nitrification tanks during Phase I to create 2nd anoxic and reaeration zones will be removed to return the nitrification tank to their original configuration. The existing internal recirculation pumps will be reused in their current location; and the 48-inch suction pipe extended in Phase I will be removed. Existing clarifiers 1a, 1b and 1c will be repurposed into 2nd anoxic and reaeration tanks by replacing all internal equipment, walls etc. with new walls and mixers etc. to provide two complete parallel 2nd anoxic and reaeration reactors. Two new 90-ft diameter circular clarifiers with 16-ft side water depth will be constructed.

NORTH

0 40 80

GRAPHIC SCALE
SCALE: 1" = 40'-0"

AUTOMATIC ACCESS CONTROL GATE

EFFLUENT HOLDING TANK

RECLAIMED WATER STORAGE TANK

RECLAIMED WATER STORAGE TANK

REUSE PUMP AND OFFICE BUILDING

LAB

MAINTENANCE BUILDING

STORAGE SHED

STORAGE SHED

SUBMERSIBLE INFLUENT PUMP STATION AND FINE MECHANICAL SCREENS

NEUTRALIZATION TANK

RAW SEWAGE INFLUENT STRUCTURE

VACTOR DUMP STATION

NEUTRALIZATION BUILDING

EFFLUENT METERING WEIR

CHLORINE CONTACT TANK

PLANT WATER PUMPING STRUCTURE

REAERATION TANKS

AEROBIC DIGESTION TANKS

ODOR CONTROL

SLUDGE THICKENING TANK NO. 1

SLUDGE THICKENING TANK NO. 2

COVERED PARKING

ASPHALT

WAREHOUSE

COVERED STORAGE

DPR AND HYPOCHLORITE BUILDING

FILTER BACKWASH HOLDING TANK

FILTERS

SLUDGE HANDLING BUILDING

PORTABLE BUILDING

FUEL/TANK

COVERED STORAGE

AUTOMATIC ACCESS CONTROL GATE

GENERATOR AND POWER DISTRIBUTION BUILDING

HEADCELL (GRIT REMOVAL)

BLOWER BUILDING

RAS PUMP STATION

EQUIPMENT STORAGE BUILDING

OPERATIONS BUILDING

CHEMICAL HANDLING FACILITY

ANOXIC TANK NO. 1

NITRIFICATION TANK NO. 1

ANOXIC TANK NO. 2

NITRIFICATION TANK NO. 2

SECONDARY SETTLING TANK NO. 1A

SECONDARY SETTLING TANK NO. 1B

SECONDARY SETTLING TANK NO. 1C

FLOCCULATION MIX TANKS

SECONDARY SETTLING TANK NO. 2A

SECONDARY SETTLING TANK NO. 2B

SECONDARY SETTLING TANK NO. 2C

COVERED CONCRETE

KELLER RD

GATEWAY DR

REV	DATE	ISSUED FOR

REV	DATE	ISSUED FOR

RAJ SINGH, P.E.
FLORIDA REG. NO.41210

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CLIENT: CITY OF ALTAMONTE SPRINGS

PROJECT: REGIONAL WATER RECLAMATION FACILITY

SHEET TITLE: EXISTING OVERALL SITE PLAN

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FIG. 1-1

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2. Basis of Design

2.1. Data Evaluation

Based on the data (from August 2014 to December 2016) evaluation, the average and maximum month values for different influent characteristics were determined. Table 2-1 summarizes the existing influent criteria and the observed peaking factors for different influent constituents.

Table 2-1 Existing Influent Characteristics for Design Criteria -Altamonte Springs RWRF

Influent Parameter	Units	Average (AD)	Max. Month (MM)	Peaking Factor (MM/AD)
Flow	mgd	5.82	6.4	1.08
BOD	lb/d	**11,407**	**14,259**	
	mg/L	235	294	1.25
TSS	lb/d	**13,348**	**15,884**	
	mg/L	275	327	1.19
NH_3	lb/d	**1,468**	**1,585**	
	mg/L	30.25	33	1.08
TKN	lb/d	**2,451**	**2,745**	
	mg/L	50.5	56.6	1.12
TP	lb/d	**393**	**447**	
	mg/L	8.1	9.2	1.14

The above design criteria will be used to calibrate the existing MLE process reactors, and setup process models for proposed alternatives using BioWin 5 process modeling software. The design criteria for the operating mixed liquor concentration will be 3,200 -3,500 mg/L.

As stated in the previous technical memorandum (included in Appendix A), the MLE process is currently in use at the ASRWRF. The existing reactor was modelled based on the existing structural dimensions and operational conditions/parameters as follows:

- **Anoxic Tank-** 112’ (L) X 50.33’ (W) X15.83’ (D); 0.59 million gallons (MG)
- **Nitrification Tank-** 257.5’ (L) X 50.33’ (W) X15.83’ (D); 1.53 MG
- For the purposes of the aeration control each Nitrification Tank is divided into three (3) equal size zones (0.51 MG) equipped with diffused aeration equipment.
  - Aeration Zone 1 - 2,706 diffusers
  - Aeration Zone 2 - 1,640 diffusers
  - Aeration Zone 3 - 1,092 diffusers
- The plant recycles from the Gravity Thickener and Belt Filter Press.
- Returned Activated Sludge from the Clarifier is estimated at about 6 mgd (1Q).
- The nitrated mixed liquor, internal recycle (IR) is estimated at about 18 mgd (4Q)

A Schematic of the existing MLE process reactor configuration is presented in Figure 2-1.

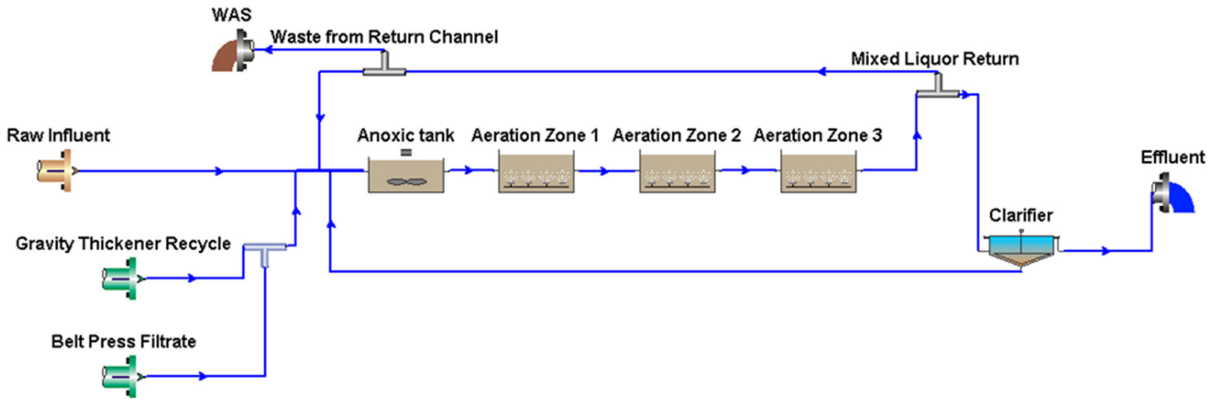


Figure 2-1 Schematic of Existing MLE Process Configuration at Altamonte Springs RWRF

2.2. Influent Basis of Design

2.2.1. Phase I – 9.0 mgd Average Daily Flow

The influent loading criteria for the biological process design was developed using the peaking factors for the influent Parameters determined from the existing data evaluation. The recommended influent basis of design for the phase I improvements of ASRWRF is presented in Table 2-2.

Table 2-2 Phase I – Influent Basis of Design for Altamonte Springs RWRF

Influent Parameter	Units	Average (AD)	Max. Month (MM)	Peaking Factor (MM/AD)
Flow	mgd	9.0	9.72	1.08
BOD	lb/d	**17,639**	**23,833**	
	mg/L	235	294	1.25
TSS	lb/d	**20,642**	**26,508**	
	mg/L	275	327	1.19
NH_3	lb/d	**2,270**	**2,676**	
	mg/L	30.25	33	1.08
TKN	lb/d	**3,790**	**4,588**	
	mg/L	50.5	56.6	1.12
TP	lb/d	**608**	**746**	
	mg/L	8.1	9.2	1.14

2.2.2. Phase II – 12.0 mgd Average Daily Flow

The recommended influent basis of design for the phase II improvements of ASRWRF is presented in Table 2-3.

Table 2-3 Phase II – Influent Basis of Design for Altamonte Springs RWRF

Influent Parameter	Units	Average (AD)	Max. Month (MM)	Peaking Factor (MM/AD)
Flow	mgd	12.0	12.96	1.08
BOD	lb/d	**23,519**	**31,777**	
	mg/L	235	294	1.25
TSS	lb/d	**27,522**	**35,344**	
	mg/L	275	327	1.19
NH_3	lb/d	**3,027**	**3,567**	
	mg/L	30.25	33	1.08
TKN	lb/d	**5,054**	**6,118**	
	mg/L	50.5	56.6	1.12
TP	lb/d	**811**	**994**	
	mg/L	8.1	9.2	1.14

2.3. Effluent Basis of Design

The effluent basis of design for both the Phase I and Phase II improvements are same in terms of the concentration. The major difference is associated with the average daily flow. A summary of the effluent basis of design is presented in Table 2-4.

Table 2-4 Phase I and Phase II – Effluent Basis of Design for Altamonte Springs RWRF

Effluent Parameter	Units	Phase I	Phase II
Flow	mgd	9.0	12.0
BOD	mg/L	5	5
TSS	mg/L	5	5
NH_3[1]	mg/L	<0.5	<0.5
TKN	mg/L	3	3
TP[2]	mg/L	1	1

[1] Not mandated by the permit. However, effluent ammonia concentration below 0.5 mg/L represent complete nitrification
[2]Includes phosphorus removal through tertiary treatment.

3. Process Design

The goal of the Process Modeling for the purposes of this report was to use the calibrated model of the existing process configuration (after aeration system upgrade) and validate it using the current data and evaluate the projected performance for the Phase I and Phase II improvements based on the design criteria established. An industry-accepted biological process modeling software, BioWin 5, was used to model both the existing process and the proposed alternatives.

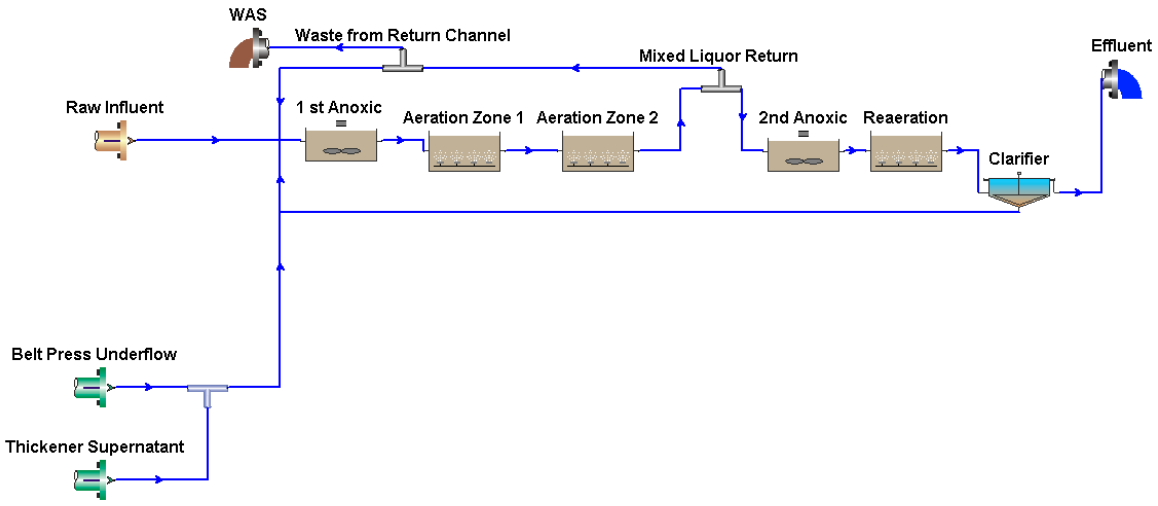
To achieve enhanced nutrient removal for upgrading the plant to 9.0 mgd in Phase I and 12.0 mgd in Phase II, effluent total nitrogen needs to be reduced from the current 8 mg/L concentration to about 3 mg/L

concentration. This can be achieved by modifying the existing MLE process configuration to a 4-stage Bardenpho configuration. A detailed process evaluation summary is presented in Appendix A- Technical Memorandum - ASRWRF Process Evaluation.

The configuration of the aeration basins for the 4-stage Bardenpho process configuration is shown on Figure 3-1. This is a single sludge process with a four-stage sequence for nitrogen removal. The process includes dual anoxic and aerobic zones. The function of each zone in this process configuration can be briefly described as follows:

- First Anoxic Zone
  - Internal recycle returns activated sludge and nitrates/nitrites to the beginning of the process for denitrification
  - Organic carbon consumed by bacteria converting nitrates and nitrites to nitrogenous gas
- First Aerobic Zone
  - Oxidation of influent organic carbon
  - Nitrification of influent ammonia
- Second Anoxic Zone
  - Endogenous respiration to remove remaining nitrates/nitrites
- Second Aerobic Zone
  - Re-aeration of wastewater prior to discharge to secondary clarifiers

Figure 3-1 Schematic of 4-stage Bardenpho Process Configuration



3.1. Proposed Improvements for Phase I

The Phase I improvements include minor modifications to the existing reactor without any additional reactor volume to achieve the effluent design criteria to treat an average daily flow of 9.0 mgd. There will be no major modifications to the existing anoxic tanks, a portion of the nitrification tank (aeration zone) will be modified to a 2nd anoxic and reaeration zones. A process flow diagram for the modified Phase I process is illustrated in Figure 3-2. Reconfiguration of the existing aeration basins will require partitioning of the existing aeration tanks with baffle walls as illustrated in figures 3-6 and 3-7. Existing submersible mixers will be used for mixing in the 2nd anoxic zone. The existing air diffusers in the 2nd anoxic zone will be isolated such that in Phase II they can be re-incorporated in the process scheme. The existing internal recirculation pumps will be reused in their current location; however, a 48-inch suction pipe will be extended to the discharge end of the reconfigured aeration tanks.

The reliability of the process configuration is largely dependent on the secondary clarifier performance. At ASRWRF the existing secondary rectangular clarifiers are nearing the end of their useful life and lack

modern sludge control means. Clarification/sedimentation is a critical process for the successful performance of an advanced wastewater treatment process. The performance of the secondary clarifier limits the operating mixed liquor concentration in the aeration tank. A higher operating mixed liquor concentration in the aeration tank can be maintained without sludge thickening and sludge settleability issues in the Secondary clarifiers. Therefore, as recommended below, state of the art new circular clarifiers are required.

The existing secondary rectangular clarifiers 1a, 1b, 1c, 2a, 2b and 2c were designed for a 12.5 MGD AADF capacity, however, sludge withdrawal and rate control is inadequate. These clarifiers and the mechanisms have been in service over 25 years and need major concrete and mechanism rehabilitation, which is estimated cost well over $1.0M for each set of the clarifiers. In lieu of spending the money in rehabilitating the old and outdated clarifiers, a phased approach is recommended to replace these clarifiers with more modern and efficient circular clarifiers. Therefore, it is recommended, in phase I, the existing secondary clarifiers 2a, 2b, and 2c be demolished to provide space for two new 90-ft-diameter-circular secondary clarifiers with a side water depth of 16-ft. A demolition plan for phase I upgrades is illustrated in figures 3-3 thru 3-5. An overall site layout showing the Phase I improvements is shown in Figure 3-6.

Class I Reliability and existing Plant Operation during construction: Upon completion of the Phase I improvements, there will include two (2) 90-ft diameter new clarifiers with 16-ft side water depth (SWD) and three (3) old rectangular clarifiers (33'X150'X13.5 SWD). Based on this the loading rates will be as follows:

- At the current permitted average daily flow (ADF) capacity of 12.5 mgd the loading rates will be 452 gpd/ft^2 at ADF and 904 gpd/ft^2 at peak flow.

- With the largest unit, out of service, i.e.1-90' out of service (1-90' in service and (3) old rectangular clarifiers in service, flow =75% of peak flow of 25 MGD peak flow)) the loading rate for class I reliability will be 884 gpd/ft^2, which is well within typical range of 800-1000 gpd/ft^2 for peak flow conditions.

- During construction of phase I improvements, the Average Daily Flow is projected to be in 7.0 mgd range, which will be handled by the three (3) old rectangular clarifiers (33'X150'X13.5 SWD) with a loading rate of 471 gpd/ft^2. Therefore, the TSS loading and fecal coliform count to the downstream processes (filters, chlorine contact tanks) would remain unaffected.

12" REUSE AUGMENTATION FROM STORM PONDS

EFFLUENT HOLDING TANK

ULTRASONIC FLOW METER FOR PLANT RECYCLES

48"/42" RAW SEWAGE

48" PLANT EFFLUENT TO WEKIVA RIVER

24" EFFLUENT DIVERSION

42" EFFLUENT DIVERSION

SUBMERSIBLE INFLUENT PUMP STATION AND FINE MECHANICAL SCREENS

48" PLANT EFFLUENT

pH CONTROL RAPID MIX CHAMBER

DECHLORINATION MIX CHAMBER

NEUTRALIZATION METERING STRUCTURE

pH CONTROL SLOW MIX CHAMBER

SULFUR DIOXIDE SUPPLY

SULFUR DIOXIDE STORAGE

ACID SUPPLY

ACID PUMPS

ACID STORAGE

NEUTRALIZATION BUILDING

RAW SEWAGE INFLUENT STRUCTURE

30" RAW SEWAGE

36" RAW SEWAGE FM

RAW SEWAGE FLOW METER

HEADCELL (GRIT REMOVAL)

30" HEADCELL BYPASS

DEGRITTED EFFLUENT

TO PROJECT "APRICOT" GROUND STORAGE TANKS

36" EFFLUENT PUMPING STATION BY-PASS

EFFLUENT METERING WEIR

EFFLUENT PUMPING STATION

CHLORINE

CONTACT TANK

SCUM PUMP

PLANT AIR

TO PLANT DISTRIBUTION SYSTEM

CHLORINE INJECTION

PLANT WATER PUMPING STRUCTURE

DIRECT POTABLE REUSE PROCESS

REAERATION TANKS

No. 1

No. 2

FILTER EFFLUENT

12" DIGESTER SUPERNATANT DRAIN

AEROBIC DIGESTION TANKS

No. 1

No. 2

No. 3

BELT PRESS FEED PUMPS

6" DIGESTED SLUDGE

20" AIR SUPPLY

6" SCUM LINE

4" THICKENER DILUTION WATER

3" BELT PRESS SPRAY WATER

3" CHLORINE SOLUTION

20" BACKWASH SUPPLY

6" FILTER BACKWASH RETURN

FILTER BACKWASH WASTE PUMPS

BACKWASH SUPPLY FLOW ELEMENT

6" FILTER RESEED

FILTERS

No. 1

No. 2

No. 3

No. 4

No. 5

No. 6

No. 7

24" BACKWASH WATER

FILTER BACKWASH HOLDING TANK

BACKWASH AIR BLOWERS

POLYMER FEEDERS

POLYMER ADDITION

BELT PRESSES

SCUM REMOVAL

SCUM SCREEN

SLUDGE CAKE

TRUCK

8" THICKENED SLUDGE

PLANT AIR

THICKENED SLUDGE PUMPS

SLUDGE THICKENING TANK No. 1

SLUDGE THICKENING TANK No. 2

SODIUM HYPOCHLORITE FEED PUMPS AND STORAGE

8" AIR SUPPLY

20" AIR SUPPLY

8" WASTE ACTIVATED SLUDGE

12" BELT PRESS UNDER FLOW

12" SUPERNATANT

24" SUPERNATANT □ DEWATERING DRAIN

FILTER INFLUENT FLOW METER (METHANOL FEED CONTROL)

SCUM

BLOWER BUILDING

BLOWERS

8" WASTE ACTIVATED SLUDGE

8" OPTIONAL WASTE ACTIVATED SLUDGE

RAS PUMP STATION

48" FILTER INFLUENT

CHEMICAL HANDLING FACILITY

CHEMICAL FEED PUMPS

1" ALUM FEED

SECONDARY TANK SCUM PUMP

6" SECONDARY SCUM

RAS FLOW METER

30" RETURN ACTIVATED SLUDGE

24" RAS

METHANOL ADDITION

MIXED LIQUOR RETURN (CHANNEL)

1st ANOXIC TANKS

NO. 1

NO. 2

NITRIFICATION TANKS

NO. 1

NO. 2

2nd ANOXIC TANKS

IR PUMP SUCTION

NO. 1

IR PUMP SUCTION

NO. 2

24" AIR SUPPLY

MIXED LIQUOR RETURN PUMPS (TYP.)

