



Gurnee STP



North Shore Sanitary District

The North Shore Sanitary District (district) was established by referendum pursuant to the Sanitary District Act of 1911 and is the second-largest wastewater treatment agency in Illinois. The district works diligently to safeguard Lake Michigan and other local waterways, such as the Skokie and Des Plaines Rivers, from pollutants while providing wastewater treatment service to over 300,000 residents in 15 communities within its Service Area in the eastern part of Lake County, Illinois. The district collects wastewater from the local municipalities' sewer systems within its

service area and conveys it via 125 miles of interceptor sewers and 11 pumping stations to its three advanced sewage treatment plants (STP) located in Waukegan, Highland Park (the Clavey Road STP), and Gurnee, which have a combined average design capacity of 63.4 million gallons a day.

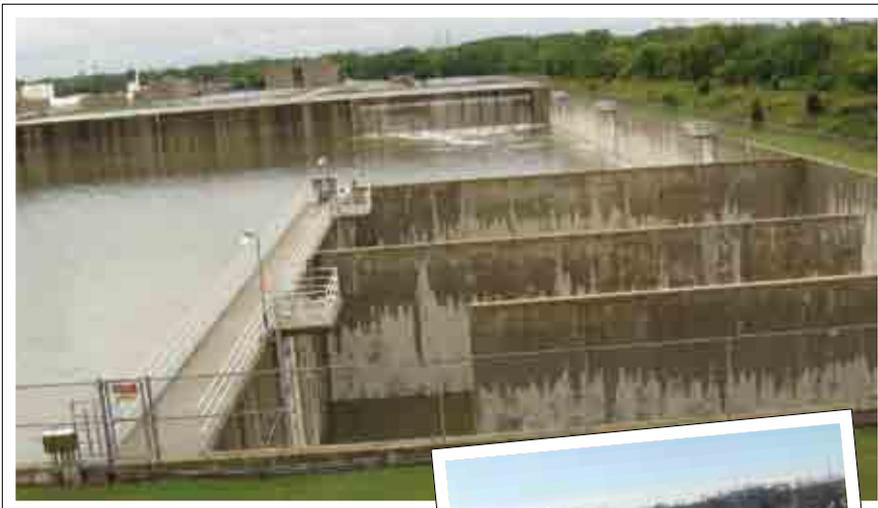
The district's dedication to efficient treatment is evident by its continual achievement of operation and performance awards. The district's advanced STPs and highly skilled staff consistently discharge treated effluent that is of out-

standing quality. The final effluent from all three facilities has a monthly average of <1 mg/L for total suspended solids, <2 mg/L for BOD5, and <0.05 mg/L for ammonia nitrogen. The effluent discharge during the disinfection months of May through October is also consistently <5 colonies/100mL for fecal coliform.

Advanced treatment processes

The wastewater treated at the district's three sewage treatment plants passes through a series of five major treatment processes. In addition, the solids produced by the wastewater treatment processes are treated and disposed separately. Wastewater treatment requires an intricate balance of physical, biological, and chemical processes, which are described below.

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Gurnee STP excess flow basin

Preliminary treatment consists of mechanical screening, influent/overflow pumping, and grit removal. The grit is removed centrifugally at the Gurnee and Clavey Road STPs and via gravity at the Waukegan STP. The screened material is collected and disposed of at a municipal landfill, while the wastewater flows to primary treatment.

Primary treatment involves the removal of the settled and floating solids. Solids removed from this process are treated in the solids handling portion of the plant. The primary sedimentation tanks and Imhoff tanks (at the Waukegan STP) are designed to remove approximately 50% of the suspended solids and the BOD load.



Secondary treatment utilizes naturally occurring microorganisms which digest organic material, reduce nutrients, and eventually settle as solids. Primary effluent flow enters the first stage aeration tanks where biological treatment (activated sludge process) removes carbonaceous



Waukegan STP aerial view

BOD. Following first stage aeration, flow enters the first stage clarifiers. The clarified first stage effluent is then pumped to the second stage treatment process. Sludge that settles in the first stage clarifiers is either returned to the first stage aeration tanks or wasted from the process. The second stage biological treatment process is basically the same as the first stage process except that the removal of nitrogenous wastes (ammonia) takes place instead of carbonaceous wastes.

