SOUTHWEST WASTEWATER TREATMENT PLANT
URBANA & CHAMPAIGN SANITARY DISTRICT

Plant History

The mission of the UCSD is to protect public health and safety, preserve the public trust, and protect the natural environment. This is accomplished by meeting present and future community needs, efficiently collecting, and treating wastewater, and retaining and developing qualified staff. The district was organized in 1922 and dedicated its first treatment plant known as the Northeast Wastewater Treatment Plant in 1924. Growth of the service area which includes all the City of Urbana, the City of Champaign, the University of Illinois campus, the Village of Savoy and surrounding unincorporated areas resulted in the construction of the Southwest Wastewater Treatment Plant (SW WWTP) in 1968. The SW WWTP was expanded in the early 1980's and again in 2005 to its present-day capacity of 7.98 MGD (Design Average Flow) and 17.25 MGD (Design Maximum Flow).

Service Area

The SW WWTP serves the Village of Savoy and the northwest, west, and southwest areas of the City of Champaign AND THE Village of Bondville. Homes, businesses, and institutions within the service area are connected to a network of below ground pipes (sanitary sewers) that carry their wastewater to the SW WWTP. A separate system of below ground storm sewers carries rainwater runoff directly to area streams with no treatment.

Type of Treatment

The SW WWTP is designed to provide preliminary treatment, secondary treatment, and tertiary treatments prior to discharge to the Copper Slough. During excess flow, a portion of the flow receiving preliminary treatment is disinfected, clarified, and combined with the treatment plant effluent receiving secondary and advanced treatment in the rest of the plant prior to discharge to the Copper Slough, a tributary of the Kaskaskia River.

Preliminary Treatment and Raw Wastewater Pumping

Two 54-inch diameter sewers bring the flow from the network of sanitary sewers within the service area into the Headworks Building where it passes through fine screens. The screens are designed to remove ¼-inch and larger solids from the wastewater to protect downstream equipment from damage these solids may cause and to minimize maintenance that would be required to clean these solids from downstream channels, pipes, and tanks. The screenings are washed, compacted, and conveyed to a dumpster for off-site disposal in a landfill. After passing through the fine screens, flow enters two parallel raw sewage wet wells. Each wet well contains one

9,000 gpm (maximum) pump and one 13,000 gpm (maximum) pump. All four pumps have variable frequency drives which enable the pumps to match the flow coming into the plant.
Flow pumped from the wet wells enters two parallel aerated grit chambers where the wastewater is slowed down just long enough to allow sand, grit, and other inorganic solids to settle to the bottom. The grit is then removed, washed, and dewatered in grit classifiers, and deposited in a dumpster for off-site disposal in a landfill.

Flow Distribution and Disinfection Structure and Excess Flow Treatment

After preliminary treatment, the wastewater flows to structure (ZN1) by gravity where it first enters a distribution chamber that contains a fixed weir and a motorized downward operating weir gate. During normal dry weather flow conditions, the motorized weir gate is fully up (closed position) so the wastewater is directed over a fixed weir and on to the secondary treatment process. During a storm event, the motorized weir gate is lowered so excess flow above the design maximum flow of 17.25 MGD can be directed through a Parshall flume for flow measurement to two 110 ft. diameter excess flow clarifiers. This flow is disinfected with sodium hypochlorite prior to traveling to the clarifiers. Overflow from these clarifiers is by gravity to a manhole where it mixes with the fully treated effluent from the rest of the plant before being discharged to the Copper Slough. After the storm event is complete and flows have returned to normal, water remaining in these clarifiers is drained back to the raw sewage wet wells for further treatment. There are collector mechanisms in each clarifier that direct any settled solids into the return line.