RE-AERATION TANKS NO.1 AND NO.2

SECONDARY SETTLING TANKS

NO. 1A

NO. 1B

NO. 1C

FLOCCULATION □ MIX TANKS

NO. 1

NO. 2

SECONDARY INFLUENT

SECONDARY INFLUENT (CHANNEL)

24" CLARIFIER INFLUENT

CLARIFIER INFLUENT FLOW SPLITTER BOX

36" SECONDARY EFFLUENT

NO. 1

NO. 2

24" EFF

24" RAS

6" SECONDARY SCUM

SECONDARY CLARIFIERS

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SHEET TITLE: PROCESS FLOW DIAGRAM- PHASE I

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FIG. 3-2

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NORTH

0 40 80

GRAPHIC SCALE
SCALE: 1" = 40'-0"

AUTOMATIC ACCESS CONTROL GATE

EFFLUENT HOLDING TANK

RECLAIMED WATER STORAGE TANK

RECLAIMED WATER STORAGE TANK

REUSE PUMP AND OFFICE BUILDING

LAB

MAINTENANCE BUILDING

STORAGE SHED

STORAGE SHED

SUBMERSIBLE INFLUENT PUMP STATION AND FINE MECHANICAL SCREENS

NEUTRALIZATION TANK

RAW SEWAGE INFLUENT STRUCTURE

VACTOR DUMP STATION

NEUTRALIZATION BUILDING

EFFLUENT METERING WEIR

CHLORINE CONTACT TANK

PLANT WATER PUMPING STRUCTURE

REAERATION TANKS

AEROBIC DIGESTION TANKS

ODOR CONTROL

SLUDGE THICKENING TANK NO. 1

SLUDGE THICKENING TANK NO. 2

COVERED PARKING

ASPHALT

WAREHOUSE

COVERED STORAGE

DPR AND HYPOCHLORITE BUILDING

FILTER BACKWASH HOLDING TANK

FILTERS

SLUDGE HANDLING BUILDING

KELLER RD

PORTABLE BUILDING

FUEL/TANK

COVERED STORAGE

AUTOMATIC ACCESS CONTROL GATE

GENERATOR AND POWER DISTRIBUTION BUILDING

HEADCELL (GRIT REMOVAL)

BLOWER BUILDING

EQUIPMENT STORAGE BUILDING

OPERATIONS BUILDING

CHEMICAL HANDLING FACILITY

RELOCATE CHEMICAL FEED FACILITY- PHASE I

RAS PUMP STATION

DEMOLISH SECONDARY SETTLING TANKS- PHASE I (SEE DEMOLITION PLAN)

ANOXIC TANK NO. 1

NITRIFICATION TANK NO. 1

ANOXIC TANK NO. 2

NITRIFICATION TANK NO. 2

SECONDARY SETTLING TANK NO. 1A

SECONDARY SETTLING TANK NO. 1B

SECONDARY SETTLING TANK NO. 1C

FLOCCULATION MIX TANKS

SECONDARY SETTLING TANK NO. 2A

SECONDARY SETTLING TANK NO. 2B

SECONDARY SETTLING TANK NO. 2C

COVERED CONCRETE

DEMOLISH INTERNAL WALLS AND EQUIPMENT-PHASE II (SEE DEMOLITION PLAN)

GATEWAY DR

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SHEET TITLE: EXISTING SITE -PHASE I AND PHASE II DEMOLITION PLAN

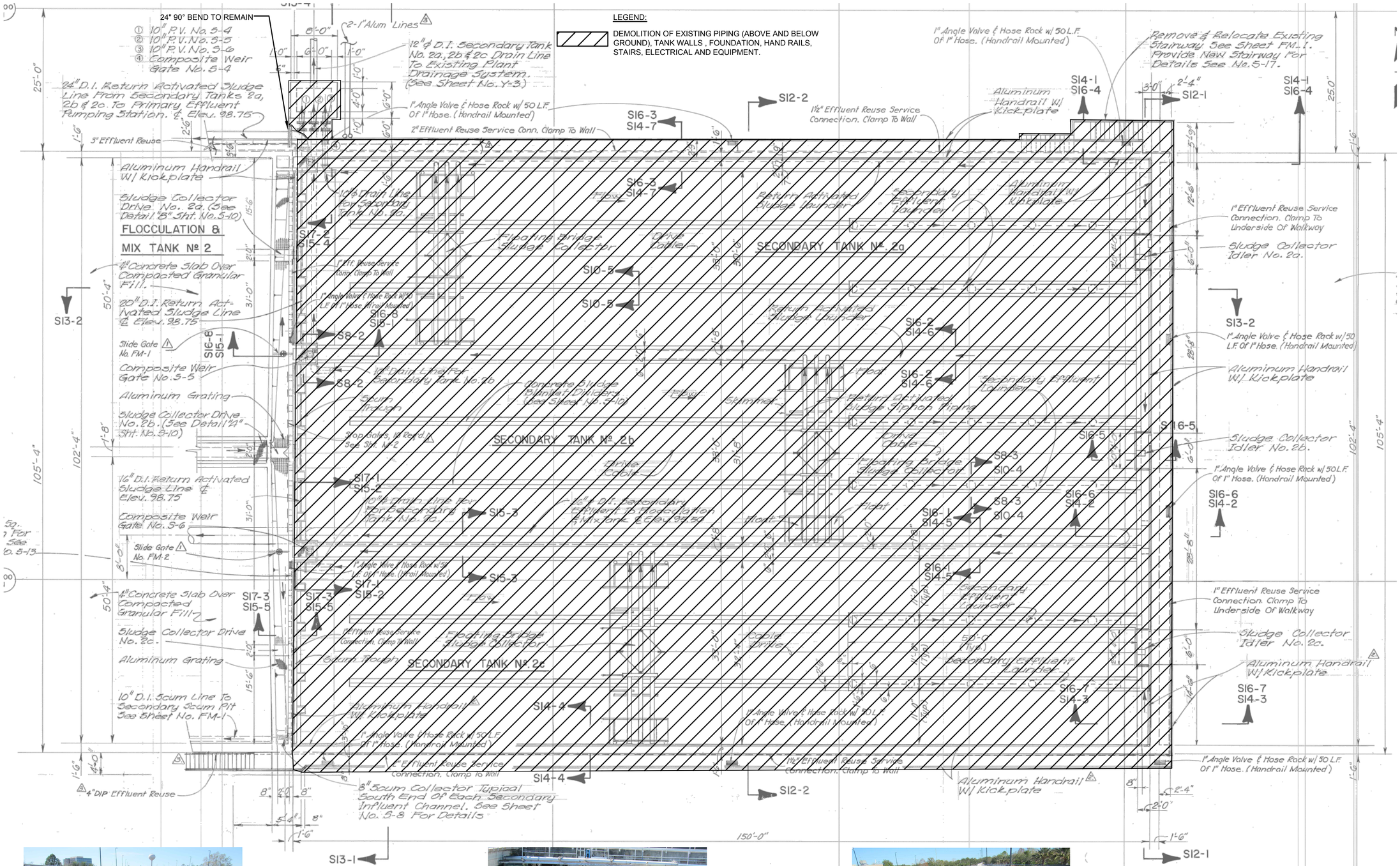
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FIG. 3-3

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SECONDARY CLARIFIER 1c (1a AND 1b SIMILAR)



SECONDARY CLARIFIER 1c LOOKING WEST
EFFLUENT LAUNDER BLOW-UP



SECONDARY CLARIFIER 1c LOOKING EAST
FLOATING BRIDGE SLUDGE COLLECTOR BLOW-UP

LEGEND:

DEMOLITION OF EXISTING PIPING (ABOVE AND BELOW GROUND), TANK WALLS , FOUNDATION, HAND RAILS, STAIRS, ELECTRICAL AND EQUIPMENT.

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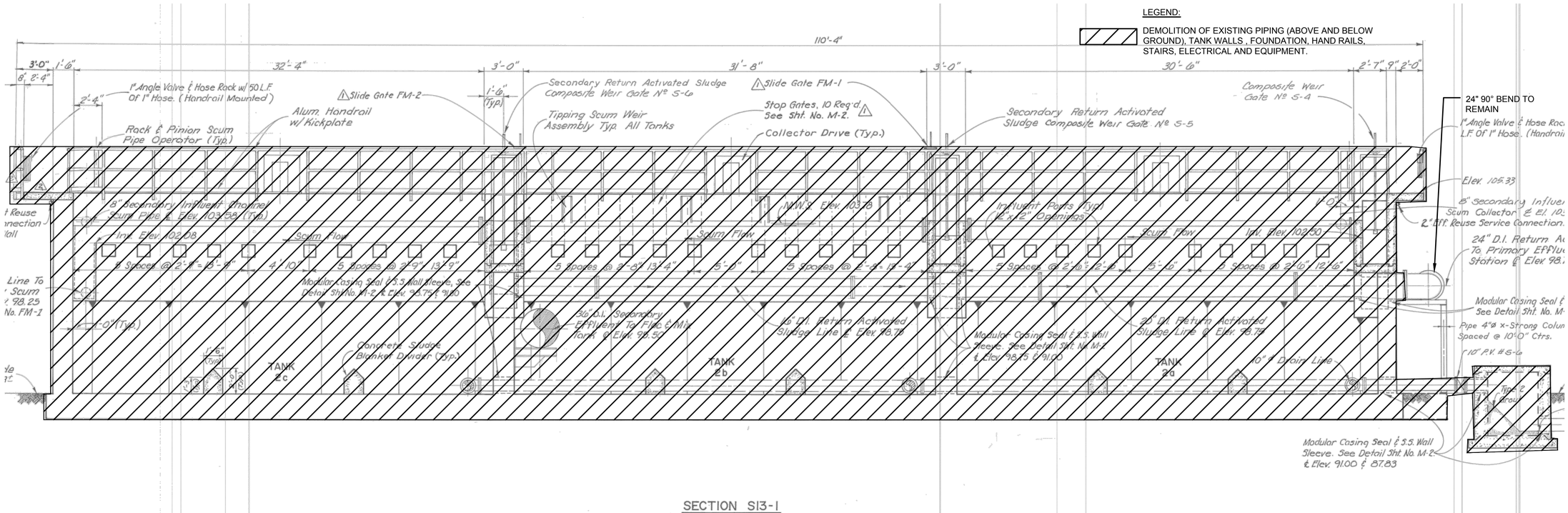
SHEET TITLE: SECONDARY CLARIFIERS No. 2 a, 2 b and 2 c DEMOLITION PLAN- PHASE I

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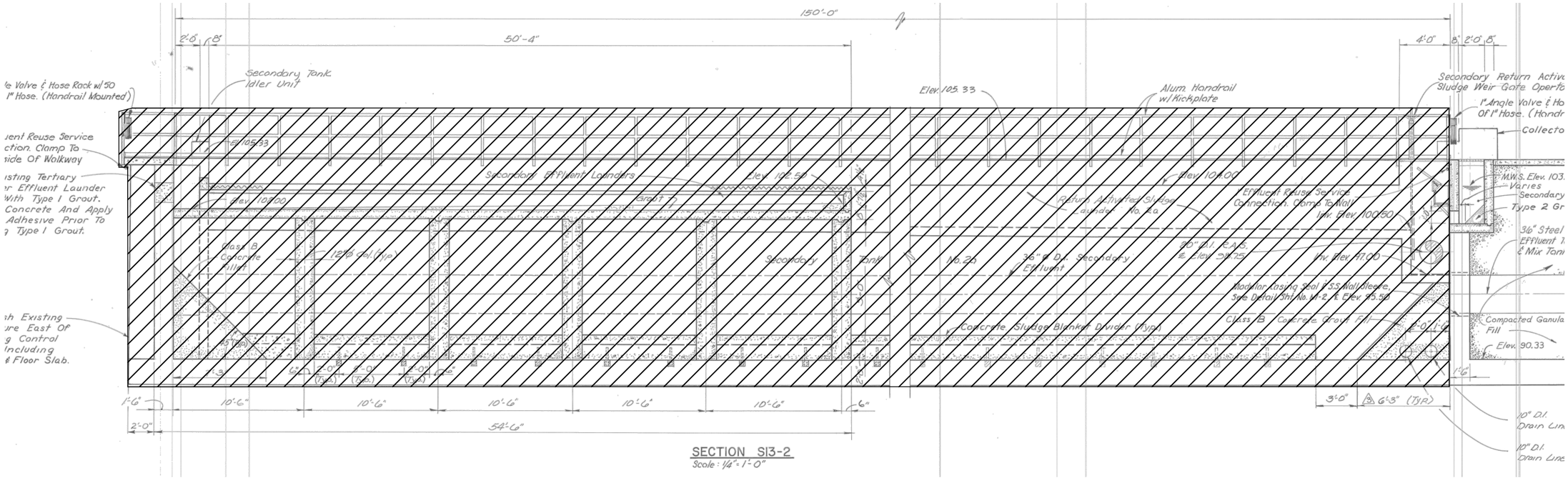
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FIG. 3-4

PLOT DATE: Mar 13, 2017 - 5:24pm
FILE NAME: C:\Users\gord.fish\appdata\local\temp\AcPublish_13872\02_Existing Secondary Clarifier Tank No 2a 2b 2c_Demolition plan_Phase I.dwg



SECTION S13-1
Scale: 1/4"=1'-0"



SECTION S13-2
Scale: 1/4"=1'-0"

PLOT DATE: Mar 13, 2017 - 1:45pm
FILENAME: C:\Users\gcox1391\appdata\local\temp\AcPublish_13972\04_Existing Secondary Clarifier Tank No 2a 2b 2c sections_Demolition_Phase I.dwg

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CLIENT: CITY OF ALTAMONTE SPRINGS

PROJECT: REGIONAL WATER RECLAMATION FACILITY

SHEET TITLE: SECONDARY CLARIFIERS 2a 2b 2c SECTIONS-DEMOLITION PHASE I

ATKINS
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FIG. 3-5

NORTH

0 40 80

GRAPHIC SCALE
SCALE: 1" = 40'-0"

AUTOMATIC ACCESS CONTROL GATE

EFFLUENT HOLDING TANK

RECLAIMED WATER STORAGE TANK

RECLAIMED WATER STORAGE TANK

REUSE PUMP AND OFFICE BUILDING

LAB

MAINTENANCE BUILDING

STORAGE SHED

STORAGE SHED

SUBMERSIBLE INFLUENT PUMP STATION AND FINE MECHANICAL SCREENS

NEUTRALIZATION TANK

RAW SEWAGE INFLUENT STRUCTURE

VACTOR DUMP STATION

NEUTRALIZATION BUILDING

EFFLUENT METERING WEIR

PLANT WATER PUMPING STRUCTURE

REAERATION TANKS

CHLORINE CONTACT TANK

AEROBIC DIGESTION TANKS

ODOR CONTROL

COVERED PARKING

ASPHALT

WAREHOUSE

COVERED STORAGE

DPR AND HYPOCHLORITE BUILDING

FILTER BACKWASH HOLDING TANK

FILTERS

SLUDGE HANDLING BUILDING

SLUDGE THICKENING TANK NO. 1

SLUDGE THICKENING TANK NO. 2

KELLER RD

PORTABLE BUILDING

FUEL/TANK

COVERED STORAGE

AUTOMATIC ACCESS CONTROL GATE

GENERATOR AND POWER DISTRIBUTION BUILDING

HEADCELL (GRIT REMOVAL)

RELOCATED CHEMICAL HANDLING FACILITY

BLOWER BUILDING

EQUIPMENT STORAGE BUILDING

OPERATIONS BUILDING

RAS PUMP STATION

RE-AERATION TANK NO.1

SECONDARY CLARIFIER NO. 1

FUTURE SECONDARY CLARIFIER NO. 3

FLOW SPLITTER BOX

SLUDGE COLLECTION BOX

1st ANOXIC TANK NO. 1

NITRIFICATION TANK NO. 1

2nd ANOXIC TANK NO.1

EXISTING SECONDARY CLARIFIER 1a

EXISTING SECONDARY CLARIFIER 1b

EXISTING SECONDARY CLARIFIER 1c

SECONDARY CLARIFIER NO. 2

FUTURE SECONDARY CLARIFIER NO. 4

1st ANOXIC TANK NO. 2

NITRIFICATION TANK NO. 2

2nd ANOXIC TANK NO.2

RE-AERATION TANK NO.2

COVERED CONCRETE

GATEWAY DR

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CLIENT: CITY OF ALTAMONTE SPRINGS

PROJECT: REGIONAL WATER RECLAMATION FACILITY
PHASE I PLANT IMPROVEMENTS

SHEET TITLE: PROPOSED PHASE I MODIFICATIONS
OVERALL SITE PLAN

ATKINS

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SHEET NO.	FIG 3-6
REV.	△

PLOT DATE: Sep 28, 2017 - 1:25pm
FILE NAME: c:\Users\gary.k.191\appdata\temp\AcPublish_15084\C-5_PROPOSED_Phase I_OVERALL_SITE_PLAN.dwg

By constructing new baffle walls in the nitrification tank, the tanks will be reconfigured to include 2nd anoxic zone and reaeration zones with revised aeration zones. Since downstream end of the existing oxic zone would be converted to an anoxic zone, the IR pump suction would be moved to the point furthest downstream in the oxic zones. There will be no physical reconfiguration of the existing aeration system in the Nitrification Tank. The existing oxic zone 3a will be converted to the second anoxic zone by constructing baffle walls in Nitrification Tank. The diffusers will be turned off and mixers will be installed. The existing oxic zone 3b will be converted to the reaeration zone by constructing baffle walls in Nitrification Tank. No diffuser clogging issues are anticipated by turning off the membrane type diffusers. The effluent total phosphorus concentration is achieved using chemical precipitation using alum. Figure 3-7 shows the reactor modifications associated with the Phase I improvements.

The model application was developed to determine the ability of the biological process for achieving the targeted nutrient removal. It was observed, the total nitrogen values in the secondary effluent predicted by the model slightly exceed the 3 mg/L criteria and total phosphorus effluent criteria of 1 mg/L. The reason for increase in the effluent TN could be variation in the refractory organic nitrogen in the influent and the role of influent BOD in the denitrification of NOx. The observed BOD/TKN ratio is less than the normal. Model simulations were developed to determine the external carbon source dosage to reduce the TN to the effluent goal of 3 mg/L and alum dosage to meet effluent TP goal of 1 mg/L as presented in Table 3-1.

Table 3-1 summarizes the predicted performance of 4-stage Bardenpho Process configuration at 20 and 30 ℃ including necessary addition of external Carbon source and Alum.

Table 3-1 Model Predicted Performance – Phase I

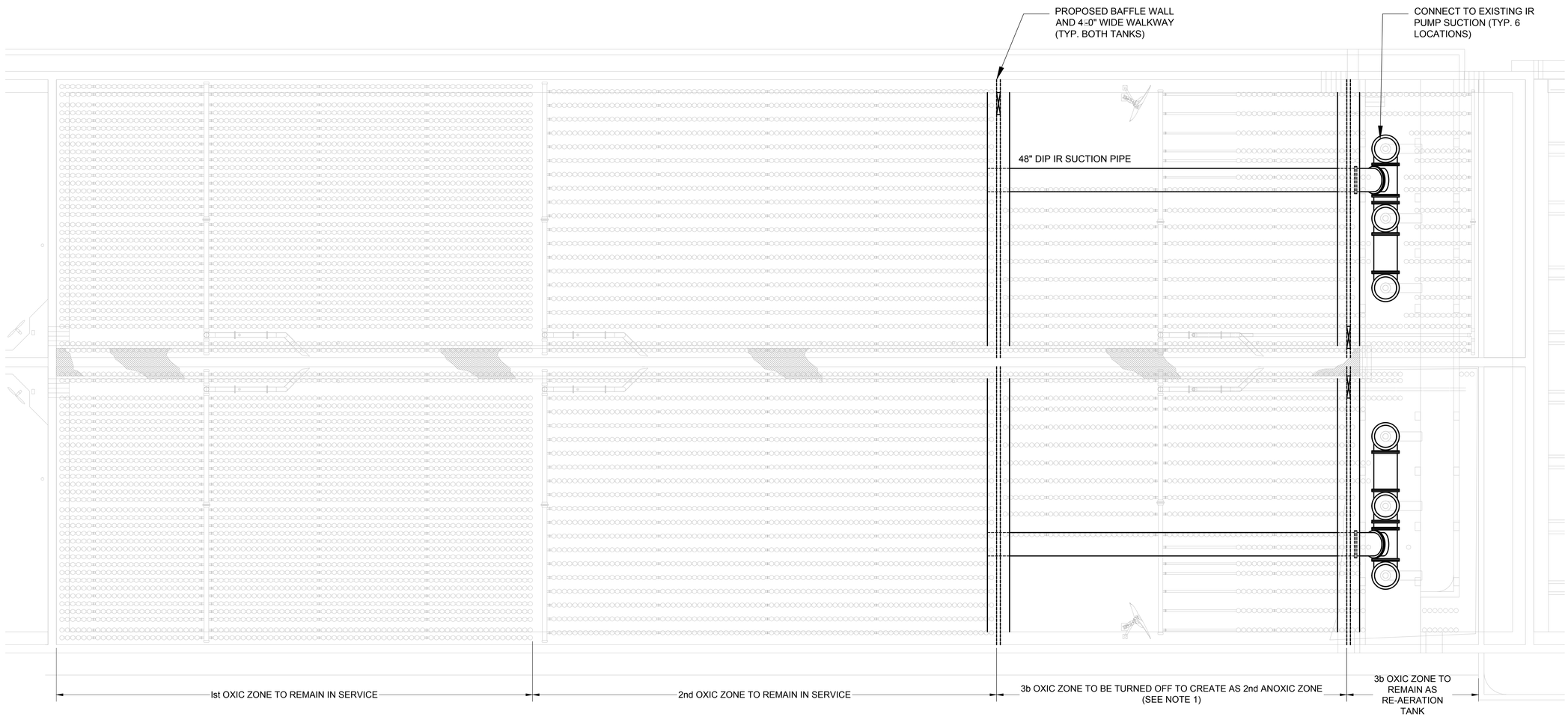
Process Parameters	20℃	30℃
Influent Flow (mgd) (two trains), Q	9.00	9.00
MLSS (mg/L)	3500	3500
IR (mgd), 4.5Q	40.50	40.50
SRT (days)	9.98	10.57
RAS (mgd)	5.40	5.40
WAS (mgd)	0.56	0.52
VSS/TSS	0.67	0.65
Yield (lb TSS/lb BOD)	0.91	0.86
Anoxic Volume (MG)	0.67	0.67
Aeration Volume (MG)	1.02	1.02
Post-Anoxic Volume (MG)	0.41	0.41
Re-Aeration Volume (MG)	0.09	0.09
Effluent NH3 (mg N/L)	0.35	0.15
Effluent NO3 (mg N/L)	0.58	0.92
Effluent NO2 (mg N/L)	0..32	0.08
Effluent TKN (mg N/L)	1.77	1.54
Effluent TN (mg N/L)	2.95	2.78
Effluent TP (mg P/L)	0.74	1.0
Effluent BOD, TSS (mg/L)	<5	<5
Methanol dosage to reduce TN to <3 mg/L (gpd)	104	74
Alum (metal) dosage to reduce TP to <1 mg/L (gpd)	200	358

The storage volume for 30-day feed requirement will require about 2,880-gallon storage tank for methanol and 5,550-gallon storage tank for alum. Neat methanol is stored in the tank which can be diluted to 20%

using dilution water pumps to the feed point. Alternative carbon sources such as MicroC® will also be considered to mitigate safety concerns.

