METROPOLITAN SYRACUSE
WASTEWATER TREATMENT PLANT GUIDE

Onondaga County Department of
WATER ENVIRONMENT PROTECTION

ONONDAGA COUNTY SEAL

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WELCOME TO METRO

Nestled on the south shore of Onondaga Lake, the Metropolitan Syracuse Wastewater Treatment Plant (Metro) is the largest plant owned and operated by the Onondaga County Department of Water Environment Protection (WEP).

Metro's History: The completion of the Erie Canal and railroads and roadways established the City of Syracuse as the heart of the Upstate region. In 1896, the City began constructing its original sewer system. But this early version of wastewater infrastructure didn't treat the wastewater and discharged it directly into streams and drainage ditches, contaminating Central New York waterways.

The Syracuse Sewer Board was established in the early 1900s to investigate sewage disposal and flooding within the city limits. The Board found ways to treat the wastewater (using screening, grit removal, and basic anaerobic processes) and by October 1924 the Syracuse Sewage Treatment Works Plant began operations. In 1940, the City of Syracuse added another treatment plant, the Ley Creek Sewage Treatment Plant and renamed Syracuse Sewage Treatment Works to the Hiawatha Sewage Treatment Plant. Ten years later, Onondaga County took responsibility for wastewater treatment in Syracuse and renamed it the Metropolitan (Metro) plant.

Over the years Metro has underwent major renovations to improve the plant's capacity and treatment processes.

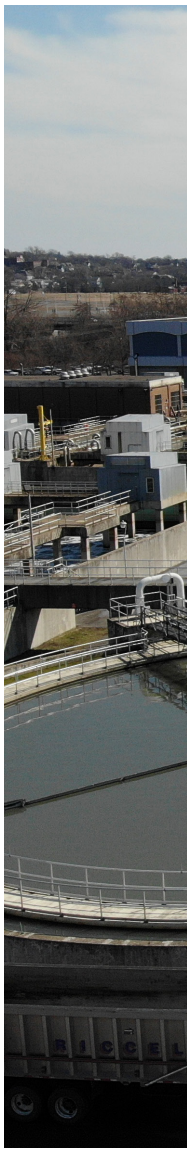
Today Metro serves residents, commercial businesses and industrial customers located in the City of Syracuse and surrounding suburbs. Metro treats an average of 84 million gallons of wastewater a day but can handle up to 240 million gallons!

Photo top left
Exterior of Screen & Grit

Photo bottom left
Interior of Screen & Grit

Photo top right
View of Metro's primary tanks

Photo bottom right
Primary Clarifier



PRELIMINARY
TREATMENT

Preliminary treatment is the first step to treating wastewater when it comes into the facility. It's main purpose is to get rid of the larger solids and debris. This initial procedure is critical because it ensures effective results from other phases of treatment and protects equipment and infrustructure from clogs and damage.

Screenings: Wastewater flows through large steel bars, often called a bar rack or bar screen. The bars are spaced so larger debris can't float through.

Grit Removal: Smaller debris like sand and stones are removed by grit chambers. The grit chambers slow the flow and create a vortex through the chamber, spinning the larger particles out and to the bottom of the tanks.

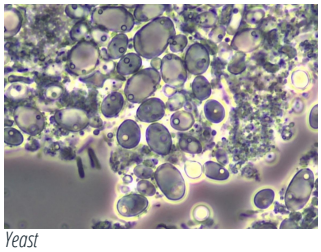
Low Lift Pump Station: Wastewater leaves the grit chambers and enters a wet well before being pumped to primary treatment. By pumping the wastewater up at this stage the plant can use gravity to flow through the next stages of treatment. Metro's Low Lift Pump Station has five (5) centrifugal pumps rated for 600 horsepower.

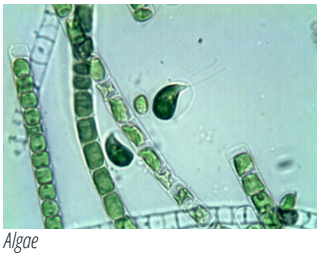
PRIMARY
TREATMENT

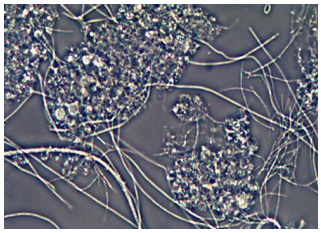
Primary treatment is similar to preliminary treatment in its purpose to further remove solids from wastewater. Solid particles are removed by gravity, while matter that floats is skimmed.

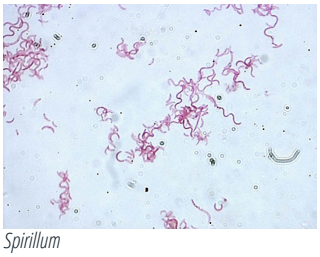
Primary Clarifiers: Metro has eight (8) primary clarifier tanks. Wastewater spends about 2 hours in the tank, giving solids, oils, and grease to separate out. Each tank has two arms that rotate around the tanks. The top arm skims oils and grease that float to the top, while the bottom arm pushes the settling solids to the center of the tank to be pumped out. (*See Biosolids Treatment for the settled solids next steps*).

MICRO-ORGANISMS IN ACTIVATE SLUDGE


Yeast


Algae


Filamentous Bacteria


Spirillum


Stalked Cilates


Rotifers


Nematodes


Water Bears

SECONDARY TREATMENT

Micro-organisms are added to the treatment process at this stage and they feed on the organic matter and suspended solids leftover from primary treatment. Secondary treatment removes roughly 85% of the organic matter in sewage by using a bubbling brew of biological activity.

