Description of the Water Conserv II Facility

Introduction

The Water Conserv II (WCII) Water Reclamation Facility provides service to a majority of the southwest section of Orlando. The WCII facility has a design capacity of 25 mgd and is designed to service about 250,000 people. This volume of flow is equal to about 454,500 55 gallon drums! The WCII facility was built to protect the Central Florida environment, especially in Orange County, with its "Zero Discharge" method of effluent reuse/recharge. The highly treated effluent is pumped nearly 20 miles to Southwest Orange and East Lake Counties for irrigation of citrus groves, and recharge of the aquifer through a series of Rapid Infiltration Basins. The benefit of the Water Conserv II plant, as well as each of the City of Orlando's Water Reclamation facilities, is equal to its goal ... to ***preserve the environment*** and to ***protect public health***. This is also in harmony with the City of Orlando's mission ... ***"Serving Orlando with Innovation, Responsiveness, Knowledge, Professionalism and Courtesy."***

The facility's design incorporates an advanced secondary treatment process, energy conservation, resource recovery, odor control and computerized process control.

Water Conserv II is a Class A Level I facility. The main liquid process stream includes influent pumping, screenings and grit removal, primary clarification, activated sludge process with fine bubble diffusion, secondary clarification, effluent filtration, high level disinfection with chlorine, reuse water transmission pumping, and flow measurement at various locations throughout the facility. The main solids process stream includes sludge thickening by gravity belt thickener, sludge conditioning/stabilization by anaerobic digestion, sludge dewatering by belt filter presses, and hauling of dewatered sludge to land application sites.

The treatment facility incorporates several unique features that are summarized below:

- The facility has two identical treatment trains that consist of screenings and grit removal, primary sedimentation, activated sludge with fine bubble aeration, and secondary clarification. The effluent is filtered and chlorinated prior to being pumped to the distribution center for reuse by citrus irrigation.

• Electricity is produced with gas powered generators by utilizing methane gas produced in the anaerobic digestion process. Hot water from the cooling jackets of the engine-generators is recovered and used to heat the sludge in the anaerobic digesters.

• The primary clarifiers and effluent equalization tanks are covered to control odors. The odorous air from within the domes of the primary clarifiers serves as supply for the aeration blowers and is diffused into the aeration tanks.

• The plant process control system features local manual control, a central control station and satellite control stations for monitoring, data logging and computerized process control for various areas of the plant. Monitoring information is displayed on screens in the Operations Control Room.

Facility Flow Pattern Description

The Water Conserv II Water Reclamation Facility has a design capacity of 25 mgd, and, as of 1997, treats an average daily flow of about 15 mgd. The basic flow patterns for liquid and solids treatment are identified in the next few pages:

Liquid Flow Stream

Two gravity mains and two force mains are joined together and enter one common wet well at the master pump station. All of the in-plant recycle flow (sidestreams) is combined into the gravity main. In this manner, all flow enters the master pump station wet well. The Master Pump Station is equipped with five high capacity pumps with variable speed VFD drives. The master pump station discharges into a common inlet forebay at the preliminary treatment structure.

Capital Cost of the Water Conserv II Facility

Year	Phase/mgd	Dollars
1984	Expansion / 13 mgd	$40 Million

This expansion took the facility to a permitted capacity of 25 mgd.

Water Conserv II Facility

Annual O&M Budget - 1996

$6.4 Million

From here, the influent flow is split with slide gates to separate preliminary treatment systems. Each north and south system includes a Parkson bar/filter screen, a manual bar screen, a Pista grit chamber and a grit removal screw. Grit and screenings are stored in dumpsters for disposal in an approved landfill. Leaving the preliminary treatment structure, the flow remains totally separate through the north and south plants until the secondary clarifier effluent is combined prior to effluent filtration.