A 5-Stage Bardenpho process was evaluated for biological phosphorus (Bio-P) removal. However, chemical phosphorus removal was more effective at this plant due to the following considerations:

- At high temperature, the phosphorus accumulating organisms (PAOs) are characterised by relatively low reaction rate there by reducing the effective Bio-P accumulation.
- The PAOs compete with glycogen accumulating organisms and heterotrophic denitrifying organisms for readily biodegradable organic matter in the influent wastewater.



NOTES:

1. REMOVE AND PROPERLY STORE DIFFUSERS IN ZONE 3a THAT ARE IN CONFLICT WITH THE BAFFLE WALL AND 48" IR PUMP SUCTION PIPE.
2. REMOVE AND RE-INSTALL DIFFUSERS IN 2nd OXIC AND 3b OXIC ZONE THAT INTERFERES WITH NEW BAFFLE WALL.

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CLIENT: CITY OF ALTAMONTE SPRINGS

PROJECT: REGIONAL WATER RECLAMATION FACILITY

SHEET TITLE: PROPOSED PHASE I NITRIFICATION TANK MODIFICATION PLAN

ATKINS

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FIG. 3-7

PLOT DATE: Mar 13, 2017 - 1:57pm
FILE NAME: U:\WO\Projects\City of Altamonte Springs\ASR\WF Plant Expansion\5_Plans\Design\14_Proposed_Nitrification Tank Phase I modifications.dwg

The operation of a 4-stage Bardenpho process will be optimized by use of oxidation-reduction potential (ORP) sensors, ammonia (NH_4) and nitrate (NO_3) sensors. The purpose of these sensors is to provide a continuous feedback to the blowers by monitoring the ORP (equivalent to dissolved oxygen concentration) and the ammonia and nitrate concentration change in the reactor. This will be helpful to achieve a reliable and repeatable performance, hence are recommended to be included in the design. ORP sensors will be located at the end of the Pre-Anoxic and Aerobic Zones which control the amount of air added thereby controlling the nitrification and denitrification. The set-points on the ORP will be revised based on feedback information from the NH_4 and NO_3 sensors located at the end of the Aerobic Zone and at the end of Re-Aeration Zone.

3.2. Proposed Improvements for Phase II

For the required additional reactor volume to treat an average flow of 12.0 mgd, iterations were performed by increasing the anoxic and aerobic volume required to meet the desired effluent criteria. Increase in the anoxic volume was provided based on the effluent total nitrogen. The effluent total phosphorus concentration is achieved using chemical precipitation using alum. The total reactor volume for each train was determined at 3.14 MG. Each train of the existing MLE reactor is about 2.19 MG; therefore, additional reactor volume of about 0.94 MG will be required. A process flow diagram for the modified Phase II process is illustrated in Figure 3-8. The reliability of the process configuration is largely dependent on the secondary clarifier performance. At ASRWRF the existing secondary clarifiers are nearing the end of their useful life and are recommended to be demolished as illustrated in figures 3-9 and 3-10. An overall site layout showing the improvements associated with Phase II is shown in Figure 3-11.

As part of the Phase II improvements no additional modifications the existing anoxic tank and nitrification tank will be required. As the existing clarifiers are currently near end of their useful life, reusing them to provide additional reactor volume was evaluated. The additional reactor volume is estimated at about 116 ft. long anoxic reactor and about 44 ft. long oxic reactor. The additional post anoxic and re-aeration will be provided by modifying the existing secondary clarifiers. The modifications to the existing rectangular secondary clarifiers is shown in Figure 3-11.

In Phase II, 2nd set of the existing rectangular secondary clarifiers will be repurposed as 2nd anoxic and reaeration tanks and replaced with two new 90-ft-diamerter-circular secondary clarifiers to provide a total of four-90-ft-diameter clarifiers (two-90-ft-diameter-circular clarifiers will be added as part of Phase I). The new clarifiers are recommended to be equipped with a spiral scraper mechanism, covers over the effluent launder for algae control, density current baffles for more efficient performance and telescoping valves for controlled sludge withdrawal from each clarifier. All the telescoping valves will be located inside a common sludge box which will be connected to the RAS pump station currently under construction.

Class I Reliability: Upon completion of the Phase II improvements, there will be four (4) 90-ft diameter new clarifiers with 16-ft side water depth (SWD). Based on this the loading rates will be as follows:

- At the current permitted average daily flow (ADF) capacity of 12.5 mgd the loading rates will be 491 gpd/ft^2 at ADF and 982 gpd/ft^2 at peak flow.
- With the largest unit, out of service, i.e.1-90’ out of service (3-90’ in service, flow =75% of peak flow of 25 MGD peak flow)) the loading rate for class I reliability will be 982 gpd/ft^2, which is well within typical range of 800-1000 gpd/ft^2 for peak flow conditions.
- The new clarifiers will be equipped with density current baffles for enhanced performance and the 16-ft SWD would allow higher than typical loading rates.

12" REUSE AUGMENTATION FROM STORM PONDS

EFFLUENT HOLDING TANK

ULTRASONIC FLOW METER FOR PLANT RECYCLES

48"/42" RAW SEWAGE

48" PLANT EFFLUENT TO WEKIVA RIVER

24" EFFLUENT DIVERSION

42" EFFLUENT DIVERSION

SUBMERSIBLE INFLUENT PUMP STATION AND FINE MECHANICAL SCREENS

48" PLANT EFFLUENT

pH CONTROL RAPID MIX CHAMBER

DECHLORINATION MIX CHAMBER

NEUTRALIZATION METERING STRUCTURE

pH CONTROL SLOW MIX CHAMBER

SULFUR DIOXIDE SUPPLY

SULFUR DIOXIDE STORAGE

ACID SUPPLY

ACID PUMPS

ACID STORAGE

NEUTRALIZATION BUILDING

RAW SEWAGE INFLUENT STRUCTURE

30" RAW SEWAGE

36" RAW SEWAGE FM

RAW SEWAGE FLOW METER

HEADCELL (GRIT REMOVAL)

30" HEADCELL BYPASS

DEGRITTED EFFLUENT

12" DIGESTER SUPERNATANT DRAIN

TO PROJECT "APRICOT" GROUND STORAGE TANKS

CHLORINE INJECTION

DIRECT POTABLE REUSE PROCESS

36" EFFLUENT PUMPING STATION BY-PASS

EFFLUENT METERING WEIR

CHLORINE

CONTACT TANK

PLANT WATER PUMPING STRUCTURE

REAERATION TANKS

No. 1

No. 2

FILTER EFFLUENT

AEROBIC DIGESTION TANKS

No. 1

No. 2

No. 3

BELT PRESS FEED PUMPS

PLANT AIR

TO PLANT DISTRIBUTION SYSTEM

SCUM PUMP

EFFLUENT PUMPING STATION

20" AIR SUPPLY

6" SCUM LINE

4" THICKENER DILUTION WATER

3" BELT PRESS SPRAY WATER

6" DIGESTED SLUDGE

3" CHLORINE SOLUTION

20" BACKWASH SUPPLY

BACKWASH SUPPLY FLOW ELEMENT

6" FILTER BACKWASH RETURN

FILTER BACKWASH WASTE PUMPS

6" FILTER RESEED

FILTERS

No. 1

No. 2

No. 3

No. 4

No. 5

No. 6

No. 7

BACKWASH AIR BLOWERS

POLYMER FEEDERS

SCUM REMOVAL

SCUM SCREEN

SODIUM HYPOCHLORITE FEED PUMPS AND STORAGE

FILTER BACKWASH HOLDING TANK

8" AIR SUPPLY

20" AIR SUPPLY

24" BACKWASH WATER

POLYMER ADDITION

SLUDGE CAKE

BELT PRESSES

TRUCK

8" THICKENED SLUDGE

PLANT AIR

THICKENED SLUDGE PUMPS

SLUDGE THICKENING TANK No. 1

SLUDGE THICKENING TANK No. 2

8" WASTE ACTIVATED SLUDGE

12" BELT PRESS UNDER FLOW

SCUM

12" SUPERNATANT

24" SUPERNATANT □ DEWATERING DRAIN

FILTER INFLUENT FLOW METER (METHANOL FEED CONTROL)

BLOWER BUILDING

BLOWERS

8" WASTE ACTIVATED SLUDGE

8" WASTE ACTIVATED SLUDGE

6" SECONDARY SCUM

SECONDARY CLARIFIER SCUM PUMP

48" FILTER INFLUENT

CHEMICAL HANDLING FACILITY

CHEMICAL FEED PUMPS

RAS PUMP STATION

8" OPTIONAL WASTE ACTIVATED SLUDGE

RAS FLOW METER

30" RETURN ACTIVATED SLUDGE

24" RAS

1" ALUM FEED

48" SECONDARY EFFLUENT

6" SECONDARY SCUM

36" SECONDARY EFFLUENT

MIXED LIQUOR RETURN (CHANNEL)

FIRST ANOXIC TANKS

NO. 1

NO. 2

NITRIFICATION TANKS

NO. 1

NO. 2

MIXED LIQUOR RETURN PUMPS

MIXED LIQUOR RETURN PUMPS

24" AIR SUPPLY

2ND ANOXIC TANKS

NO. 1

NO. 2

NO. 1

NO. 2

FLOC TANK NO.1

FLOC TANK NO.2

GATE

24" CLARIFIER INFLUENT

CLARIFIER INFLUENT FLOW SPLITTER BOX

REAERATION TANKS

BYPASS CHANNEL

NO. 1

NO. 3

NO. 2

NO. 4

24" EFF

24" RAS

SLUDGE BOX

6" SECONDARY SCUM

SECONDARY CLARIFIERS

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CLIENT: CITY OF ALTAMONTE SPRINGS

PROJECT: REGIONAL WATER RECLAMATION FACILITY

SHEET TITLE: PROCESS FLOW DIAGRAM- PHASE II-FINAL

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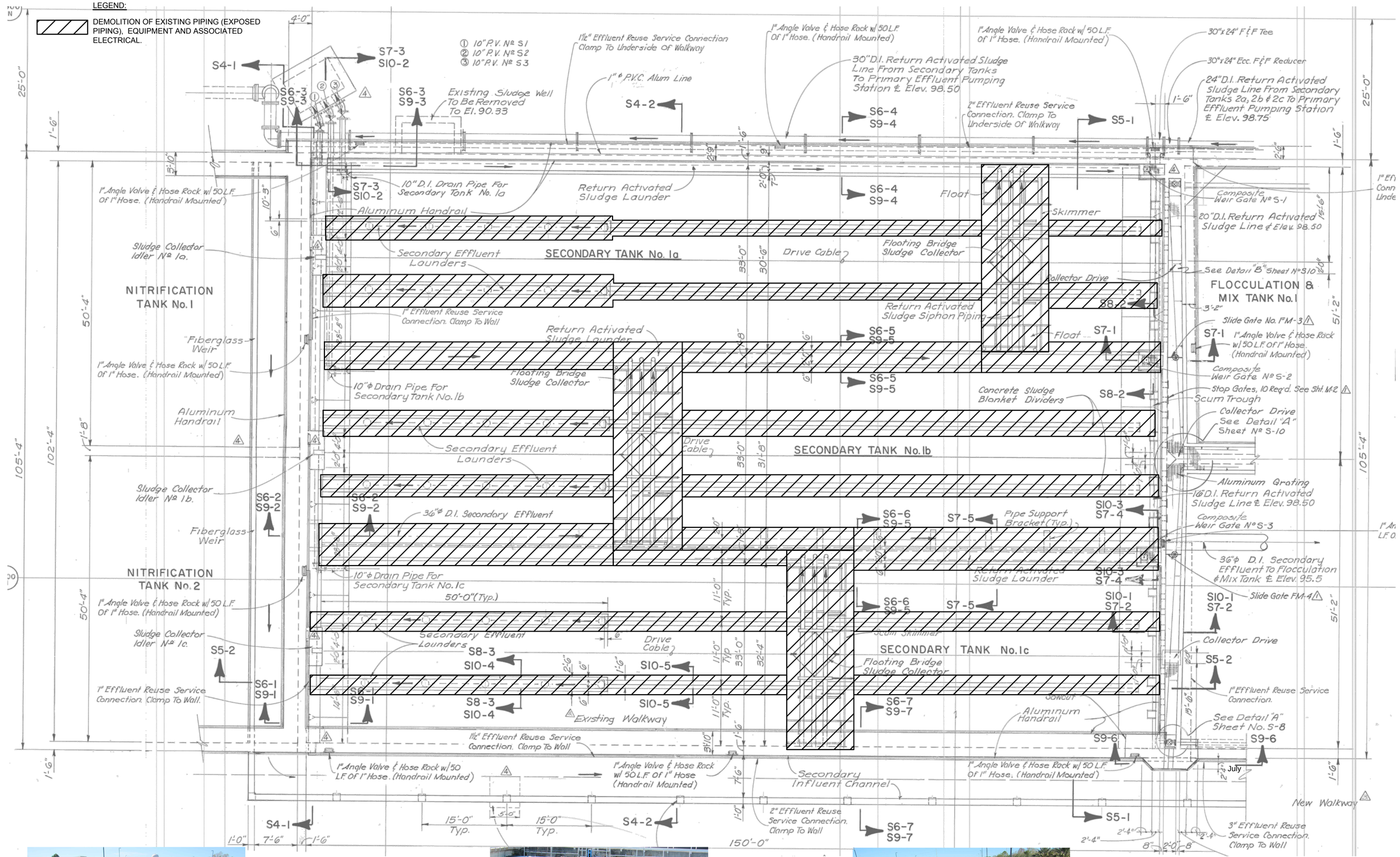
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FIG. 3-8

PLOT DATE: Mar 13, 2017 - 1:59pm
FILE NAME: C:\Users\gonz139\Appdata\Roaming\Autodesk\C3D\Acad-Default_13872\10_Process Flow diagram-PPDR-PHASE II FINAL.dwg

LEGEND:

DEMOLITION OF EXISTING PIPING (EXPOSED PIPING), EQUIPMENT AND ASSOCIATED ELECTRICAL.





SECONDARY CLARIFIER 1c (2a, 2b, 2c SIMILAR)



SECONDARY CLARIFIER 1c LOOKING WEST
EFFLUENT LAUNDER BLOW-UP (2a, 2b, 2c SIMILAR)



SECONDARY CLARIFIER 1c LOOKING EAST
FLOATING BRIDGE SLUDGE COLLECTOR BLOW-UP (2a, 2b, 2c SIMILAR)

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CLIENT: CITY OF ALTAMONTE SPRINGS

PROJECT: REGIONAL WATER RECLAMATION FACILITY

SHEET TITLE: SECONDARY CLARIFIERS NO. 1 a, 1 b and 1 c DEMOLITION PLAN- PHASE II

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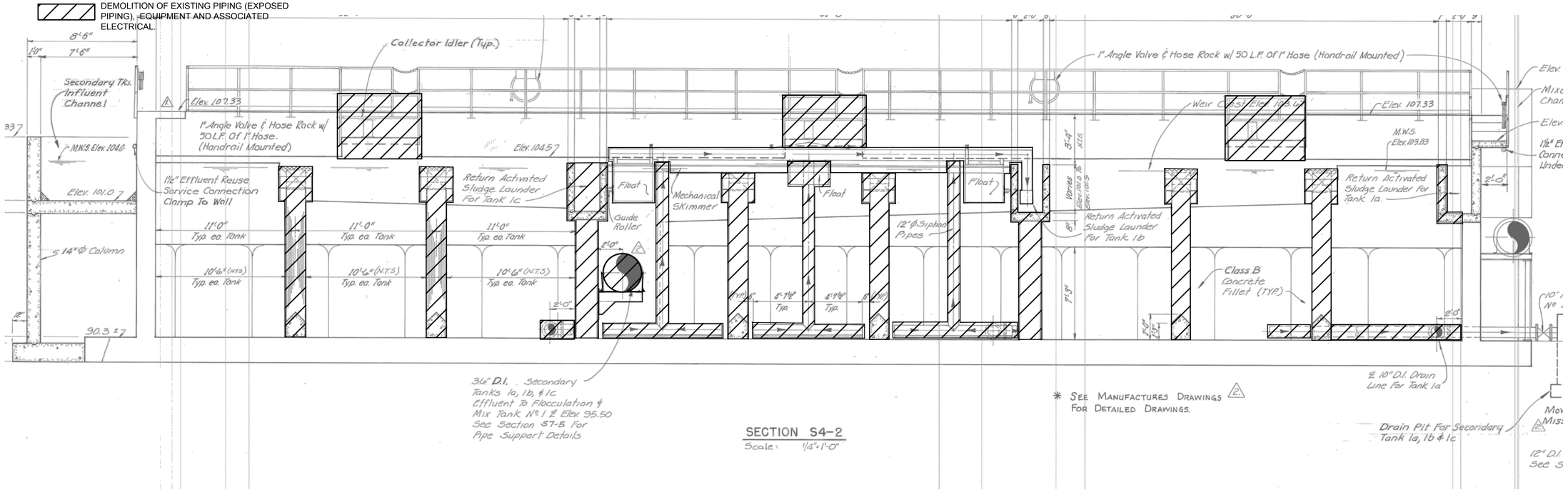
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FIG. 3.-9

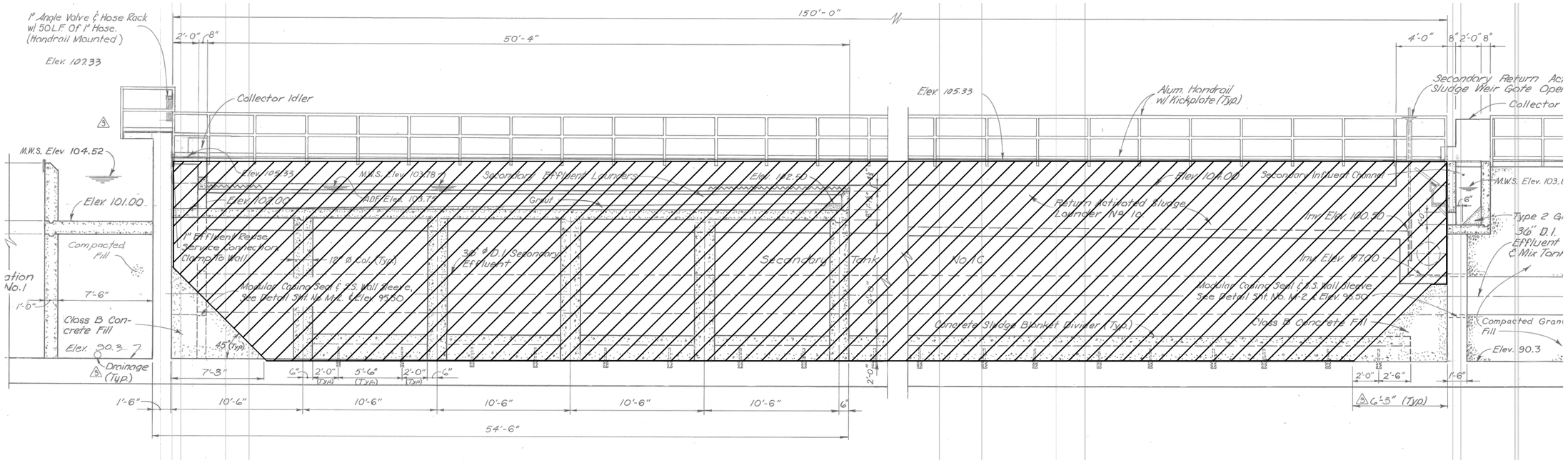
PLOT DATE: Mar 13, 2017 - 2:03pm
FILE NAME: C:\Users\grace.r.hill\Hoppstad\Local\Temp\AcPublish_13972\05_Existing Secondary Clarifier Tank No. 1a 1b 1c_Demolition plan_Phase II.dwg

LEGEND:

DEMOLITION OF EXISTING PIPING (EXPOSED PIPING), EQUIPMENT AND ASSOCIATED ELECTRICAL.