Tertiary (or advanced) treatment is used to further improve the quality of the water. The second stage effluent flow is pumped through deep bed sand filters which significantly reduce

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Ultraviolet disinfection

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the suspended solids and further purify the wastewater. After tertiary treatment, over 90% of solids and BOD have been removed from the wastewater.

Disinfection is the final step in the wastewater treatment process. Following sand filtration, the flow is disinfected by ultraviolet light from May through October. The Waukegan STP and the

Gurnee STP discharge treated effluent to the Des Plaines River and the Clavey Road STP discharges treated effluent to the Skokie River.

Solids Handling involves the treatment of the biosolids removed from the wastewater treatment processes. The solids that are removed during the wastewater treatment processes still

contain a large amount of water so to reduce the volume of solids and disposal costs, the solids are thickened and then dewatered by belt filter presses. The dewatered biosolids are then loaded into trailers and transported to the Zion Sludge Recycling Facility for drying prior to disposal.

The solids at the Clavey Road STP located in Highland Park, undergo anaerobic digestion prior to dewatering by the belt filter presses.

Plant capacity

All three of the district’s advanced sewage treatment plants have permitted excess flow facilities. Built in 1935, the Waukegan STP is designed to treat 22 million gallons per day (MGD) average flow and 44 MGD maximum flow. Influent flows up to 44 MGD are routed through the plant. Influent flows in excess of 44 MGD are pumped to the excess flow retention basins for storage. After the plant influent flow subsides to less than 44 MGD, the sewage in the basins is returned to the plant for treatment. Flows in excess of the storage capacity of the retention basins (38 MG) are discharged to Lake Michigan after screening, sedimentation, and disinfection.

Built in 1956, the Clavey Road STP is designed to treat 17.8 MGD average flow and 28 MGD maximum flow. Influent flows up to 28 MGD are routed through the plant while influent flows in excess of 28 MGD are diverted to the treatment facility’s excess flow retention basins for storage. After the plant influent flow subsides to less than 28 MGD, the

Lake Forest PS underground basin





Waukegan STP

sewage in the basins is returned to the plant for treatment. Flows in excess of the capacity of the retention basins (20.4 MG) are discharged to the Skokie River after screening, sedimentation, and disinfection.

The Gurnee STP, built in 1976, is designed to treat 23.6 MGD average flow and 47.2 MGD maximum flow. Influent flows up to 47.2 MGD are routed through the plant. Influent flows in excess of 47.2 MGD are diverted to the treatment facility's excess flow retention basins for storage. After the plant influent flow subsides to less than 47.2 MGD, the sewage in the basins is returned to the plant for treatment. Flows in excess of the capacity of the retention basins (50 MG) are discharged to the Des Plaines River after screening, sedimentation, and disinfection.

“To further protect the environment, the district is currently designing extensive improvements to its other lakefront pumping stations in Highland Park and Lake Bluff.”

In addition to the excess flow facilities at each STP, the district has also constructed storage basins at two of its pumping stations (PS) located along Lake Michi-



Waukegan STP

gan in North Chicago and in Lake Forest. The storage basin at the Lake Forest PS was the most recently constructed basin and is a two million underground storage basin with automatic flushing gates. To further protect the environment, the district is currently designing extensive improvements to its other lakefront pumping stations in Highland Park and Lake Bluff.

Odor control

The Clavey Road STP has unique operational challenges as it is a completely covered facility. The district covered the STP in the 1970s to control odors. To address possible future volatile organic carbon air emission requirements and to meet neighbors' expectations for odor control, the district installed advanced odor control

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Clavey Road STP

systems at the Clavey Road STP and the Gurnee STP in the 1990s. The installation of advanced odor control systems have led to a significant reduction in odor complaints. The district has also proactively initiated work at the Waukegan STP to install an odor control system in anticipation of the City of Waukegan's future lakefront development plan.

Process automation

Each of the three district sewage treatment plants as well as its pumping stations are fully automated and operate with only two operators in one eight hour shift, five days per week. The rest of the time the plants



Clavey Road STP

operate unstaffed. Each process in the plants is automated using programmable logic controllers (PLCs). The PLC systems have been designed to withstand and recover from momentary power outages and equipment failures.

During the time the plants have been running with this automation, the plant effluent standards have been maintained so that all three plants have continued to meet the criteria for the National Association of Clean Water Agencies' Silver, Gold or Platinum awards each year. The automation has also been beneficial in terms of labor cost savings and in increasing the availability of operational information. [CS](#)



Gurnee STP

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