Flow from each preliminary treatment outlet is measured with magnetic flow meters before entering the primary treatment system. Each primary treatment system has a domed primary clarifier with primary sludge pumps, scum removal system with a common rotary drum for grease removal (the rotary drum filtrate is returned to the plant headworks - master pump station wet well), and an odor control system by means of aeration blowers through multiple staged filters. From here, primary effluent and secondary clarifier RAS flows to its own bank of aeration tanks. Each aeration bank is comprised of five, rectangular, plug flow aeration tanks with fine bubble dome diffusers. The north bank has aeration tanks 1, 3, 5, 7, and 9; the south bank has aeration tanks 2, 4, 6, 8, and 10. The aeration banks can be interconnected at the inlet mixing structure of the first stage aeration tanks. The inlet air to four centrifugal Hoffman blowers originates from inside the domed primary clarifiers. The air is then supplied to the fine bubble diffusers in each aeration tank. Each aeration tank is equipped with four diffuser droplegs with isolation valves. This design allows for operator control of dissolved oxygen at various portions of the aeration tank. Each aeration tank outlet includes continuous monitoring of dissolved oxygen. Aeration effluent mixed liquor is combined into common channels, separate for the north and south banks, and flows into a segmented mixed liquor splitter box. From here, the north side mixed liquor is split between secondary clarifiers 1 and 3, and the south side mixed liquor is split between secondary clarifiers 2 and 4. The clarifier splitter box can be interconnected to combine both the north and south mixed liquor from both aeration banks.

RAS from the north side clarifiers flows by gravity over an adjustable weir gate and then into the north RAS wet well; RAS from the south side clarifiers flows by gravity over another adjustable weir gate and then into the south RAS wet well. Weir gate adjustability is used to control the flow of RAS from each bank of secondary clarifiers. Each RAS wet well has three RAS pumps with 2-speed motors (a total of six RAS pumps). The north RAS is metered with a sonic flow meter and returned to the head of the north bank of aeration tanks; the south RAS is metered with another sonic flow meter and returned to the head of the south bank of aeration tanks. The RAS can be interconnected to combine all RAS flow into either

Facility Permit Requirements

Parameter	Permitted Limit
Permitted Flow Capacity	25 mgd
Effluent Permit Limitations	
$CBOD_5$	20 mg/L
TSS - before disinfection	5 mg/L
Fecal Coliform	Less than 1 per 100 ml
pH	6.0 to 8.5
NO_3	12 mg/L weekly average 10 mg/L monthly average
Total Chlorine Residual	No less than 1.0 mg/L

Protocol	
Pre-Filtration Total Chlorine Residual	No less than 0.5 mg/L
Effluent Turbidity	Less than 2.0 NTU

of the facility for various process functions. To state a few examples, plant water is used for seal and cooling water of process pumps, hose bibbs for washdown function at process tanks, spray water at the scum troughs of the primary clarifiers, washwater for the gravity belt thickeners and the belt filter presses, and, last but not least, solution water for the chlorination system.

Chlorination System

The Chlorination process includes two separate chlorine feed systems; one for liquid feed and the other for gas feed. There are a total of 4 ton containers, each with a separate scale, that can supply liquid chlorine to the evaporators, and a total of 12 ton containers, using two 6-container scales, which feed chlorine gas to vacuum-type chlorinators. The container loading station has a two-ton capacity hoist system and trunnions to service numerous full and empty containers. Chlorine solution can be supplied to various portions throughout the treatment process.

Emergency Power System

The Emergency Power system has six gas-fired, engine-driven generators to provide emergency power to the entire facility during power failure periods. The engine-generators can be operated with natural gas or digester gas as the fuel source. A comprehensive power control system automatically starts the generators when normal power is lost. A schematic map is provided of the electrical flow pattern to indicate the positional status of the Motor Control Center breakers.

Energy Recovery System

The Energy Recovery System is an extremely comprehensive and successful process. Three of the generators are dedicated for the purpose of co-generation and heat recovery. These units are automatically started, regulated and stopped based on the availability of methane gas in the gas holding digester. Electricity is produced and fed to the main electrical bus system. Co-generation significantly reduces the overall electrical consumption in the facility. Heat produced by the engines is recovered by a closed-loop hot water recovery system using a water-to-water heat exchanger. This hot water is then supplied to the primary digester heat exchangers for heating of the digesting sludge. The process includes a standby boiler system to supplement or provide the total heat necessary for the digesters. The boiler unit is not normally operated due to the heat recovery system, which saves additional money for the natural gas which fuels the boiler.

or both RAS wet wells; the discharge of the RAS pumps can also be interconnected to supply RAS to either bank of aeration tanks.