SECTION S4-2
Scale: 1/4"=1'-0"



PLOT DATE: Mar 13, 2017 - 2:09pm
FILENAME: C:\Users\grace.chi\Desktop\Section\temp\Ad-Out\sec_1397206_Existing Secondary Clarifier Tank No. 1a 1b 1c_sections_Demolition_Phase II.dwg

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SHEET TITLE: SECONDARY CLARIFIERS 1a 1b 1c SECTIONS-DEMOLITION PHASE II

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FIG. 3-10

NORTH

0 40 80

GRAPHIC SCALE
SCALE: 1" = 40'-0"

AUTOMATIC ACCESS CONTROL GATE

EFFLUENT HOLDING TANK

RECLAIMED WATER STORAGE TANK

RECLAIMED WATER STORAGE TANK

REUSE PUMP AND OFFICE BUILDING

LAB

MAINTENANCE BUILDING

STORAGE SHED

STORAGE SHED

SUBMERSIBLE INFLUENT PUMP STATION AND FINE MECHANICAL SCREENS

NEUTRALIZATION TANK

RAW SEWAGE INFLUENT STRUCTURE

VACTOR DUMP STATION

NEUTRALIZATION BUILDING

EFFLUENT METERING WEIR

CHLORINE CONTACT TANK

PLANT WATER PUMPING STRUCTURE

REAERATION TANKS

AEROBIC DIGESTION TANKS

ODOR CONTROL

COVERED PARKING

ASPHALT

WAREHOUSE

COVERED STORAGE

DPR AND HYPOCHLORITE BUILDING

FILTER BACKWASH HOLDING TANK

FILTERS

SLUDGE HANDLING BUILDING

SLUDGE THICKENING TANK NO. 1

SLUDGE THICKENING TANK NO. 2

PORTABLE BUILDING

FUEL/TANK

COVERED STORAGE

AUTOMATIC ACCESS CONTROL GATE

GENERATOR AND POWER DISTRIBUTION BUILDING

HEADCELL (GRIT REMOVAL)

RELOCATED CHEMICAL HANDLING FACILITY

BLOWER BUILDING

RAS PUMP STATION

EQUIPMENT STORAGE BUILDING

OPERATIONS BUILDING

RE-AERATION TANKS

FLOW SPLITTER BOX

SLUDGE COLLECTION BOX

SECONDARY CLARIFIER NO. 1

SECONDARY CLARIFIER NO. 3

SECONDARY CLARIFIER NO. 2

SECONDARY CLARIFIER NO. 4

ANOXIC TANK NO. 1

NITRIFICATION TANK NO. 1

SECOND ANOXIC TANK NO. 1

ANOXIC TANK NO. 2

NITRIFICATION TANK NO. 2

SECOND ANOXIC TANK NO. 2

COVERED CONCRETE

KELLER RD

GATEWAY DR

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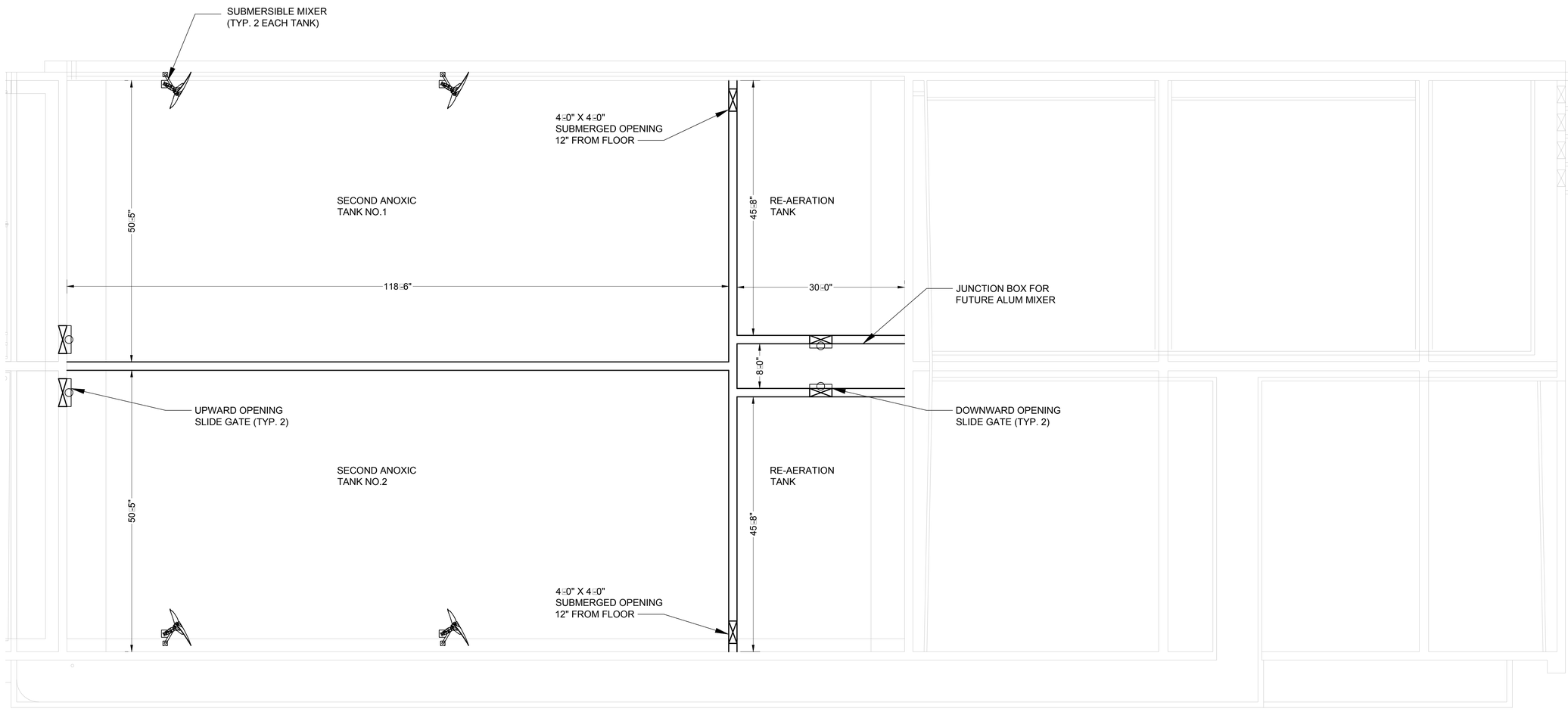
SHEET TITLE: PROPOSED OVERALL SITE PLAN- PHASE II-FINAL

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FIG. 3-11

PLOT DATE: Sep 28, 2017 - 1:35pm
FILE NAME: c:\Users\gyuri.1991\appdata\local\temp\AcPublish_1508\408_PROPOSED_Phase II_OVERALL_SITE_PLAN-FINAL.dwg



PLOT DATE: Mar 13, 2017 - 2:46pm
FILE NAME: C:\Users\gcox1391\appdata\local\temp\AcPublish_13972\15_Proposed_SECOND ANOXIC Tank Phase II modification.dwg

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SHEET TITLE: PROPOSED PHASE II
SECOND ANOXIC AND RE-AERATION TANK PLAN

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FIG. 3-12

The model application was developed to determine the ability of the biological process for achieving the targeted nutrient removal. It was observed, the total nitrogen values in the secondary effluent predicted by the model slightly exceed the 3 mg/L criteria and total phosphorus effluent criteria of 1 mg/L. The reason for increase in the effluent TN could be variation in the refractory organic nitrogen in the influent and the role of influent BOD in the denitrification of NOx. The observed BOD/TKN ratio is less than the normal. Model simulations were developed to determine the external carbon source dosage to reduce the TN to the effluent goal of 3 mg/L and alum dosage to meet effluent TP goal of 1 mg/L as presented in Table 3-2.

Table 3-2 summarizes the predicted performance of 4-stage Bardenpho Process configuration at 20 and 30 ℃ including necessary addition of external Carbon source and Alum.

Table 3-2 Model Predicted Performance – Phase II

Process Parameters	20℃	30℃
Influent Flow (mgd) (two trains), Q	12.00	12.00
MLSS (mg/L)	3,420	3,500
IR (mgd), 4.5Q	54.00	54.00
SRT (days)	7.80	8.49
RAS (mgd)	8.40	8.40
WAS (mgd)	0.74	0.68
VSS/TSS	0.67	0.64
Yield (lb TSS/lb BOD)	0.903	0.846
Anoxic Volume (MG)	0.67	0.67
Aeration Volume (MG)	1.52	1.52
Post-Anoxic Volume (MG)	0.60	0.60
Re-Aeration Volume (MG)	0.10	0.10
Effluent NH3 (mg N/L)	0.41	0.19
Effluent NO3 (mg N/L)	0.55	0.86
Effluent NO2 (mg N/L)	0.16	0.05
Effluent TKN (mg N/L)	1.77	1.54
Effluent TN (mg N/L)	2.84	2.80
Effluent TP (mg P/L)	0.54	0.77
Effluent BOD (mg/L)	<5	<5
Effluent TSS (mg/L)	6.77	6.86
Methanol dosage to reduce TN to <3 mg/L (gpd)	104	94
Alum (metal) dosage to reduce TP to <1 mg/L (gpd)	280	304

The storage volume for 30-day feed requirement will require about 3120-gallon storage tank for methanol and 9,120-gallon storage tank for alum. Neat methanol is stored in the tank which can be diluted to 20% using dilution water pumps to the feed point. Alternative carbon sources such as MicroC® will also be considered to mitigate safety concerns.

The reactor configuration developed for treating 12.0 mgd average daily flow was simulated at 12.5 mgd average daily flow. Based the model output, following are the findings:

- The airflow predicted in Aeration Zone -1 and Aeration Zone-2 was high to accommodate the additional BOD loading due to flow increase.
- The effluent total nitrogen was less than 4 mg/L, which can be removed by supplemental carbon source addition.
- Alum is required to meet the effluent TP criteria of 1 mg/L.

4. Hydraulic Profile

The hydraulic profile throughout the liquid process treatment unit processes was developed. A detailed hydraulic profile showing the water surface elevation at the peak influent flow is shown if Figures 4-1 through 4-3.

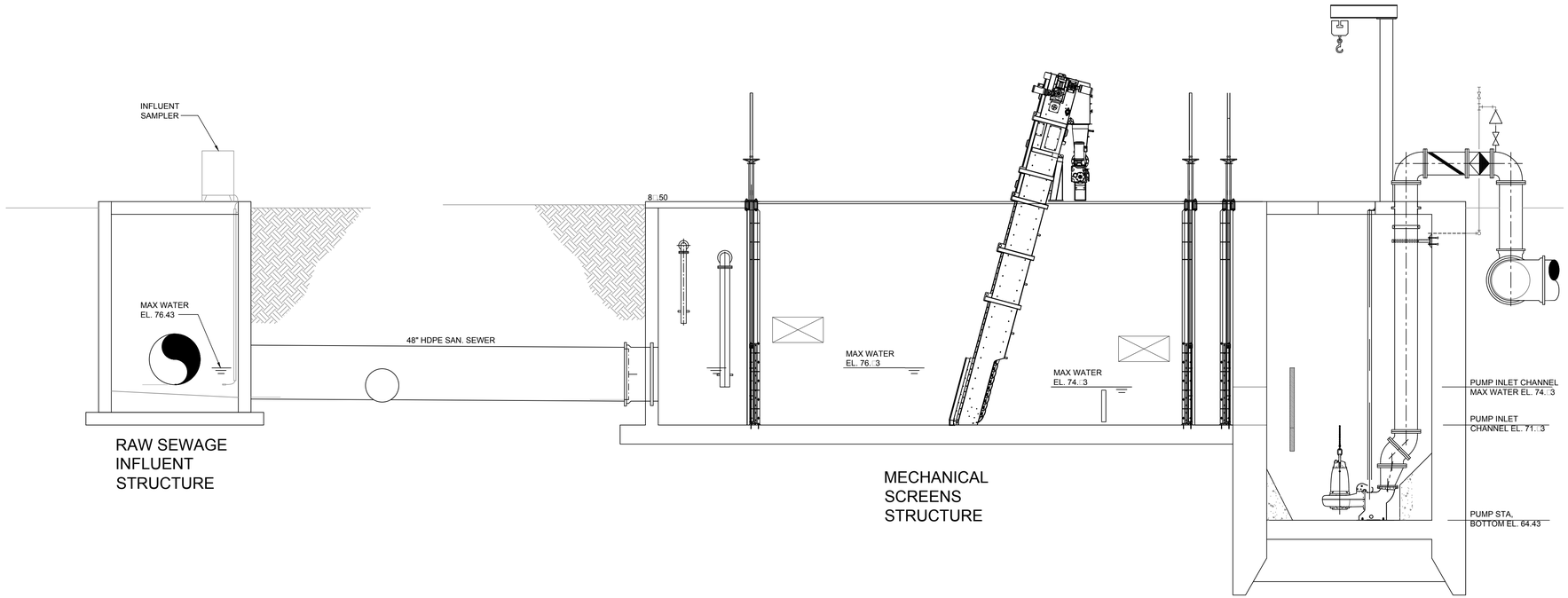


FIG. 4-1

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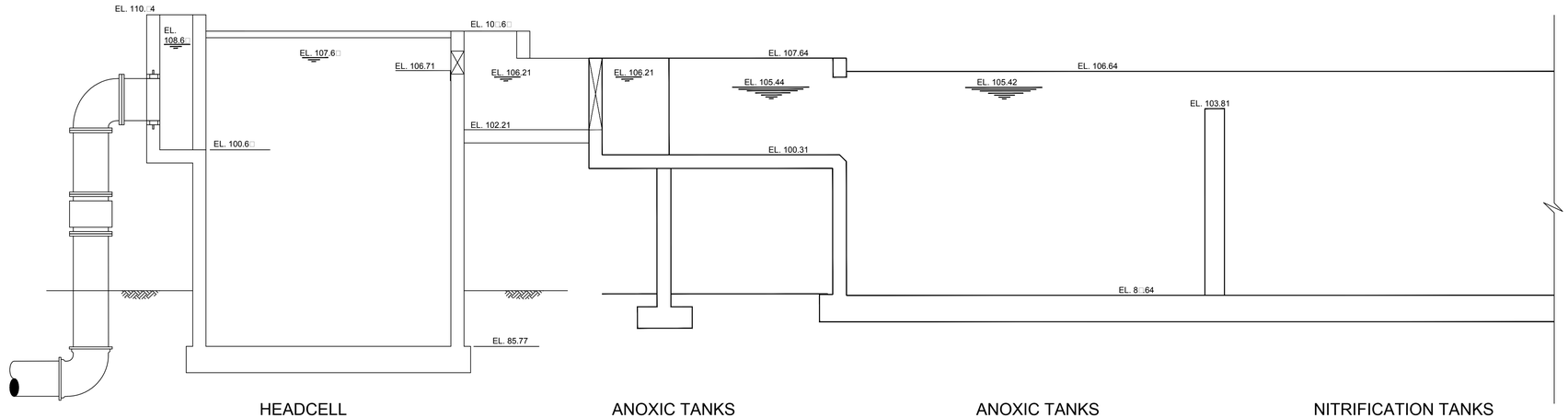
SHEET TITLE: PROCESS HYDRAULIC PROFILE- SHEET 1

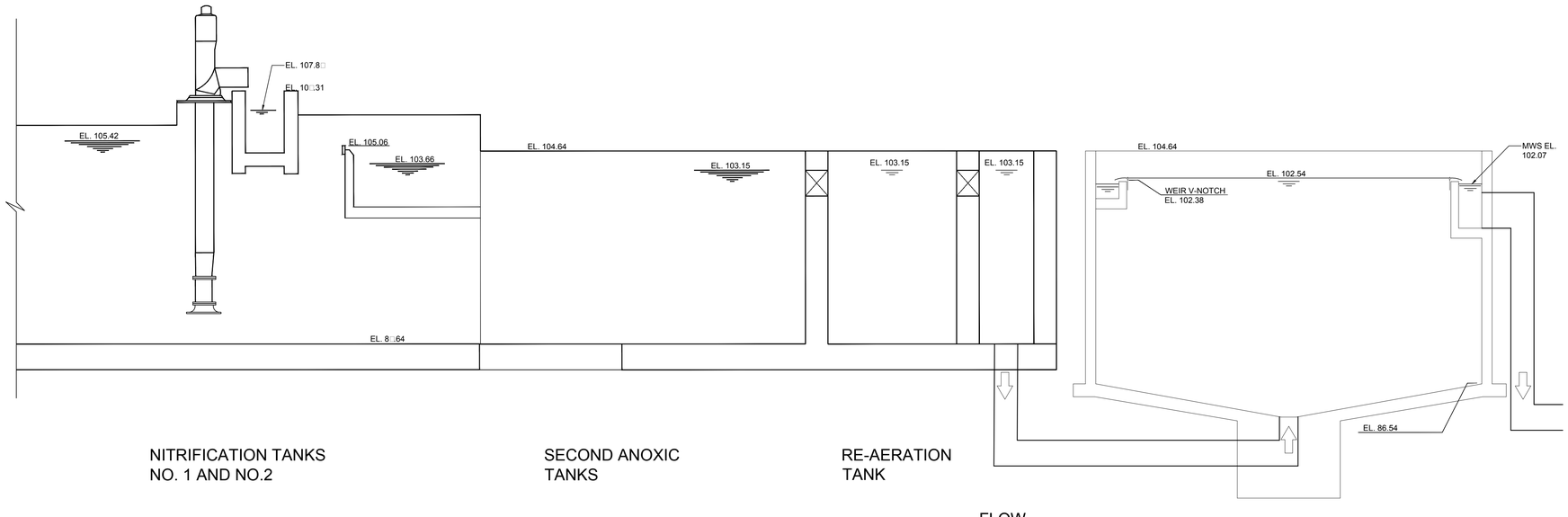
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115 110 105 100 □5 □0 85 80

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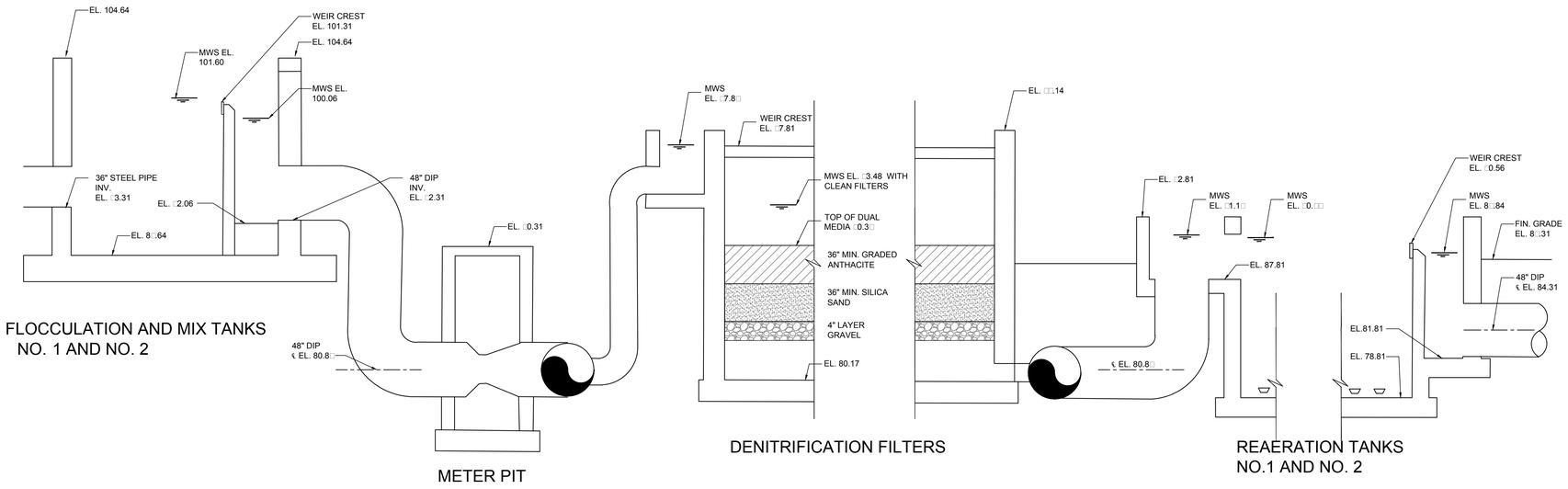
SHEET TITLE: PROPOSED PROCESS HYDRAULIC PROFILE-SHEET 2