Activated Sludge Aeration Tanks: Just like the clarifiers, Metro has eight (8) activated sludge aeration tanks that can each hold up to 1.4 million gallons of water. Activated sludge refers to the bacteria, protozoa, and fungi that are introduced at this stage. The micro-organisms feed on the remaining organic matter and solids. The addition of oxygen to the tanks creates the ideal environment for the micro-organisms to thrive.

Secondary Clarifiers: After several hours in the aeration tanks, the brew is moved into settling tanks. Similar to primary treatment, time and gravity allow the activated sludge to separate out of the wastewater. The activated sludge can then be reused in the aeration tanks.

ADVANCED
TREATMENT

After the secondary stage, 85% - 90% of organic matter has been removed from the water and it is safe for the environment. WEP takes treatment a step further to reduce specific nutrients and obtain a higher level of water quality.

Ammonia Removal: Ammonia in high concentrations can be deadly for young fish and other aquatic animals. Through a biological aerated filter (BAF) system, Metro removes the ammonia in the water. The BAF system has eighteen (18) tanks, or cells, that are filled with billions of little beads made of polystyrene. Bacteria are grown on these beads that convert the ammonia in the water to stable forms of nitrogen.

Phosphorous Removal: Phosphorous is a nutrient that helps algae growth. While in limited quantities algae is beneficial, too much can cause problems. To reduce levels , water flows through a series of tanks and a process that uses high rate flocculated settling (HRFS), In the first tank, coagulants are added that stick to phosphorous molecules, creating a larger particle. The second tank has microsand that clings to the coagulants and phosphorous, creating what's called floc. In the third tank, everything gets mixed so floc particles further combine, creating even bigger, heavier particles. In the final tank, the floc sinks to the bottom and is removed from the water. The microsand is then separated from the particles and can be reused in the HRFS process. The rest is sent to the solids handling facility (*see Biosolids Treatment*).

UV Disinfection: In the warmer months of the year, Metro uses ultraviolet disinfection system. The system has 308 high-intensity ultraviolet lights that emit a lethal dose to micro-organisms and destroy genetic material in pathogens that prevents them from multiplying.

BIOSOLIDS
TREATMENT

The solids removed during the wastewater treatment process go through their own process to further remove liquids and disposal costs. Solids are treated physically and chemically to produce biosolids. Metro handles the biosolids treatment for Metro and four other WEP wastewater treatment plants.

Thickening: After being removed from the wastewater, solids still contain some liquid. This is known as sludge. To further separate the solids and liquid, Metro uses two types of equipment that use gravity.

Tank Thickeners: The solids from primary and advanced treatment are sent to tank thickeners. Tank thickeners work similar to the clarifiers. Solids settle to the bottom of the tank and pushed to the center where they are then pumped to the Sludge Blend Building. Liquids at the top, also known as supernatant, are sent to the Low Lift Pump Station to begin the wastewater treatment process.

Gravity Belt Thickeners: Sludge from secondary treatment is thickened using a gravity belt system. The system is like a conveyor belt with holes in it. The holes allow the liquid to drain, separating it from the solids.

Sludge Blend Building: Once thickened, the sludges from Metro's thickening processes are mixed with sludges received from the other four wastewater treatment plants. This creates a more consistent mix for the next steps of treatment.

Primary & Secondary Digesters: Metro has three (3) primary digesters. The digesters are heated, oxygen-free environments that use anaerobic bacteria. The bacteria "digests" the solids and as a result, biogas is produced. (*See Biogas Storage*). The secondary digester continues the process, breaking down solids even further by extending the digestion duration.

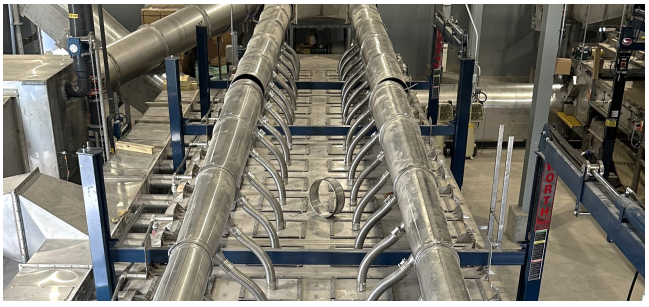
Centrifugal Thickening: Once the anaerobic bacteria have had their fill, remaining solids are sent to centrifuge thickeners. This process is similar to a salad spinner, using speed and rotation to remove liquids. The addition of polymers helps to separate the water from the solids. At this point, what was sludge is now referred to as cake and still contains roughly 70% water and is 30% solids.

Drying: The final stage of biosolids treatment uses a dryer system. The cake moves along a conveyor belt through a large heated forced air dryer. This process can remove almost all water, leaving up to 90% solids that are lighter, reducing disposal costs, and are higher quality biosolids.

Gravity Belt Thickener

Primary Digester

Centrifuge



Biosolids Dryer

BIOGAS
STORAGE AND USE

Biogas is the byproduct of digestion during biosolids treatment and is mostly methane gas.

Storage: Metro has two (2) big blue domes on campus called duospheres. Each one can hold 122,000 cubic feet of gas.

Use: Combined heat and power (CHP) units take biogas from the duospheres and generate heat for the digesters and electricity for the Metro treatment plant.

Burning biogas: When the duospheres are full, the excess biogas is burned.

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Website
ongov.net/wep