All secondary clarifier effluent is combined and flows by gravity to the IPS (Intermediate Pump Station) wet well, where it is either stored in the EQ (Equalization) tanks, and/or applied onto the effluent filters. Flow to be stored for equalization of filter loading is pumped into the EQ tanks with variable speed EQ Pumps. Flow to be applied to the filters is pumped with variable speed Transfer Pumps. Before the flow is applied to the effluent filters, it first passes through flash mixing and flocculation stages. Currently, no chemicals other than chlorine are used in this process.

There are six dual-media, dual-carriage rapid gravity ABW filters with automatic backwash carriages. Spent backwash water is returned, via the plant drain system, to the plant headworks Master Pump Station.

The following filtration system locations are continuously monitored with turbidity analyzers: common filtration inlet, filtration outlet for each filter, and common filtration outlet.

Filtration effluent passes through two chlorine contact chambers where it is chlorinated for disinfection. The final effluent flow is continuously monitored for turbidity and total chlorine residual. From the contact chambers, the effluent flows by gravity to the TPS (Transmission Pump Station) wet well where it is pumped to the Reuse Distribution Facilities, in Winter Garden, Florida, for citrus irrigation and RIB disposal. A portion of the effluent is also pumped to the Metro West reuse system.

Sludge Treatment Processes

Primary sludge is pre-thickened in the primary clarifiers and pumped to the digester feed well where it is combined with thickened WAS. There are three positive displacement primary sludge pumps controlled through an adjustable, automatic counter and timer system. This combined sludge flow is metered with a sonic flow meter and pumped directly into the primary anaerobic digesters with three digester feed pumps.

Waste activated sludge is removed from the RAS wet well with three centrifugal WAS pumps and delivered into the sludge thickening feed well. WAS can also be pumped to the inlet of the primary clarifiers for co-settling with the primary sludge. The WAS pumps are controlled with an adjustable, automatic timer system. Three thickener feed pumps deliver the WAS to the sludge thickening system, where it is first conditioned with

polymer, and then thickened with two gravity belt thickeners. Washwater for belt cleaning is plant water supplied to separate booster pumps located at each belt thickener unit.

The combined sludge is conditioned/stabilized in the anaerobic digestion system at the mesophilic temperature range. Sludge is transferred from the three primary digesters into the fourth sludge storage/gas holding tank. Low pressure digester gas is supplied to four high pressure gas compressors. The compressed gas is returned to the primary digesters for mixing of the tank contents via gas mixing guns. Each primary digester has four gas mixing guns with internal heat exchangers. Hot water is supplied to the digester heat exchangers from the Energy Recovery System.

Digested sludge is withdrawn from the sludge storage/gas holding tank with four sludge dewatering feed pumps. The digested sludge is conditioned with polymer and then dewatered with four belt filter presses.

All plant sidestreams, spent backwash water from the ABW filters, filtrate and washwater from the belt thickener is returned to the plant headworks via the plant drain system and the Master Pump Station. The sidestream for the belt filter presses is conveyed to the backwash gravity thickeners where the heavier solids are settled and removed. The bottom sludge from the gravity thickeners is removed with the TUF (Thickened Underflow) pumps and discharged into the digester feed well. The underflow solids are combined with the primary sludge and the TWAS, and then pumped into the primary digesters. The liquid overflow from the gravity thickeners is returned to the plant headworks via the plant drain system and Master Pump Station.

Dewatered sludge is hauled off-site and disposed of by means of agricultural land application meeting all requirements for Class B residuals.

Facility Support Systems

The Water Conserv II Facility has various support systems, including the Plant Water Pumping Station, the Chlorination System, the Emergency Power System and the Energy Recovery System.

Plant Water Pumping System

The Plant Water Pumping System has four vertical turbine pumps with multiple-stage impellers. These pumps deliver plant water to every location