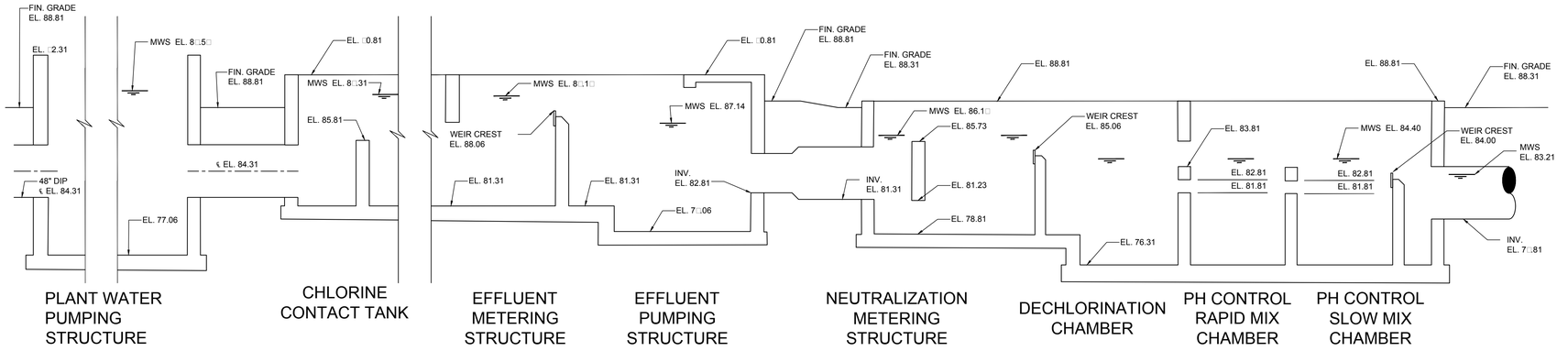
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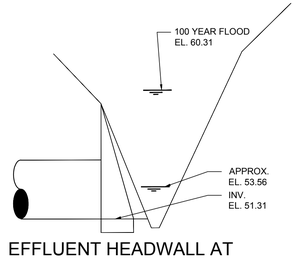
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FIG. 4-2

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EFFLUENT HEADWALL AT
LITTLE WEKIVA RIVER

PLOT DATE: Mar 08, 2017 - 6:17pm
FILE NAME: U:\WO\Projects\City of Altamonte Springs\ASR\WF Plant Expansion\15_Plant\Design\13_Proposed_Process Hydraulic Profile.dwg

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SHEET TITLE: PROCESS HYDRAULIC PROFILE-SHEET 3

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FIG. 4-3

5. Cost Opinion

A preliminary opinion of probable construction cost for the improvements to the aeration tanks to convert the existing MLE process configuration to a 4-stage Bardenpho process configuration for both Phase 1 (8.5 mgd) and Phase 2 (10.27 mgd) is presented in Tables 5-1 and 5-2. The estimate is based on budgetary vendor quotations for equipment and engineering judgement from experience on similar projects for unit prices. Costs are in 2017 dollars and carry a 20 percent contingency consistent with the level of detail available at this stage of project development.

Table 5-1 Preliminary Opinion of Probable Construction Cost – Phase I

Item	Cost
General Requirements	
Mobilization, Demobilization, Environmental	$200,000
New Clarifiers	
Demolition of Existing Clarifier 2a, 2b, and 2c Equipment and Structures	$150,000
2-New 90-ft diameter clarifiers	$2,200,000
Channel Modification and Clarifiers Splitter Box with gates	$150,000
Sludge Collection Box and telescoping valves	$100,000
Influent, effluent and RAS Piping, Valves, and Appurtenances	$500,000
Nitrification Tanks Modifications	
Baffle walls, walk way and rails for both tanks	$150,000
Internal Recirculation Pumps Suction modifications	$150,000
Chemical Feed System Relocation	
Chemical Feed System Relocation	$250,000
Miscellaneous	
Site Work	$100,000.00
Subtotal	$3,950,000
Contractor's overhead, profit, insurance @ 15%	$592,500
Subtotal	$4,542,500
Contingencies @ 20%	$913,000
Total Preliminary Construction Cost Opinion	**$5,455,500**

Table 5-2 Preliminary Opinion of Probable Construction Cost – Phase II

Item	Cost
General Requirements	
Mobilization, Demobilization, Environmental	$150,000
New Clarifiers	
Demolition of Existing Clarifier 1a, 1b, and 1c Equipment and Structures	$100,000
2-New 90-ft diameter clarifiers	$2,200,000
Influent, effluent and RAS Piping, Valves, and Appurtenances	$250,000
Nitrification Tanks Modifications	
Reinstallation of diffusers etc. removed in Phase I	$25,000
Internal Recirculation Pumps Suction pipe removal	$25,000
Clarifiers 1a, 1b and 1c Conversion to 2nd Anoxic and reaeration tanks	
2nd Anoxic tank wall, walkway etc.	$350,000
Existing tanks rehab and coatings	$500,000
Miscellaneous	
Site Work	$50,000
Subtotal	$3,650,000
Contractor's overhead, profit, insurance @ 15%	$547,500
Subtotal	$4,197,500
Contingencies @ 20%	$844,000
Total Preliminary Construction Cost Opinion	**$5,041,500**

Appendices

Appendix A. Technical Memorandum ASRWRF – Process Evaluation

Technical Memorandum

To:	Raj Singh, PE		
From:	Karthik Manchala, PE, PMP	**Email:**	Karthik.manchala@atkinsglobal.com
Phone:	301-210-6800	**Date:**	11-10-2014
Ref:	100040698	**cc:**	City of Altamonte Springs
Subject:	Altamonte Springs Regional Water Reclamation Facility – Process Evaluation		

1.1. Background

The Altamonte Springs Regional Water Reclamation Facility (ASRWRF) has a permitted wastewater treatment capacity of 12.5 million gallons per day (mgd) annual average daily flow (AADF). Existing treatment uses a Modified Ludzack Ettinger (MLE) process configuration (two-stage process; anoxic-denitrification/aerobic-nitrification), followed by secondary clarification, flocculation, denitrification, filtration, a chemical feed system, post aeration, chlorination, dechlorination/ neutralization. Effluent is beneficially reused for irrigation throughout the City limits.

Currently, the excess reclaimed water that cannot be reused is discharged to the Little Wekiva River (Outfall D-001 to the Little Wekiva River). Permitted River discharge effluent limit are: BOD-5 mg/l; TSS-20 mg/l; Nitrogen, N as nitrate- no max limit (1,092 lbs/yr); and phosphorous, P no max limit (312 lbs/yr). Similarly the reuse and land use application permitted discharge effluent limit are: BOD-20mg/l; TSS-5 mg/L; Nitrogen, N as 10 mg/l; and phosphorous, P no max limit. The City retained Atkins North America Inc. to perform a process evaluation to determine maximum capacity of the plant with existing tankage that will meet 5 mg/l (BOD); 5 mg/l (TSS); 3 mg/l (N); 1 mg/l (P) effluent quality and alternatively develop recommendations for upgrade to meet these effluent limits at a defined minimum flow level.

The purpose of this technical memorandum is to summarize the influent loading design criteria, review the calibrated process model outputs, and to identify potential alternatives for modifying the existing tanks to achieve the effluent quality for advanced treatment, and recommend a cost effective alternative which can reliably treat the wastewater to effluent design criteria.

1.2. Data Collection and Evaluation

A review of the existing information was performed. These documents include:

- *Discharge Monitoring Reports from April 2013 through August 2014.*
- *Special Sampling Data - May 2014 through June 2014.*
- *Altamonte Springs RWRF Aeration System Blower Replacement Project - Contract Documents* (June,2014)
- *Altamonte Springs RWRF Process Blower Evaluation - Technical Memorandum* (July 14,2014)

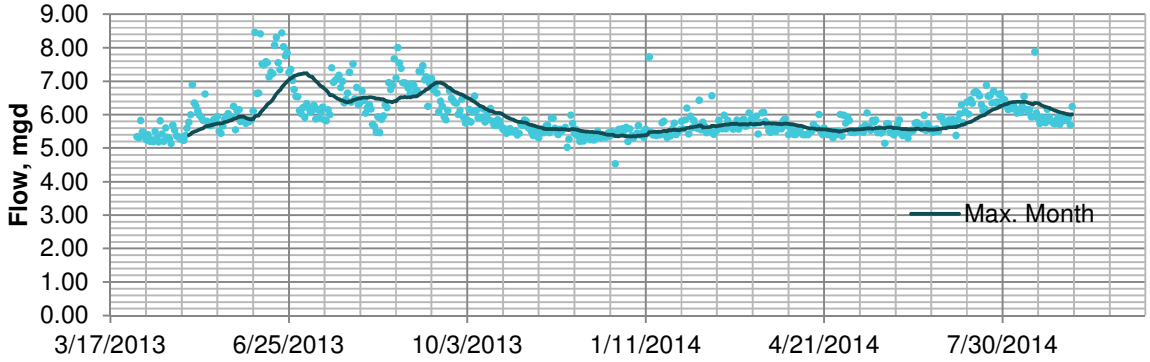
Data evaluation was conducted using moving average plots, which smooths out short-term fluctuations and highlights longer-term trends or cycles while providing an accurate representation of the true maximum month conditions. Hence the values from the plots are influenced by all data points. Likewise the average concentrations are determined by calculating an arithmetic mean of all concentrations within the considered time frame. The observed maximum month load is the maximum value on the 30-day rolling average curve within the considered time period.

1.2.1. Discharge Monitoring Reports Data Evaluation

Data Analysis was performed to identify trends of the raw water influent characteristics, including flow, biochemical oxygen demand (BOD), total suspended solids (TSS), and ammonia, total Kjeldahl nitrogen (TKN), and total phosphorus (TP).

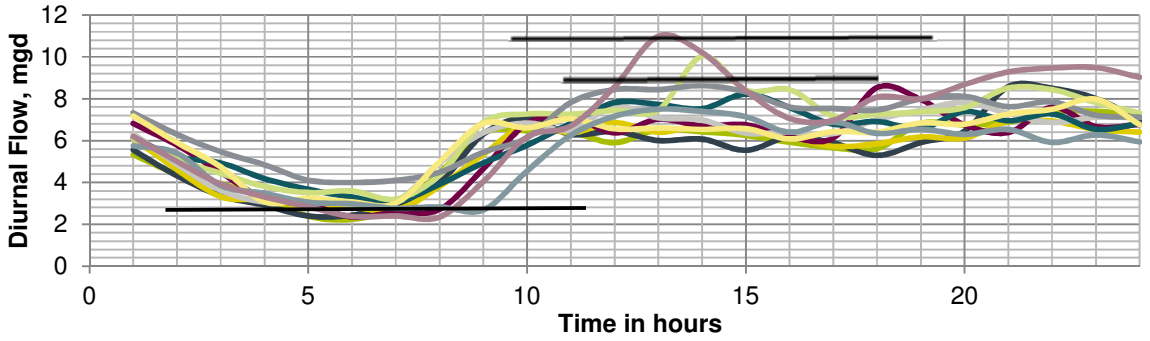
Although the plant is rated for a 12.5 mgd capacity, as shown in Figure 1, current maximum month flow is about 6.4 mgd. The average influent flow is about 5.9 mgd.

Figure 1. Raw Influent Flow



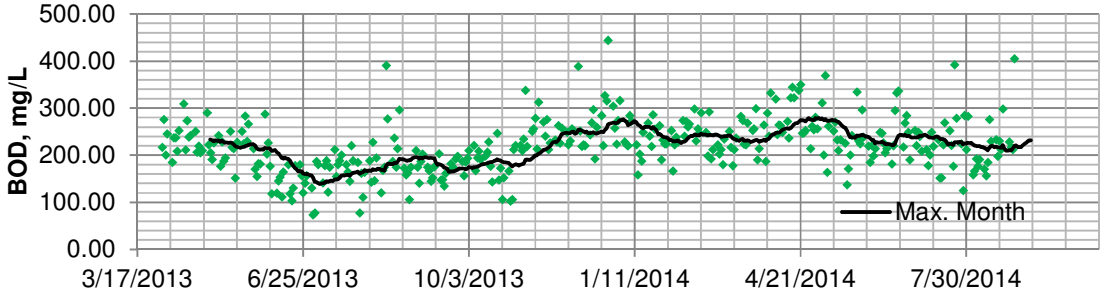
The diurnal flow variation was considered for time period of May 2013 through May 2014, to identify a potential impact of influent flow to the process reactors, as shown in Figure 2, the diurnal flow varied from 2 mgd to 11 mgd. It can be observed that maximum diurnal flow is about 8 mgd on a frequent basis.

Figure 2. Raw Influent Flow Diurnal Curve



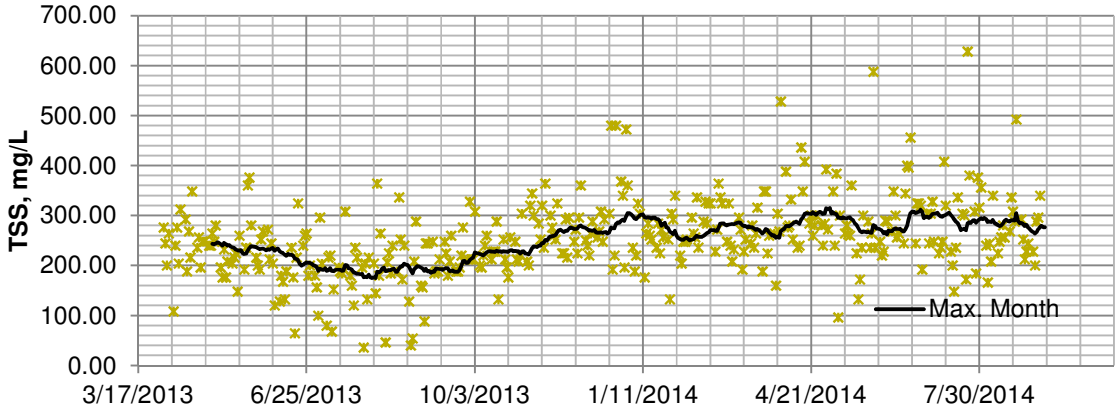
The raw influent BOD was consistent over the considered time frame of April 2013 through August 2014, as shown in Figure 3; the maximum month concentration is about 275 mg/L. The average BOD is about 220 mg/L. There is an increase in average BOD from 2013 to 2014, the average BOD in 2013 was about 210 mg/l whereas average BOD in 2014 was about 240 mg/L. The reason for such an increase is to be investigated further as the higher BOD will potentially enhance the plant performance by providing additional substrate for more efficient denitrification.

Figure 3. Raw Influent BOD



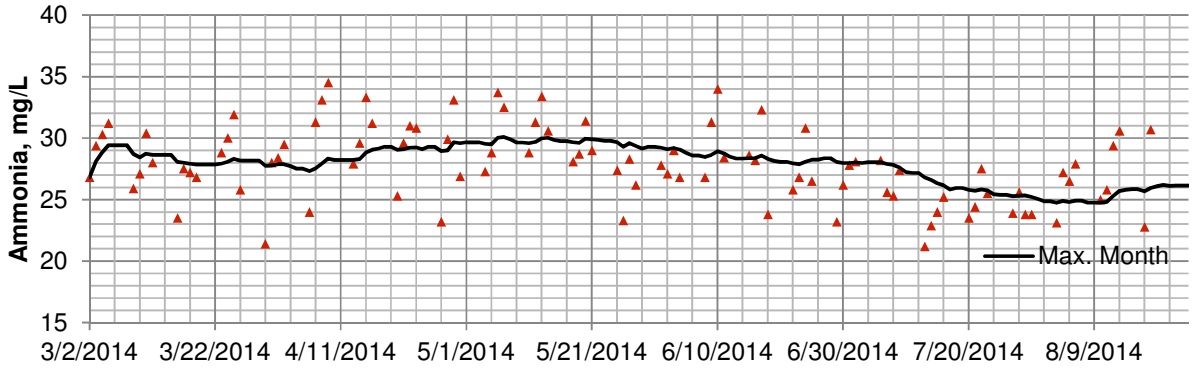
The raw influent TSS was consistent over the considered time frame of April 2013 through August 2014, as shown in Figure 4, the maximum month TSS is about 300 mg/L. The average TSS is about 253 mg/L. There is an increase in average TSS from 2013 to 2014, the average TSS in 2013 was about 227 mg/l where as average BOD in 2014 was about 281 mg/L. The reason for such an increase is to be investigated further.

Figure 4. Raw Influent TSS



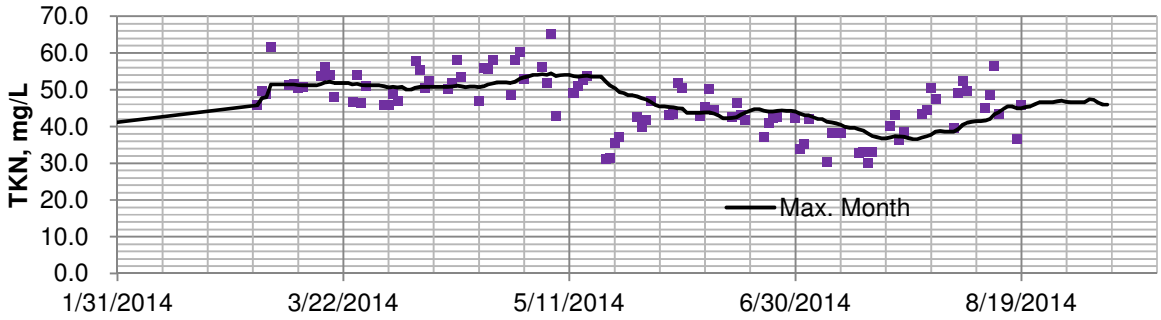
The raw influent ammonia was consistent over the considered time frame of March 2014 through August 2014, as shown in Figure 5; the maximum month ammonia is 30 mg/L. The average ammonia is about 28 mg/L. The influent ammonia has a direct correlation to the effluent nitrogen levels and the level of treatment required., The sampling for this parameter has been included recently in year 2014.

Figure 5. Raw Influent Ammonia



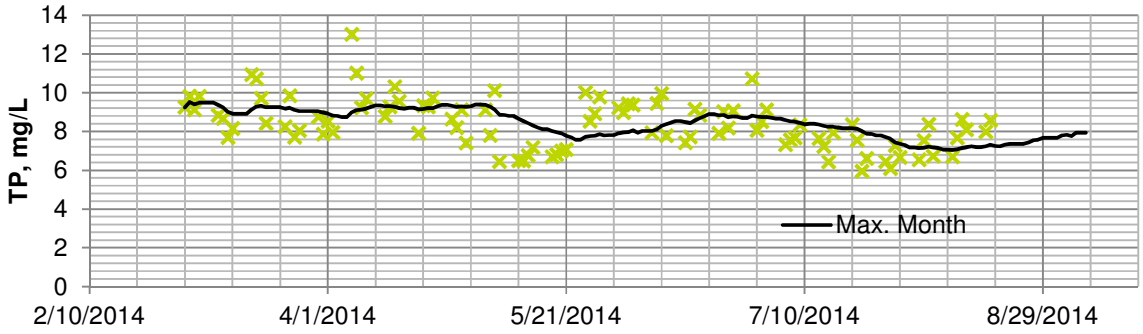
The raw influent TKN over the considered time frame of March 2014 through August 2014 is shown in Figure 5; the maximum month TKN is 52 mg/L. The average TKN is about 46 mg/L. Although there is slight decrease in influent TKN during July 2014, the maximum month TKN observed during April 2014 is considered for the design criteria. The sampling for this parameter has been included recently in year 2014.

Figure 6. Raw Influent TKN



The raw influent TP over the considered time frame of March 2014 through August 2014 is shown in Figure 5; the maximum month TP is 9.6 mg/L. The average TP is about 8.4 mg/L. Although there is slight decrease in influent TP during May and July 2014, the maximum month TP observed during March 2014 is considered for the design criteria. The sampling for this parameter has been included recently in year 2014.

Figure 7. Raw Influent TP



1.3. Design Criteria

Based on the data evaluation, the average and maximum month values for different influent characteristics were determined, Table 1 summarizes the recommended design criteria for the ASRWRF. It is assumed that the hydraulic peak and concentration peak do not occur simultaneously, therefore, average flow with a maximum month concentration was used to determine the maximum month loading.

Table 1. Recommended Design Criteria for Altamonte Springs RWRF

Influent Parameter	Units	Average (AD)	Max. Month (MM)	Peaking Factor (MM/AD)
Flow	mgd	5.93	6.4	1.08
BOD	lb/d	**10,880**	**13,600**	
	mg/L	220	275	1.25
TSS	lb/d	**12,512**	**14,889**	
	mg/L	253	300	1.19
NH_3	lb/d	**1,375**	**1,485**	
	mg/L	27.8	30	1.08
TKN	lb/d	**2,295**	**2,570**	
	mg/L	46.4	52	1.12
TP	lb/d	**415**	**473**	
	mg/L	8.4	9.6	1.14

The above design criteria will be used to calibrate the existing MLE process reactors, and setup process models for proposed alternatives using BioWin 3 process modeling software.