Secondary Treatment

After the anaerobic tanks, the mixed liquor flows to five aerated tanks operated in parallel. Air is introduced to these tanks through a grid of fine bubble diffusers located on the bottom of each tank. In these tanks the organic matter present or carbonaceous biochemical oxygen demand (BOD5) is reduced, and the phosphorus is absorbed by the activated sludge microorganisms which feed on the waste just as they would in nature converting the dissolved solids into suspended solids which can then physically settle out. Most of the ammonia in the wastewater is oxidized by nitrogenous bacteria that turn it into nitrate ions. The final products of this step are carbon dioxide, cleaner water, nitrates and nitrites, and more microorganisms. At the design average flow of 7.98 MGD, the hydraulic detention time through the aeration tanks including the RAS flow is 4.2 hours.

Flow from the aeration tanks is by gravity to five secondary clarifiers. The solids (microorganisms) that settle to the bottom of the clarifiers are removed by a slowly revolving mechanism attached onto the bottom of the bridge structure. The settled solids are pumped out of each tank by one of seven return activated sludge (RAS) pumps, or one of the two waste activated sludge (WAS) pumps. The RAS flow is returned to the anaerobic tanks and the WAS flow is discharged to one of two gravity belt thickeners for further treatment. It is necessary to remove a portion of the microorganisms to keep the system balanced with the amount of organic waste coming into the plant each day.

Advanced Treatment – Nitrification Towers and Tertiary Filtration

Three (3) variable speed centrifugal pumps equipped with magna drives are provided to lift the secondary effluent to the top of the two nitrification towers. The towers are packed with plastic media modules (2 ft. x 2 ft. x 4 ft.) to a depth of 24 feet and flow is distributed onto the media by a rotary distributor with four (4) arms. The biological growth that develops on the plastic media contains a group of microorganisms called nitrifying bacteria that convert the ammonia nitrogen in the secondary effluent to nitrates. Air circulates through the towers via vents located at the bottom along the walkway to keep the process aerobic.

The water from these towers flows by gravity to five (5) tertiary (disk filter) units. Each unit contains 12 disks covered with filter cloth. Water flows around the outside of the disks and through the filter cloth to the inside of the filter disk with any remaining suspended solids being captured on the filter cloth. Each filter unit has two (2) backwash/sludge pumps that periodically remove solids from the filter cloth and the tanks housing the filters. These waste flows are returned to the Headworks Building.

The filtered water flows through a magnetic flow meter, then is treated seasonally by ultraviolet light disinfection. The treated water is then discharged to the Copper Slough, a tributary of the Kaskaskia River.

Sludge Thickening

The waste activated sludge (WAS) from the secondary treatment process is pumped to a gravity-built thickener. A small amount of polymer is added to the WAS flow ahead of the belt to promote separation of water from the solids on the belt. Water draining through the belt is returned to the Headworks Building for full treatment. The thickened WAS falling off the belt at the far end is pumped by a positive displacement pump to the Sludge Holding Tank. The thickened sludge discharged from the gravity belt is typically concentrated from 0.5% to 4-6% solids.

Sludge Storage Tank

The sludge storage tank has a total storage volume of approximately 150,000 gallons. The tank is mixed by two centrifugal non-clog chopper pumps which were also designed to load a sludge truck at the loading station adjacent to the tank. Tanker trucks transport the thickened sludge to the Northeast Wastewater Treatment Plant (NE WWTP) in Urbana where it is stabilized in anaerobic digesters and dewatered by centrifuges before it is trucked off site for disposal. Hauling to the NE WWTP occurs only on weekdays and involves three to five loads per day.

Key Performance Data (Calendar Year 2022)

Parameter	Influent	Effluent	Percent Removal	Permit Violations
Average Daily Flow (MGD)	7.01			
Biochemical Oxygen Demand (BOD5 in mg/l)	245	2.6	98.9	0
Total Suspended Solids (TSS in mg/l)	264	2.3	99.1	0
Ammonia Nitrogen (NH3-N in mg/l)	20.1	0.17	99.2	0
Phosphorus (Total P in mg/l)	5.17	0.26	95.2	0

Funding (User Charges)

Funding for the operation and maintenance of UCSD facilities comes from the billing of users of the facilities and is based on water consumption. The current rate as of May 1, 2023, is $0.3302 per 100 gallons of water. No property tax money is collected by the district.