UPGRADING A WASTEWATER TREATMENT FACILITY ON A BARRIER ISLAND

Introduction

The Town of Sullivan's Island, South Carolina (Town), has a rich and colorful history. Because of its vantage point overlooking the Charleston Harbor and Atlantic Ocean, it served in a military sentry capacity for nearly 300 years. Fort Moultrie, originally built during the Revolutionary War, is a leading tourist attraction. One of its most famous military residents was Edgar Allen Poe, who used his time on Sullivan's Island as an inspiration for his story "The Gold Bug." Another well-known and visible landmark is the Sullivan's Island Lighthouse. This lighthouse, north of the entrance to Charleston Harbor, was the last one built by the government in the United States. The Coast Guard built it in 1962 to replace the threatened Morris Island lighthouse located south of the Charleston Harbor entrance. The tower is constructed of concrete wrapped in an aluminum shell with all the modern conveniences, including air conditioning and an elevator to the lantern room. The current lantern is one million candlepower, which shines approximately 26 miles out to sea and flashes every 30 seconds.

Approximately 2,000 residents live on Sullivan's Island today, and the Town is known for its unhurried pace, beautiful beaches, local charm, and proximity to historic Charleston.

The Town's history of modern wastewater treatment is not quite as extensive. It owns and operates a municipal wastewater treatment facility (WWTF) that was originally constructed in the 1960s. The collection system is made up of 80,000 linear feet of 8-inch clay gravity lines and 310 manholes. Five pump stations transport the wastewater back to the treatment facility utilizing 5,000 linear feet of force mains. The WWTF processes the wastewater load for residential and light commercial properties, and has a rated capacity of 0.57 million gallons per day (mgd) with a daily average flow of 0.430 mgd. The Water & Sewer Department is staffed with five operators. Currently one is vacant. We have been blessed with the support of council to have the right tools/equipment for the job at hand. We have the equipment to perform sewer cleaning, TV inspections (mainline and lateral), GPS locating, SCADA system, Bypass Pump, Portable Generator, Plant Generator, Backhoe, Dump Truck.

In 1996, the Town committed resources to performing a three-phased WWTP upgrade project. Since the amount of land available for future development was severely limited, off-island treatment was evaluated and determined to be cost-prohibitive. The residents then passed a local referendum that supported the Town remaining an independent wastewater provider. The Town accordingly made a commitment to continue treating wastewater at the existing plant and to proceed with the upgrade projects.

All water and wastewater performance and system monitoring testing are performed in-house in our certified lab. Only BOD, Cu, Entrococci, Nh3 are currently being performed by an outside lab. We are continuing our efforts to become fully certified by DHEC.

Two of the three phased projects were completed prior to 2001. In July 2002, the South Carolina Department of Health and Environmental Control (SC-DHEC) placed the Town under a Special Order by Consent (SOC). The SOC was issued concurrent with the commencement of the final phase of the project design. SC-DHEC mandated that the Town attain compliance with the current permit and meet new permitting requirements that will take effect in January 2005. The new NPDES permit includes more stringent effluent standards for Ammonia (NH3-N), Entrococci, PH, Dissolved Oxygen (DO), Copper (Cu) and TRC.

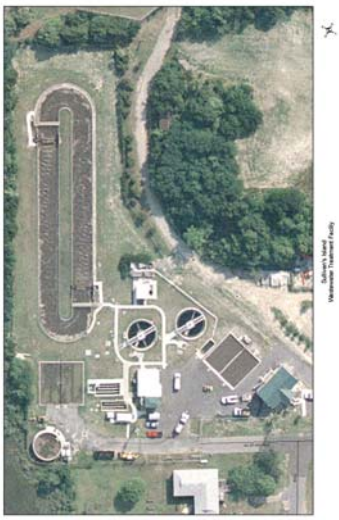
Project phases I and II consisted of the following work:

- Sewer rehabilitation projects
- Pumping unit replacements for multiple lift stations
- A new automated screening and grit removal system
- New oxidation ditch rotors
- A new aerobic digester
- A new emergency power generator.

Oxidation Ditch – Oxygen is added to the water by splashing it into the air.

In 2001, the Town began a re-evaluation of the proposed Phase III project. Phase III construction was completed in January 2005.

The existing plant treatment scheme includes:



- Influent pumping station.
- Screening and vortex grit removal headworks facility.
- Oxidation ditch.
- Two 35-foot diameter, peripheral-feed secondary clarifier.
- Chlorine contact basin.

Waste activated sludge is periodically removed from the secondary clarifier and conveyed to an on-site, 68,000-gallon, aerobic digester. The solids are then dispersed onto sludge drying beds and hauled off to a local landfill facility after approximately 10 to 14 days drying time. Return activated sludge from the secondary clarifier is recycled to the oxidation ditch. Average WWTP flow is approximately 0.430 mgd.