1.3.1. Reactor Operating Conditions

The wastewater temperature and the mixed liquor concentration in the reactor is critical to the reactor performance, Figures 8 and 9 show the temperature and mixed liquor concentration in year 2014. The temperature varied from 23℃ to 30℃, with an average of 28℃. It is noted the temperature recording during September 2013? through January 2014 is not available which are typically the cold months. The mixed liquor concentration in the reactor varied from 2,500 mg/L to 5,000 mg/L with an average of 3,136 mg/L. Based on the observed data and discussion with the plant operations, the design criterion for temperature is selected to be minimum of 20℃ and maximum of 30℃. The design criteria for the operating mixed liquor concentration will be 3,200 mg/L.

Figure 8. Wastewater Temperature

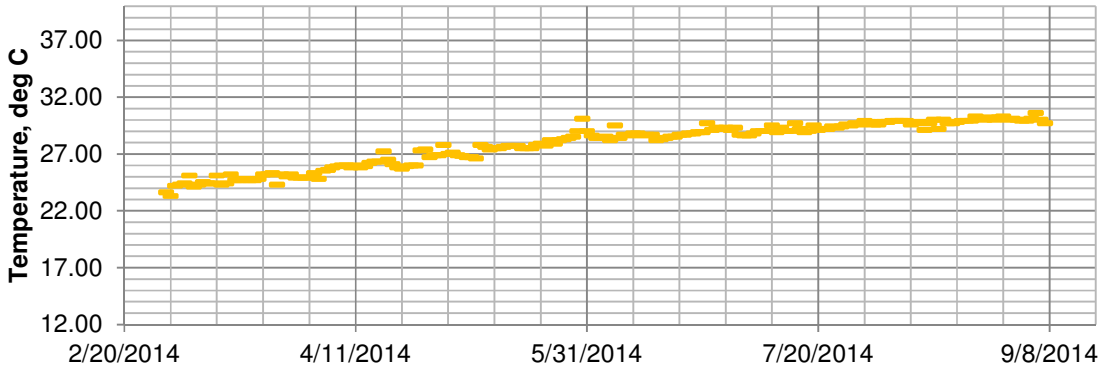
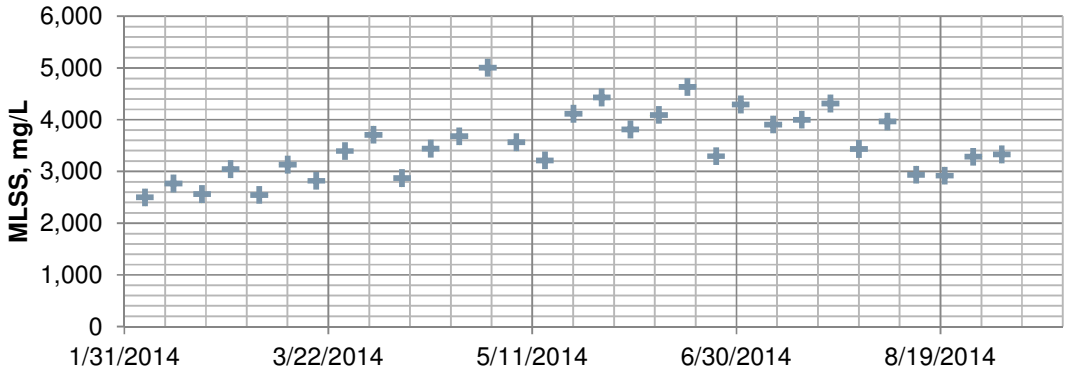


Figure 9. Reactor Mixed Liquor Concentration



1.4. Process Evaluation

The goal of the Process Modeling is to develop a calibrated model of the existing process configuration and identify the modifications required to achieve enhanced nutrient removal. As the effluent total nitrogen from the DMRs is about 8 mg/L there is a need to reduce effluent Nitrate & Nitrite to about 2 mg/L to achieve the effluent limit of TN 3 mg/L. To achieve additional denitrification post- anoxic zone is required, this can be achieved by modifying the existing MLE process configuration to a 4-stage Bardenpho or a 5-stage Bardenpho process. Other process configurations like anoxic step feed process, modified University Cape town (MUCT) process, and Johannesburg (JHB) process could be considered but will result in either adding more internal recirculation streams or significant change to the raw influent feed point to the reactor.

Process modeling was completed to evaluate the projected performance of the two process alternatives, based on the design criteria established. An industry-accepted biological process modeling software, BioWin 3, was used to model both the existing process and the proposed alternatives. The process modelling analysis included the following steps:

- Configuration of model to existing treatment process
- Calibrattion of the model using data from discharge monitoring reports of the existing treatment process
- Development of models for each recommended process alternative.

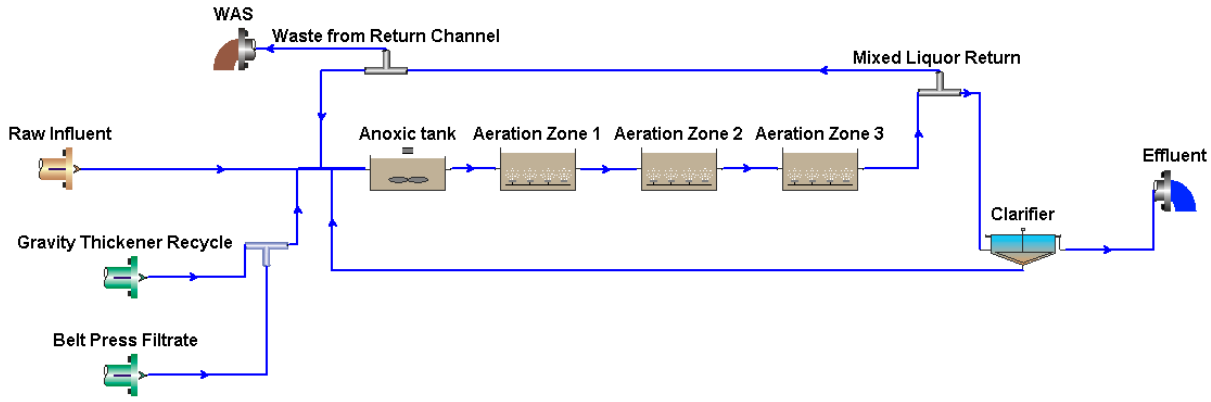
1.4.1. Model Configuration

As stated above, the MLE process is currently in use at the ASRWRF. The existing reactor was modelled based on the existing structural dimensions and operational conditions/parameters as follows:

- **Anoxic Tank-** 100’ (L) X 50.33’ (W) X15.83’ (D); 0.59 million gallons (MG)
- **Nitrification Tank-** 257.5’ (L) X 50.33’ (W) X15.83’ (D); 1.53 MG
- For the purposes of the aeration control each Nitrification Tank is divided into three (3) equal size zones (0.51 MG) equipped with diffused aeration equipment.
  - Aeration Zone 1 - 2,707 diffusers
  - Aeration Zone 2 - 1,643 diffusers
  - Aeration Zone 3 - 1,098 diffusers
- The plant recycles from the Gravity Thickener and Belt Filter Press.
- Returned Activated Sludge from the Clarifier is estimated at about 6 mgd (1Q).
- The nitrated mixed liquor is estimated at about 24 mgd (4Q)

A Schematic of the existing MLE process reactor configuration is presented in Figure 10 below.

Figure 10. Schematic of Existing MLE Process Configuration at Altamonte Springs RWRF



1.4.2. Model Calibration

Calibration was performed using the historical data from the discharge monitoring reports, Type II Calibration efforts as specified in WERF Report - Methods for Wastewater Characterization of Activated Sludge Modeling were used. The following approach was used to calibrate the model to match existing performance:

- Establish design criteria based on historical data
- Undertake additional sampling to identify the influent COD and VSS
- Adjust the influent and kinetic parameters in the to match field observations

BioWin model uses COD as the measure of organic carbon. This is the industry standard for modeling. The model requires the input of various fractions of COD measured in the influent wastewater. These fractions characterize the influent COD based on whether the COD is biodegradable, how quickly the COD can be oxidized, and whether the COD is soluble or particulate.

1.4.2.1. Design Criteria based on historical Data

The influent design criteria developed in previous section was used for the raw influent obtained based on the historical data from the DMRs as the model input. The Raw Influent Parameters and Plant Recycles from the Gravity Thickener and Belt Filter Press are presented in Tables 2 and 3 respectively.

Table 2. Influent Design Criteria

Raw Influent Parameter	Value	Units
Flow	5.93	mgd
Total Carbonaceous BOD	220	mgO_2/L
Total suspended solids	253	mg TSS/L
Total Kjeldahl Nitrogen	46.4	mg N/L
Total P	8.4	mg P/L
Nitrate N	0	mg N/L
pH	7.3	
Alkalinity	5.1	mmol/L
Calcium	80	mg/L
Magnesium	15	mg/L
Dissolved Oxygen	-	mg/L

Table 3. Recycles

Gravity Thickener Recycle	Value	Units
Flow	0.29	mgd
Total Kjeldahl Nitrogen	3.03	mg N/L
Total P	3.69	mg P/L
Belt Press Filtrate	**Value**	**Units**
Flow	0.09	mgd
Total suspended solids	500	mg TSS/L
Total Kjeldahl Nitrogen	24	mg N/L
Total P	20	mg P/L

1.4.2.2. Additional Sampling

A six-week sampling effort was undertaken to collect data for the model calibration. Grab samples of the raw influent was collected to test the following parameters:

- Chemical Oxygen Demand (COD)
- Volatile suspended solids (VSS)

The Discharge Monitoring Reports do not require any sampling of the chemical oxygen demand and volatile suspended solids; however the influent COD and VSS are required to understand the characterization of the wastewater. An additional sampling protocol was suggested to the City to collect grab samples for over couple of months from May 2014 through June 2014.

Figure 11 shows the VSS data collected through additional sampling. To get a better understanding the composite TSS samples for those particular days were plotted from the discharge monitoring reports. It can be observed that couple of VSS data points are higher than the TSS data points which is not possible, however direct comparison of grab to composite samples cannot be done. Standard deviation of the VSS samples collected is about 59 mg/L, this about 27% of the average value of 223 mg/L, this shows that there is high variability in VSS data collected.

Figure 11. Raw Influent VSS and TSS

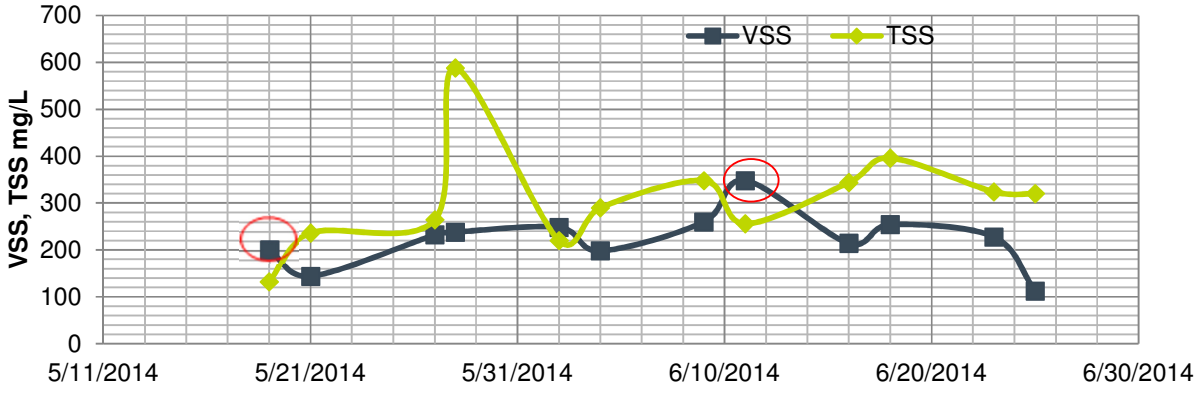
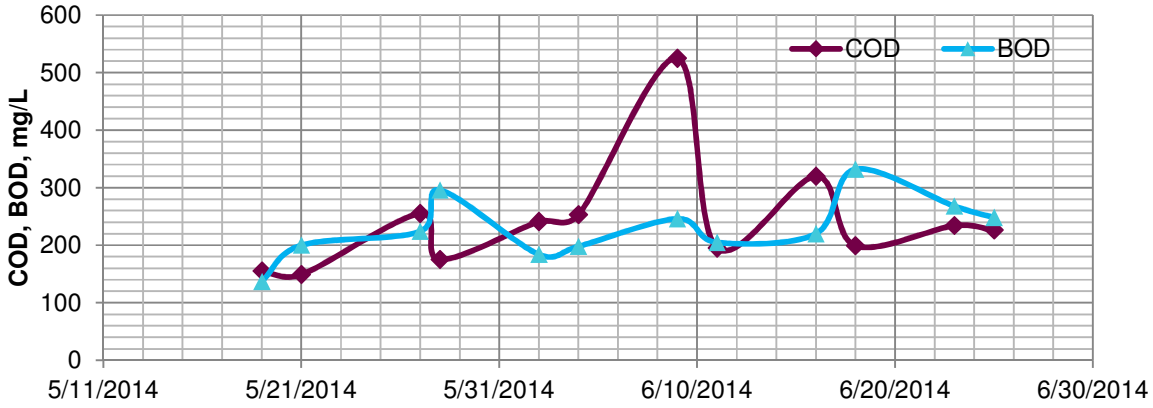


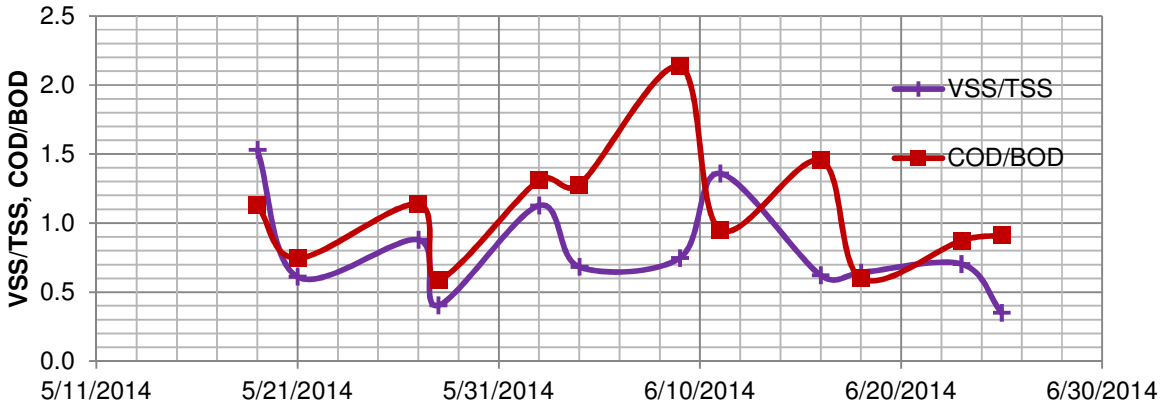
Figure 12 shows the COD data collected through additional sampling. To get a reference the composite BOD samples for those particular days were plotted from the discharge monitoring reports. It can be observed that three COD data points are lower than the BOD data points which is not possible, however direct comparison of grab to composite samples cannot be done. The average COD data points about 244 mg/L with standard deviation of 101 mg/L which is about 41% of the average value, this shows high variability in the COD data collected during additional sampling.

Figure 12. Raw Influent COD and BOD



As the additional COD and VSS data is highly variable, and the standard deviation is greater than 25% of the average, the COD/BOD and VSS/TSS ratios were plotted to compare with typical municipal wastewater. Figure 13 shows high variability of COD/BOD ratios ranging from 0.6 to 2.1; VSS/TSS ratio ranging from 0.4 to 1.5.

Figure 13. VSS/TSS and COD/BOD Ratios



Based on the results from the additional sampling and the discharge monitoring reports, the influent characterization is compared to typical municipal raw wastewater using the ratios of influent pollutant concentrations. Table 4 summarizes the observed and typical ratios. Based on the data, it is reasonable to assume that the COD and VSS is on the higher side of spectrum and therefore based on engineering judgment, and the modified fractions for COD/BOD and VSS/TSS ratios used for the design are 2.1 and 0.85 respectively that were used in the model. The observed BOD/TKN is about 4.74 which is less than the typical range of 4.8 to 5.8. Low BOD/TKN ratio generally indicates substrate limitation for enhanced nitrogen removal treatment. Supplemental carbon is required to meet the effluent nitrogen about 3 mg/L at any temperature.

Table 4. Summary of Influent Characteristics at Altamonte Springs RWRF

Influent Parameter	Observed Value	Typical Range	Design Value
COD/BOD	0.6 - 2.1	1.9 - 2.2	2.1
BOD/TKN	4.74	4.8 - 5.8	4.74
TKN/NH_3	1.67	1.4 - 1.6	1.67
VSS/TSS	0.4 - 1.5	0.75 - 0.85	0.85

1.4.2.3. Adjust the influent and kinetic parameters to match field observations

The next step in the calibration process was to adjust the influent wastewater characterization kinetic parameters of the biological process reactions so that the model results matched performance data from the field. Model projections and field data for secondary effluent quality, solids yield, mixed liquor concentration in the reactor were compared.

Additional sampling on the fractionation of the COD and BOD was not conducted. Typical values were estimated based on the fractionation of total COD and total BOD. A summary of the estimated parameters are presented in Table 5.

Table 5. Summary of Influent Characteristics at Altamonte Springs RWRF

Additional Parameters	Value	Units	Notes
COD	460	mg COD/L	COD/BOD = 2.1
Volatile suspended solids	215	mg VSS/L	VSS/TSS = 0.85
Effluent filtered COD	4	mg COD/L	COD/BOD = 2
Influent filtered COD (GFC)	210	mg COD/L	50% of COD
Influent Flocculated and Filtered COD	180	mg COD/L	45% of COD
Influent Acetate	30	mg COD/L	8% of COD
Influent Ammonia	28	mg N/L	DMR valve
Influent Ortho-phosphate	4	mg P/L	DMR valve
Influent filtered $cBOD_5$	144	mgO_2/L	65% of BOD

In the process of model calibration, the wastewater fractions were modified in an attempt to make the model solids yield and solids retention time to match existing solids yield. Table 6 compares these fractions used in the model calibration with the default model values.

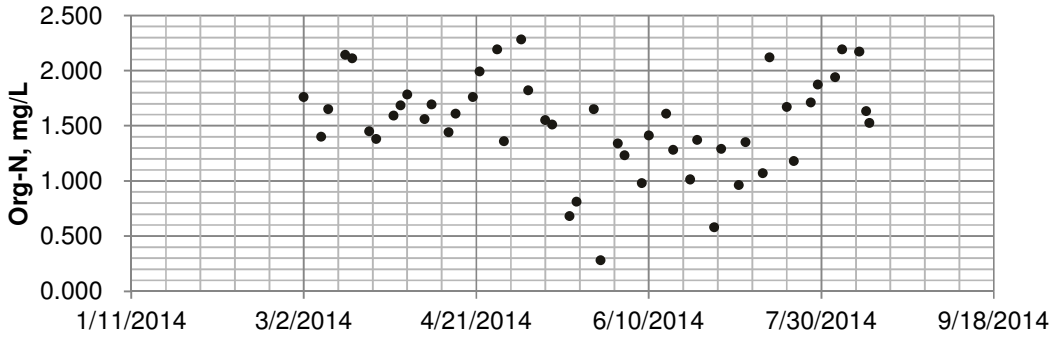
Table 6. Comparison of the Calibrated Model Parameters with Default Model

Wastewater Fractions	Default Model	Calibrated Model
Fbs - Readily biodegradable (including Acetate) [g COD/g of total COD]	0.16	0.20
Fac - Acetate [g COD/g of readily biodegradable COD]	0.15	0.32
Fxsp - Non-colloidal slowly biodegradable [g COD/g of slowly degradable COD]	0.75	0.8474
Fus - Unbiodegradable soluble [g COD/g of total COD]	0.05	0.051
Fup - Unbiodegradable particulate [g COD/g of total COD]	0.13	0.14

No variation of the default kinetic parameters was used except that the ammonification rate was increased from model default value of 0.04 (mg-N/L d)$^{-1}$ to 0.10 (mg-N/L d)$^{-1}$ this was done to align the organic nitrogen in the effluent from the DMR data to the model prediction. As shown in Figure 14, the organic nitrogen

ranged from 0.5 mg/L - 2.3 mg/L, with an average of 1.43 mg/L. It is to be noted that the organic nitrogen in the effluent cannot be reduced by any enhanced nutrient removal improvements, the only other forms of nitrogen which can be reduced in the effluent are the ammonia, and nitrate (including nitrite). To achieve a total nitrogen in the effluent to 3 mg/L, the ammonia and nitrate (including nitrite) should be less than or equal to 2.5 mg/L

Figure 14. Effluent Organic Nitrogen



The operational parameters and effluent quality predicted by the model and observed data matched closely. Tables 7 and 8 present the model predicted operational parameters and secondary effluent quality in comparison to the actual data. The solids residence time calculated includes the mass in the bioreactor and the secondary clarifier.

Thus, the default kinetic parameters and modified ammonification rate were used for the subsequent evaluations. Results from the model, therefore, can be considered predictive of absolute future performance.

Table 7. Model Predicted Process Operational Parameters in Comparison to Actual Data

Operational Parameters	Actual Value	Model Value	Units
WAS Flow	0.316	0.323	mgd
WAS MLSS	3,135	3,161	mg/L
Solids Residence Time	8.38	8.20	days
DO Aeration Zone 1	3.0-5.5	4	mg/L
DO Aeration Zone 2	1.5-4.0	3	mg/L
DO Aeration Zone 3	0.5-2.5	2	mg/L
Temperature	27.8	28	deg. C

Table 8. Model Predicted Secondary Effluent Quality in comparison to Actual (DMR) Data

Effluent Parameter	Units	Actual (DMR) Value			Model Predicted Value
		Avg.	Max.	Min.	
NH_3	mg/L	0.16	0.28	0.10	0.17
ORG-N	mg/L	1.53	2.28	0.28	1.43
TKN	mg/L	1.70	2.86	0.46	1.60
NO_3	mg/L	5.85	7.52	3.87	5.49
NO_2	mg/L	0.12	0.24	0.01	0.05
TN	mg/L	7.66	9.93	5.66	7.54
TP	mg/L	3.77	5.86	1.80	5.43

1.4.3. Process Alternatives

Based on the calibration and validation of the existing MLE configuration, it is inferred that the existing tankage consisting of two (2) trains with a volume of 2.125 MG each can reliably achieve TN concentrations of about 8 mg/L at a rated flow of 11.86 mgd (5.93 mgd through each train). To get an understanding of the effluent at the design rated flow, the existing MLE configuration was operated at 12.5 mgd in both 20 deg C and 30 deg C temperatures.

Figure 15 shows a schematic of the existing process operated at 12.5 mgd with two trains in operation.

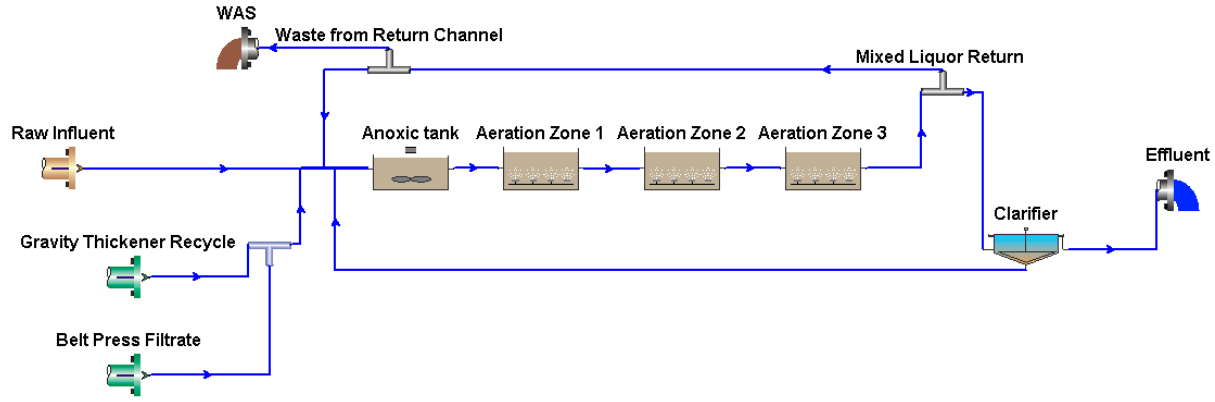


Figure 15. Schematic of Existing MLE Process (12.5 mgd avg. flow two trains in operation)

Table 9 presents the model prediction of the process operational and secondary effluent parameters.

Table 9. Model Predicted Output - 12.5 mgd Average Flow (2 trains in operation)

Operational/Effluent Parameters	Model Value (20 deg C)	Model Value (30 deg C)	Units
Influent Flow	12.5	12.5	mgd
WAS Flow	0.34	0.34	mgd
WAS MLSS	3,331	3,131	mg/L
Solids Residence Time	7.82	7.82	days
DO Aeration Zone 1	2	2	mg/L
DO Aeration Zone 2	2	2	mg/L
DO Aeration Zone 3	2	2	mg/L
NH_3	0.31	0.17	mg/L
TKN	1.76	1.59	mg/L
NO_3	5.29	5.61	mg/L
NO_2	0.18	0.05	mg/L
TN	7.68	7.67	mg/L
TP	5.18	5.46	mg/L

Based on the results from the Table 9, if no modification to the process reactors is anticipated then use of denitrification filters with supplemental carbon addition and alum addition for phosphorus removal is required to achieve an effluent goal of 5 mg/l (BOD); 5 mg/l (TSS); 3 mg/l (N); 1 mg/l (P).

As the current average flow is about 6 mgd, a simulation was performed with both trains in operation. Table 10 presents the model prediction of the process operational and secondary effluent parameters.

Table 10. Model Predicted Output - 6 mgd Average Flow (2 trains in operation)

Operational/Effluent Parameters	Model Value (20 deg C)	Model Value (30 deg C)	Units
Influent Flow	6	6	mgd
WAS Flow	0.16	0.16	mgd
WAS MLSS	3,147	3,001	mg/L
Solids Residence Time	16.10	16.11	days
DO Aeration Zone 1	2	2	mg/L
DO Aeration Zone 2	2	2	mg/L
DO Aeration Zone 3	2	2	mg/L
NH_3	0.09	0.06	mg/L
TKN	1.66	1.62	mg/L
NO_3	6.14	6.19	mg/L
NO_2	0.02	0.02	mg/L
TN	8.00	7.99	mg/L
TP	5.86	6.06	mg/L

A review of the model results from Table 10 reveals that there is significant aeration volume available at an average flow of 6 mgd (both trains in operation); and there is scope for denitrification within the reactor.

A model simulation was performed to verify if reducing the aeration volume will result in any reduction in effluent total nitrogen. The Aeration Zone 2 was operated as un-aerated without any modifications to any other operational parameters. Figure 16 shows a schematic of existing MLE process with Aeration Zone 2 (Ox-2) operated in un-aerated mode.

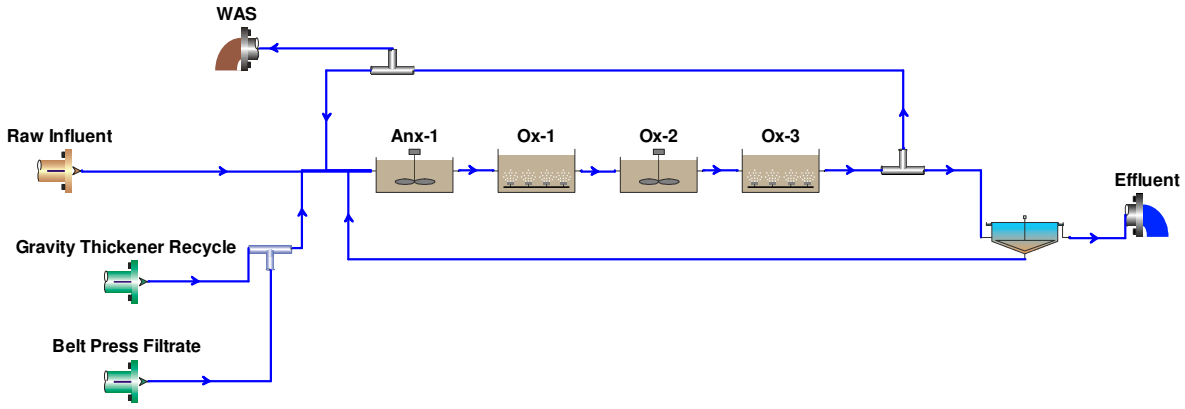


Figure 16. Schematic of Existing MLE Process with Ox-2 turned off (6 mgd avg. flow, 2 trains)

The model predictions show about 2.5 mg/L reduction in total nitrogen, which is attributed to the denitrification in the Aeration Zone 2 (Ox-2). Table 11 summarizes the model output for the simulation of 6 mgd average flow with both trains in operation and Ox-2 operated as un-aerated zone.

Table 11. Model Predicted Output - 6 mgd Avg. Flow (2 trains in operation) - Ox-2 turned off

Operational/Effluent Parameters	Model Value (20 deg C)	Model Value (30 deg C)	Units
Influent Flow	6	6	mgd
WAS Flow	0.16	0.16	mgd
WAS MLSS	3,313	3,146	mg/L
Solids Residence Time	16.09	16.10	days

DO Aeration Zone 1	2	2	mg/L
DO Aeration Zone 2	0	0	mg/L
DO Aeration Zone 3	2	2	mg/L
NH_3	0.32	0.09	mg/L
TKN	1.85	1.62	mg/L
NO_3	3.47	3.72	mg/L
NO_2	0.20	0.03	mg/L
TN	5.70	5.55	mg/L
TP	5.00	5.31	mg/L

Based on the results of 6 mgd average flow simulation, it can be observed that optimizing the anoxic/ aeration zones and relocating the internal recirculation feed point can result in further reduction in the total nitrogen to about 3 mg/L, any additional TP in the effluent can be removed using alum addition for chemical precipitation.

In order to achieve the required denitrification to reduce the nitrate and nitrate in the secondary effluent additional anoxic/anaerobic volume is to be provided. Two approaches as listed below, were taken to identify the capacity of the existing reactor and additional volume requirements based on the desired effluent quality:

- De-rating analysis was performed on the existing tanks to a lower flow rather than providing additional tankage (No additional volume).
- Determination of additional reactor volume based on the average flow of 12.5 mgd (both trains in service).

Two process alternatives were identified to achieve the required effluent goal as listed below:

1. 4-stage Bardenpho Process Configuration, enhanced nitrogen removal and phosphorus removal using chemical addition as required.
2. 5-stage Bardenpho Process Configuration, enhanced nitrogen and phosphorus removal.

Preliminary modeling was performed to determine the secondary effluent quality at two design conditions, one at a minimum temperature of 20 deg C and the other at a maximum temperature of 30 deg C. The mixed liquor suspended solids in the reactor was maintained at an average of 3,000 mg/L. The process evaluation for the de-rating analysis was performed using average raw influent flow of 8 mgd.

1.4.3.1. 4-stage Bardenpho Process - Without any Additional Reactor Volume

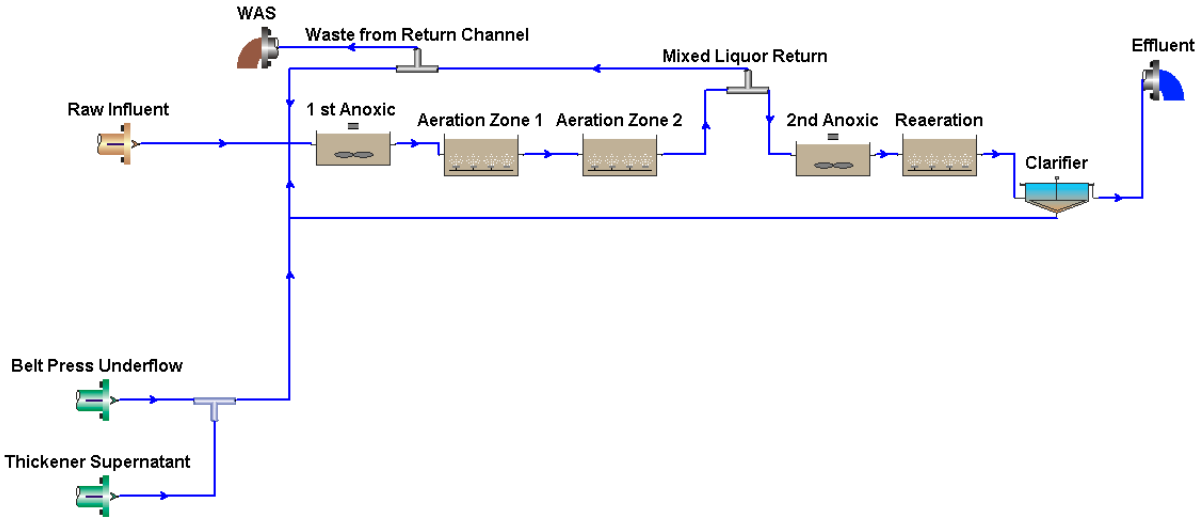
The four-stage Bardenpho process is a single sludge process with a four-stage sequence for nitrogen removal. The process includes dual anoxic and aerobic zones. The second set of anoxic zones would be located in Nitrification Tank using baffles.

The function of each zone is as follows:

- First Anoxic Zone
  - Internal recycle returns activated sludge and nitrates/nitrites to the beginning of the process for denitrification
  - Organic carbon consumed by bacteria converting nitrates and nitrites to nitrogenous gas
- First Aerobic Zone
  - Oxidation of influent organic carbon
  - Nitrification of influent ammonia
- Second Anoxic Zone
  - Endogenous respiration to remove remaining nitrates/nitrites
- Second Aerobic Zone
  - Re-aeration of wastewater prior to discharge to secondary clarifiers

The four stage system would require reconfiguration of the existing aeration system in Nitrification Tank. The configuration of the aeration basins for the 4-stage Bardenpho alternative is shown on Figure 17.

Figure 17. Schematic of 4-stage Bardenpho Process Configuration



The Nitrification tank modifications include incorporation of an anoxic zone with revised aeration zones. Since downstream end of the existing oxic zone would be converted to an anoxic zone, the IR pump would be moved to the point furthest downstream in the oxic zones.

Table 12 summarizes the preliminary runs with 4-stage Bardenpho Process configuration at 20 and 30 deg C.

Table 12. Model Predicted Secondary Effluent Quality - 4 stage Bardenpho Process

Process Parameters	20 deg C	30 deg C
Influent Flow per train (mgd)	4	4
MLSS (mg/L)	3,185	3,125
IR (mgd)	18	18
SRT (days)	11.11	12.02
RAS (mgd)	2.4	2.4
WAS (mgd)	0.24	0.22
VSS/TSS	0.69	0.69
Yield (lb TSS/lb BOD)	0.86	0.80
Anoxic Volume (MG)	0.70	0.72
Aeration Volume (MG)	0.92	0.90
Post Anoxic Volume (MG)	0.43	0.44
Re-aeration Volume (MG)	0.07	0.06
Effluent NH_3 (mg N/L)	0.50	0.20
Effluent NO_3 (mg N/L)	0.51	1.03
Effluent NO_2 (mg N/L)	0.53	0.10
Effluent TKN (mg N/L)	1.89	1.54
Effluent TN (mg N/L)	3.16	2.89
Effluent TP (mg P/L)	2.70	4.60
Effluent BOD, TSS (mg/L)	<5	<5

It can be observed that the total nitrogen value in the secondary effluent slightly exceeds the 3 mg/L criteria at 20 deg C. Based on the effluent nitrite at 20 deg C, it shows that there is indication of simultaneous nitrification and denitrification and moreover that phosphorus uptake is higher, this is attributed to the high

volatile fatty acid portion in the COD. The influent BOD plays a crucial role in the denitrification of NOx. The observed BOD/TKN ratio is less than the normal. In 2013 the influent BOD averaged about 210 mg/L and in 2014 there was an increase to 240 mg/L. A simulation was performed using influent BOD concentration of 240 mg/L, the total nitrogen in the effluent predicted was less than 3 mg/L, therefore further evaluation to confirm the influent BOD value is required. Addition of alum (9.09% pure) of about 534 lb/d (544 gpd) is required to achieve a secondary effluent of 1 mg/L TP.

The operation of a 4-stage Bardenpho process is relatively easy compared to a 5-stage Bardenpho process; however use of oxidation-reduction potential (ORP) sensors and ammonia (NH_4) and nitrate (NO_3) sensors will achieve reliable and repeatable performance is recommended. ORP sensors will be located at the end of the Pre-Anoxic and Aerobic Zones which control the amount of air added there by controlling the nitrification and denitrification. The set-points on the ORP will be revised based on feedback information NH_4 and NO_3 sensors are located at the end of the Aerobic Zone and at the end of Re-Aeration Zone.

1.4.3.1.1. 4-stage Bardenpho Process- With Additional Reactor Volume

The purpose of this model simulation is to determine the required additional reactor volume in a 4-stage Bardenpho Process configuration to treat an average flow of 12.5 mgd. Iterations were done by increasing the anoxic and aerobic volume required to achieve desired effluent total nitrogen. Increase in the anoxic volume was done based on the effluent total nitrogen. The effluent total phosphorus concentration is removed using chemical precipitation using alum. The total reactor volume for each train was determined at 3.14 MG. Each train of the existing MLE reactor is of about 2.13 MG, therefore an additional reactor volume of about 1 MG will be required.

The basis of the reactor sizing is using wastewater temperature of 20 deg C. The required aeration volume at 20 deg C is higher than 30 deg C. A swing zone is created from the aeration zone which can be operated as anoxic zone at (without air) at 30 deg C and as aeration zone at 20 deg C. This will incorporate process operational flexibility and energy savings by reducing the amount of air incorporated into the system.

Table 13 presents the secondary effluent quality at 20 deg C and 30 deg C.

Table 13. Model Predicted Secondary Effluent Quality - 4 stage Bardenpho Process

Process Parameters	20 deg C	30 deg C
Influent Flow per train (mgd)	6.25	6.25
MLSS (mg/L)	3,006	2,984
IR (mgd)	25	25
SRT (days)	10	10.24
RAS (mgd)	5	5
WAS (mgd)	0.37	0.36
VSS/TSS	0.72	0.71
Yield (lb TSS/lb BOD)	0.80	0.77
Anoxic Volume (MG)	0.77	0.77
Aeration Volume (MG)	1.48	1.48*
Post Anoxic Volume (MG)	0.77	0.77
Re-aeration Volume (MG)	0.12	0.12
Effluent NH_3 (mg N/L)	0.39	0.17
Effluent NO_3 (mg N/L)	1.18	0.99
Effluent NO_2 (mg N/L)	0.21	0.08
Effluent TKN (mg N/L)	1.75	1.52
Effluent TN (mg N/L)	3.55	2.99
Effluent TP (mg P/L)	4.86	4.61
Effluent BOD, TSS (mg/L)	<5	<5

** Out of 1.48 MG of aeration volume, 0.24 MG is operated as an anoxic zone.*

Note that the effluent total nitrogen is slightly higher at 20 deg C, in order to drive this to below 3 mg/L supplemental carbon is required as the influent BOD is insufficient to perform additional denitrification at the given temperature. The influent BOD/TKN ratio is lower than the typical value observed in municipal wastewater. Consideration need to be given to add supplemental carbon to the post anoxic zone after evaluating the total number of days the ambient temperature will be around 20 deg C. Addition of alum (9.09% pure) of about 833 lb/d (850 gpd) is required to achieve a secondary effluent of 1 mg/L TP.

The existing primary clarifiers are currently not being used and reusing them to provide additional reactor volume was evaluated. The additional reactor volume is estimated at about 130 ft long anoxic reactor before the existing reactors and about 44 ft long oxic reactor are required. The existing primary clarifiers are shallow (depth varies between 8-ft and 10-ft) compared to the existing reactor and top of the tanks is lower, therefore, additional pumping will required to and from the existing primaries which will result in significant operational costs and they do not provide total additional reactor volumes required for the process . Therefore, the reuse of the existing primary clarifiers for additional reactor volume is not a viable option.

1.4.3.2. 5-stage Bardenpho Process - Without any Additional Reactor Volume

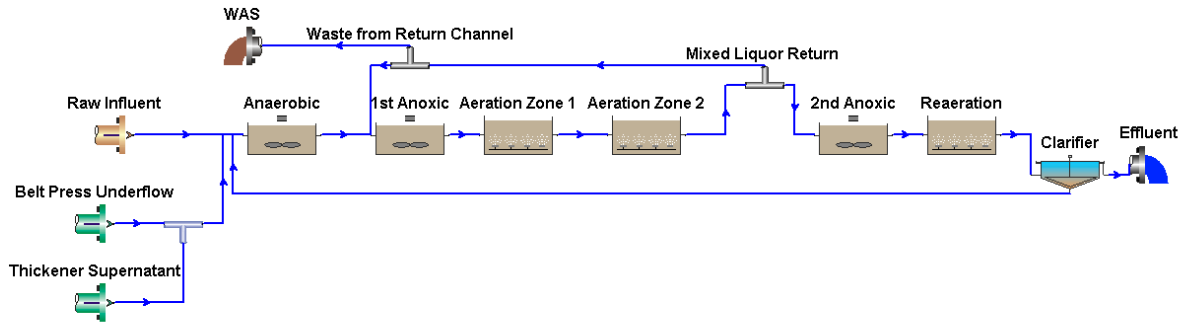
The five-stage Bardenpho process is a single sludge process with a five-stage sequence for nitrogen and phosphorus removal. The process includes anaerobic zone, and dual anoxic and aerobic zones. The existing anoxic tank will be configured into one anaerobic zone and first anoxic zone, the second set of anoxic zones would be located in Nitrification Tank using baffles.