Phase III-Related Improvements

Wastewater Influent Pumping Station. Retrofit the existing fixed speed pumping units with inverter duty rated motors and VFDs. A new computer and a full plant SCADA system were installed to control the influent pumps.

Secondary Clarification. A new secondary clarifier has been provided to enhance activated sludge process reliability as well as provide higher quality treatment during high-flow periods. The new 35-foot diameter secondary clarifier has a side water depth of 12.25 feet. The new clarifier is a center-feed unit. In addition to providing better treatment performance, SC-DHEC now requires that all domestic WWTPs have at least two primary, intermediate, and final sedimentation basins. The additional secondary clarifier also provides the Town with flexibility to take either clarifier out of service for maintenance work. The existing secondary clarifier peripheral feed mechanism has been retrofitted with a center-feed design.

New Sludge Drying Beds. As a part of the upgrade, two new sludge-drying beds were added on-site so that sludge wasting activities can occur more frequently. In addition, we added a smaller drying bed for grit dewatering prior to disposal to landfill. Grit removed from influent is air-lifted here to dewater and grit removed from the collection system with our Jet-Vac is also put here to dewater.

Oxidation Ditch. The Town hired a specialty contractor to remove inert solids from the oxidation ditch. The solids removal process was accomplished while keeping the ditch in service. The oxidation ditch had not been cleaned out since original plant construction in the late 1960s. A significant fraction of the 385,000-gallon oxidation ditch volume was occupied with grit. Approximately 200 cubic yards of grit were removed from the ditch without any operational disruption.

Chlorine Contact Basin Expansion and Effluent Flow Monitoring. The existing 3,750-gallon chlorine contact basin was undersized and required expansion to provide adequate chlorine contact time. The minimum detention time required for all operating conditions had not been met with the existing basin. The undersized basin was the primary reason for TRC and fecal coliform permit violations prior to 2004. Accordingly, a new 9,500-gallon chlorine contact basin has been constructed to provide a total of 13,250 gallons of contact volume. At average day and peak hour flow, the contact basins will provide 50- and 15-minute detention times, respectively. Supplemental dissolved oxygen (DO) was added at the end of the contact chamber to meet the new permit limit of 4.0 mg/l. Plant effluent flow was being measured downstream of the secondary clarifier via a Parshall Flume. Visual observations of the Parshall Flume indicate that the system is intermittently operating under submerged conditions. High tidal influence and peak flow events were contributing to unreliable flow measurement. The Parshall Flume has been replaced with an 8-inch magnetic flow meter to provide reliable flow measurement. Chlorine and sulfur dioxide is actively flow-paced using this new magnetic flow meter installed upstream of the chlorine contact basins.

Collection System Inflow and Infiltration (I/I). We are independently addressing I/I problems via an ongoing pipe inspection/rehabilitation and replacement program. In 2001 a sewer TV camera was acquired to inspect & identify collection system problems. In 2003 we purchased a Jet-Vac unit to perform proper sewer-cleaning operations. In cooperation with the

Environmental Protection Agency and DHEC we have successfully completed our Capacity, Management, Operations and Maintenance (CMOM) Phase One wastewater collection system review process in 2004. The Town will continue to participate in both programs in order to continue to identify and address collection system assets requiring improvements. In 2003 we inspected all Manholes in system and have replaced 105 ring and lids and relined 25.

Mapping. In 2002 we implemented an electronic mapping system with GIS using ESRI software. All water and sewer system assets have been GPS located and attributes for each continue to be updated. All Manhole inspection forms, pictures and data are linked to each Manhole in the map. In 2006 we had a new aerial photo of the Island created to give us an up to date photo overlay. Having this type of mapping system allows our staff to use our hand held GPS unit to locate taps, manholes, cleanouts, etc.

Conclusion

The final completion of the plant upgrade project cost a total of $1.8 million. With no increase in permitted flow capacity, this final phase has enabled the Town to meet most of the new NPDES permitting requirements in an environmentally sensitive coastal region. The Town will be able to serve the 2,000 residents' needs well into the future. The success of this project has encouraged the Town to consider some environmentally friendly alternatives for the future use of its wastewater effluent and residual biosolids. With an expanding Town park immediately adjacent to the WWTP, filtered effluent reuse water for irrigation and beneficial use of Class A biosolids created from plant biosolids offer several exciting environmentally oriented opportunities for this community located near one of the most historically significant cities in the U.S.

Dedicated Staff Members: Darrel Noisette, Paul Fouchecourt, Tommy Bean

Greg Gress is the Sullivan's Island Water & Sewer Department Manager. Greg can be reached at (843) 883-5748 or ggress@sullivansisland-sc.com Town Website: http://www.sullivansisland-sc.com