The function of each zone is as follows:

- Anaerobic Zone
  - Organ carbon is consumed with release of soluble phosphorus
- First Anoxic Zone
  - Internal recycle returns activated sludge and nitrates/nitrites for denitrification
  - Organic carbon consumed by bacteria converting nitrates and nitrites to nitrogenous gas
- First Aerobic Zone
  - Oxidation of influent organic carbon
  - Nitrification of influent ammonia
  - Phosphorus removed by phosphorus accumulating organisms.
- Second Anoxic Zone
  - Endogenous respiration to remove remaining nitrates/nitrites
- Second Aerobic Zone
  - Re-aeration of wastewater prior to discharge to secondary clarifiers

The 5-stage Bardenpho system would require reconfiguration of the Anoxic and Nitrification tanks, and the existing aeration system in Nitrification Tank. The configuration of the aeration basins for the 5-stage Bardenpho alternative is shown on Figure 18.

Figure 18. Schematic of 5-stage Bardenpho Process Configuration



As observed from the schematic, the existing Anoxic tank is to be modified to incorporate a new anaerobic zone. The internal recirculation has to be discharged upstream of the new anoxic zone. The Nitrification tank modifications include incorporation of an anoxic zone with revised aeration zones.

Table 14 summarizes the preliminary runs with 5-stage Bardenpho Process configuration at 20 and 30 deg C.

Table 14. Model Predicted Secondary Effluent Quality - 5 stage Bardenpho Process

Process Parameters	20 deg C	30 deg C
Influent Flow per train (mgd)	4	4
MLSS (mg/L)	3,088	3,261
IR (mgd)	18	18
SRT (days)	11.21	11.22
RAS (mgd)	2.40	2.40
WAS (mgd)	0.26	0.23
VSS/TSS	0.67	0.66
Yield (lb TSS/lb BOD)	0.90	0.85
Anaerobic Volume (MG)	0.17	0.18
Anoxic Volume (MG)	0.53	0.59
Aeration Volume (MG)	0.96	0.90
Post Anoxic Volume (MG)	0.37	0.42
Re-aeration Volume (MG)	0.08	0.04
Effluent NH_3 (mg N/L)	0.43	0.18
Effluent NO_3 (mg N/L)	3.38	4.30
Effluent NO_2 (mg N/L)	1.50	0.12
Effluent TKN (mg N/L)	1.76	1.45
Effluent TN (mg N/L)	6.87	6.10
Effluent TP (mg P/L)	0.45	1.06
Effluent BOD, TSS (mg/L)	<5	<5

It can be observed that the total nitrogen value in the secondary effluent exceeds the 3 mg/L criteria. Based on the effluent nitrite at 20 deg C it shows that there is indication of simultaneous nitrification and denitrification and moreover that phosphorus uptake is higher. The exceptional phosphorus removal can attributed to the high volatile fatty acid fraction of the influent COD. As the influent BOD/TKN ratio is lower than normal, addition of supplemental carbon is required to achieve a secondary effluent TN to 3 mg/L. To verify this phenomenon the simulation was performed using an influent BOD concentration of 240 mg/L, there was a reduction in total nitrogen of about 1.5 mg/L. It is critical to get a good estimation of the influent BOD as a slight variation in influent BOD is affecting the effluent TN concentration significantly.

To improve the reliability of the 5-stage Bardenpho process to achieve repeatable results use of oxidation-reduction potential (ORP) sensors and ammonia (NH4) and nitrate (NO3) sensors is recommended. ORP sensors will be located at the end of the Pre-Anoxic and Aerobic Zones which control the amount of air added there by controlling the nitrification and denitrification. The set-points on the ORP will be revised based on feedback information NH4 and NO3 sensors are located at the end of the Aerobic Zone and at the end of Re-Aeration Zone.

1.4.3.3. 5-stage Bardenpho Process- With Additional Reactor Volume

The purpose of this model simulation is to determine the required additional reactor volume in a 5-stage Bardenpho Process configuration to treat an average flow of 12.5 mgd. Iterations were done by increasing the anaerobic, anoxic, and aerobic volume required to achieve desired effluent total nitrogen and total phosphorus. The total reactor volume for each train was determined at 3.44 MG. Each train of the existing MLE reactor is of about 2.13 MG, therefore an additional reactor volume of about 1.3 MG will be required. As the 5-stage process configuration is designed for biological nutrient removal of both nitrogen and phosphorus, larger reactor volume is required under 5-stage process compared to that of the 4-stage process.

The basis of the reactor sizing is using wastewater temperature of 20 deg C. The required aeration volume at 20 deg C is higher than 30 deg C. A swing zone is created from the aeration zone which can be operated as anoxic zone at (without air) at 30 deg C and as aeration zone at 20 deg C. This will incorporate process operational flexibility and energy savings by reducing the amount of air incorporated into the system.

Table 15 presents the secondary effluent quality at 20 deg C and 30 deg C.

Table 15. Model Predicted Secondary Effluent Quality - 5 stage Bardenpho Process

Process Parameters	20 deg C	30 deg C
Influent Flow per train (mgd)	6.25	6.25
MLSS (mg/L)	3,337	3,337
IR (mgd)	25	25
SRT (days)	11	11
RAS (mgd)	3.13	3.13
WAS (mgd)	0.37	0.37
VSS/TSS	0.67	0.67
Yield (lb TSS/lb BOD)	0.89	0.90
Anaerobic Volume (MG)	0.29	0.29
Anoxic Volume (MG)	0.99	0.99
Aeration Volume (MG)	1.3	1.3 *
Post Anoxic Volume (MG)	0.74	0.74
Re-aeration Volume (MG)	0.12	0.12
Effluent NH_3 (mg N/L)	0.50	0.22
Effluent NO_3 (mg N/L)	0.16	0.16
Effluent NO_2 (mg N/L)	1.29	0.44
Effluent TKN (mg N/L)	1.86	1.60
Effluent TN (mg N/L)	3.71	2.59
Effluent TP (mg P/L)	0.49	0.70
Effluent BOD, TSS (mg/L)	<5	<5

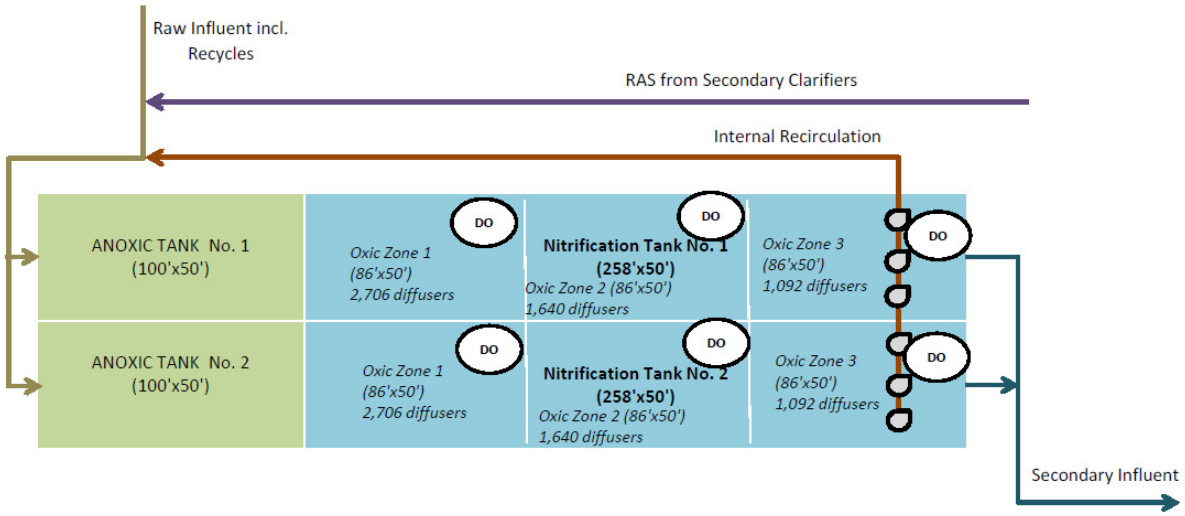
** Out of 1.3 MG of aeration volume, 0.51 MG is operated as an anoxic zone.*

The reactor volume Note that the effluent total nitrogen is slightly higher at 20 deg C, in order to drive this to below 3 mg/L supplemental carbon is required as the influent BOD is insufficient to perform additional denitrification at the given temperature. The influent BOD/TKN ratio is lower than the typical value observed in municipal wastewater. Consideration need to be given to add supplemental carbon to the post anoxic zone after evaluating the total number of days the ambient temperature will be around 20 deg C.

1.5. Layouts

Figure 19 shows the plan view of the existing MLE configuration including two trains with anoxic and nitrification tanks and internal recirculation pumps.

Figure 19. Existing MLE Layout

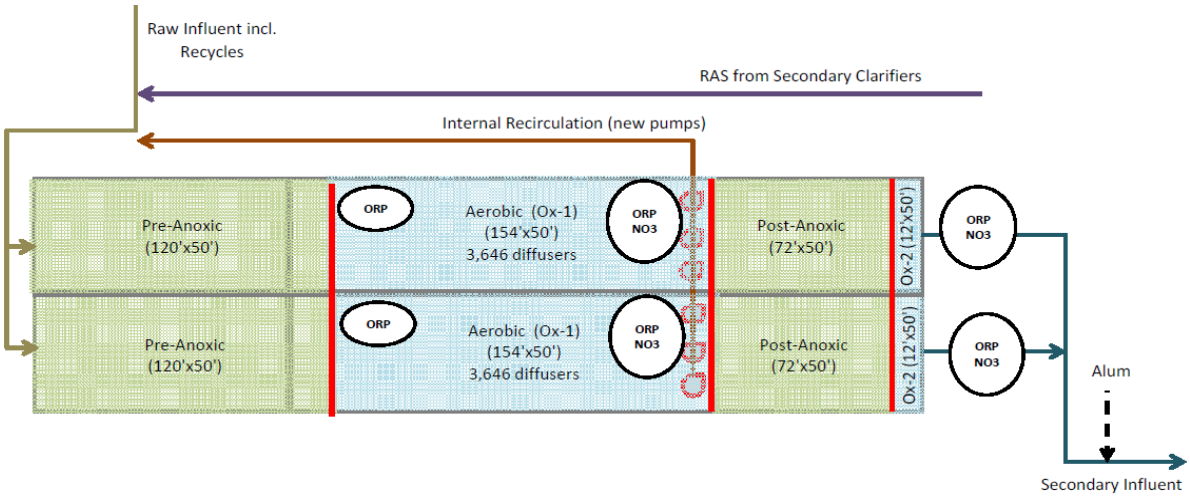


1.5.1. Layouts - No Additional Reactor Volume

1.5.1.1. 4- Stage Bardenpho Configuration

Based on the model results for the 4-stage Bardenpho process configuration, modifications to the existing MLE Layout will be required. The major change to the existing configuration will include modification of the nitrification tank into three zones separated by baffles and relocation of the internal recirculation collection point with new pumps. The modifications to the diffuser grids installed as part of the RWRF Aeration System Blower Replacement Project is very minimal. Effectively about 2,000 diffusers in Oxic Zone-1 and all the diffusers in Oxic Zone-2 will provide the required oxygen, about 80% the Oxic Zone-3 will be converted to post anoxic zone. The influent flow each train is reduced from 6 mgd to 4 mgd which is a 33% reduction. The new aeration system will effectively provide the same amount of oxygen as the modified basin aeration volume is about 60% of the existing thereby is capable of maintaining sufficient aerobic solids retention time. Figure 20 shows layout for the proposed 4-stage Bardenpho tank modifications, with different zones and there dimensions.

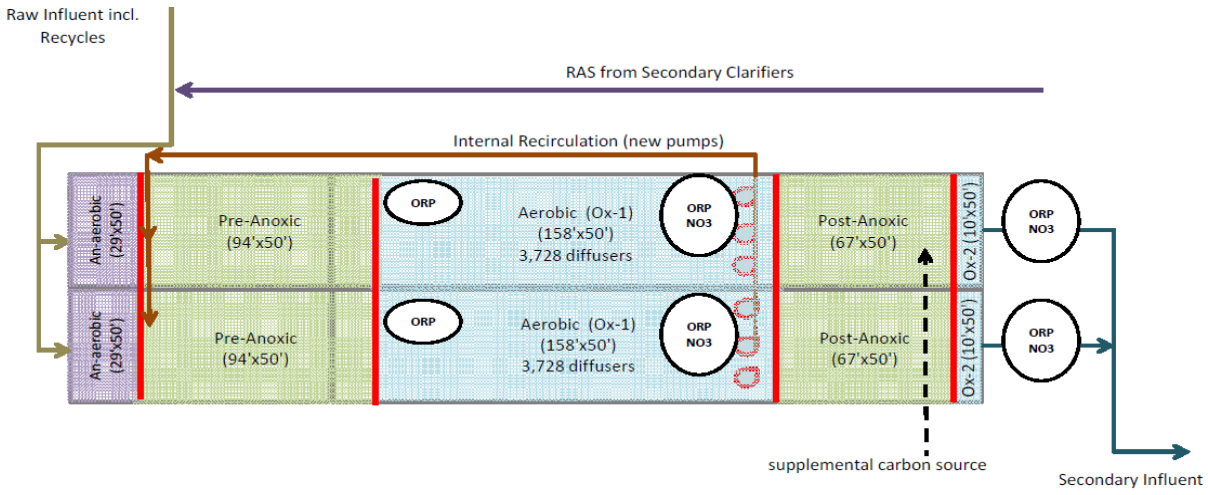
Figure 20. 4-stage Bardenpho Process Configuration Layout



1.5.1.2. 5-Stage Bardenpho Configuration

Based on the model results for the 5-stage Bardenpho process configuration, modifications to the existing MLE Layout will be required. The major change to the exiting configuration will include modification of the anoxic tank to include an anaerobic zone and Pre-Anoxic zone separated by baffle, modification of nitrification tank into three zones separated by baffles and relocation of the internal recirculation collection point with new pumps. The internal recirculation discharge point needs to be changed to downstream of the anaerobic zone to avoid reduction in phosphorus removal efficiency. The modifications to the diffuser grids installed as part of the RWRF Aeration System Blower Replacement Project is very minimal. Effectively about 2,088 diffusers in Oxic Zone-1 and all the diffusers in Oxic Zone-2 will provide the required oxygen, about 80% the Oxic Zone-3 will be converted to post anoxic zone. The influent flow each train is reduced from 6 mgd to 4 mgd which is a 33% reduction. The new aeration system will effectively provide the same amount of oxygen as the modified basin aeration volume is about 61% of the existing thereby is capable of maintaining sufficient aerobic solids retention time. Figure 21 shows layout for the proposed 5-stage Bardenpho tank modifications, with different zones and there dimensions.

Figure 21. 5-stage Bardenpho Process Configuration Layout

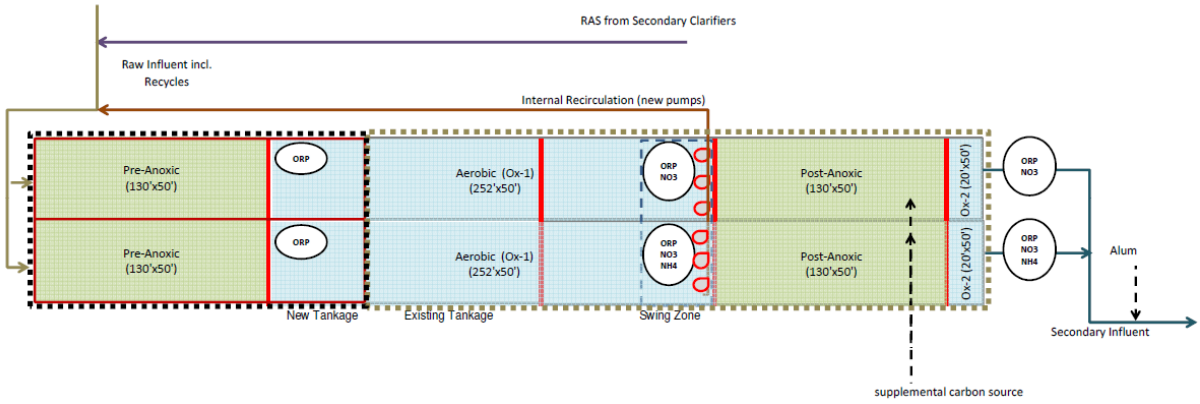


1.5.2. Layouts - Additional Reactor Volume

1.5.2.1. 4-Stage Bardenpho Configuration

Based on the model simulation for a 4-stage Bardenpho process configuration to treat an average flow of 12.5 mgd, an addition reactor volume of 1 MG is required. The new tankage (174'x50') for each train will consist of pre-anoxic reactor (130' X 50') and portion of the aerobic zone (44'x50'). The existing anoxic tank will be modified to an aerobic zone and portions of the existing nitrification tank will be modified to post-anoxic and post-aeration zones. A swing zone of 40-ft-width will be created in the aerobic zone which will be operated as anoxic zone at higher temperatures (30 deg C). Figure 22 shows layout for the proposed 4-stage Bardenpho tank modifications, with different zones and there dimensions.

Figure 22. 4-stage Bardenpho Process Configuration Layout - Including Additional Volume

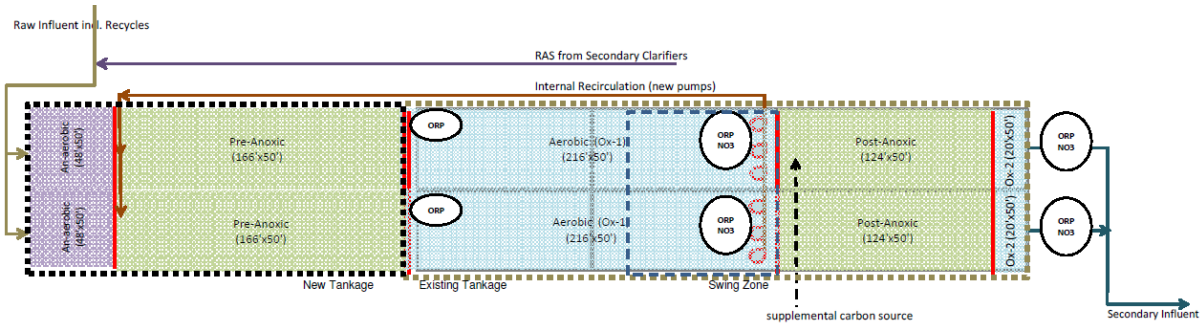


1.5.2.2. 5-Stage Bardenpho Configuration

Based on the model simulation for a 5-stage Bardenpho process configuration to treat an average flow of 12.5 mgd, an addition reactor volume of 1.3 MG is required. The new tankage (214'x50') for each train will consist of anaerobic reactor (48'X50') and a pre-anoxic reactor (166' X 50'). The existing anoxic tank will be modified to an aerobic zone and portions of the existing nitrification tank will be modified to post-anoxic and post-aeration zones. A swing zone of 86-ft-width will be created in the aerobic zone which will be operated as anoxic zone at higher temperatures (30 deg C).

Figure 23 shows layout for the proposed 4-stage Bardenpho tank modifications, with different zones and there dimensions.

Figure 23. 5-stage Bardenpho Process Configuration Layout - Including Additional Volume



1.6. Conclusions

- The 4-stage Bardenpho Process configuration is an viable alternative to meet the desired effluent criteria at an average flow of 8 mgd (two trains in operation) as this alternative does not include supplemental carbon source feed system. Alum feed systems are relatively cheaper and alum is

easier to handle compared to methanol. The 4-stage Bardenpho configuration does not require any modification to the internal recirculation discharge point; the existing mixed liquor channel can be reused with a new set of pumps at the proposed location. Additional reactor volume of 1 MG needs to be provided to treat an average flow of 12.5 mgd (two trains in operation).

- Reuse of existing primary clarifier for anoxic volume is not a viable option.
- The current blower upgrade and diffused aeration system project will provide three oxic zones (Ox-1 through Ox-3) each of 86 ft long. Modifying these three oxic zones into six smaller zones will better control the air to the nitrification tank and will minimize the reactor modifications for treating 8 mgd and 12.5 mgd average daily flow.
- The influent BOD concentration is lower in comparison with the TKN and TP values resulting in a substrate limitation condition as observed in the post anoxic zones which limit the denitrification and phosphorus release, therefore chemical addition in the form of coagulant needs to be added.
- The proposed configuration can reliably meet the effluent quality with a smaller post anoxic volume if supplemental carbon addition is considered. Methanol is by far a good supplemental carbon source as far as assimilation of denitrification bacteria is concerned; however the methanol handling requires additional safety requirements.
- The model predictions show very good biological phosphorus removal, the reason for such a good performance is that the influent volatile fatty acid fraction is high; confirmation of the raw influent fractionation is required.
- As there are several instances where the COD is less than the VSS, and VSS/TSS ratio is greater than 1, in the recent testing performed, therefore additional testing on the influent total COD, floc/filtered and glass fiber filtered CODs is required to get a better handle of the influent characterization.
- Assuming no significant change in the influent characterization, based on the preliminary process evaluation, it is observed that de-rating the existing plant from 12.5 mgd to 8 mgd can achieve the goal of an effluent limit of 5 mg/l (BOD); 5 mg/l (TSS); 3 mg/l (N); 1 mg/l (P) without any additional reactor volume.

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