City of Warren Wastewater Recovery Facility

Warren's Wastewater Recovery Facility (WWRF), constructed in 1959, was one of the first advanced wastewater treatment facilities in the country to be placed into service and continues to meet the stringent discharge limitations imposed by State and Federal authorities.

The treatment plant staff is proud of the many awards received, attesting to the outstanding operational performance of the facility. The exemplary performance record has been maintained, in part, as the result of the solid budgetary support provided in the past and can only be maintained with a continuation of that support by the Mayor and the City Council of Warren.

An efficiency study first commissioned in Fiscal Year 1999 began an elaborate process of evaluating the technologies employed in the operation of the WWRF and the work practices of employees at every level of operation. The collaborative efforts of employees and consultants resulted in the WWRF becoming a highly efficient operation.

The WWRF is a recognized leader in the protection of the environment in southeast Michigan. In 1983, and again in 1991, the United States Environmental Protection Agency presented an award to the Treatment Plant for being the best operated and maintained pollution control facility in Region V. Also, in 1991, the Warren WWRF won the award for the best operated and maintained facility in the nation for the 'Large WWTP Category' (flow more than 20 MGD).

In 1994, the City's Industrial Pretreatment Program received the Environmental Protection Agency's National 2nd Place Award for outstanding Pretreatment Program for the protection of the facility and the environment from harmful commercial and industrial discharge.

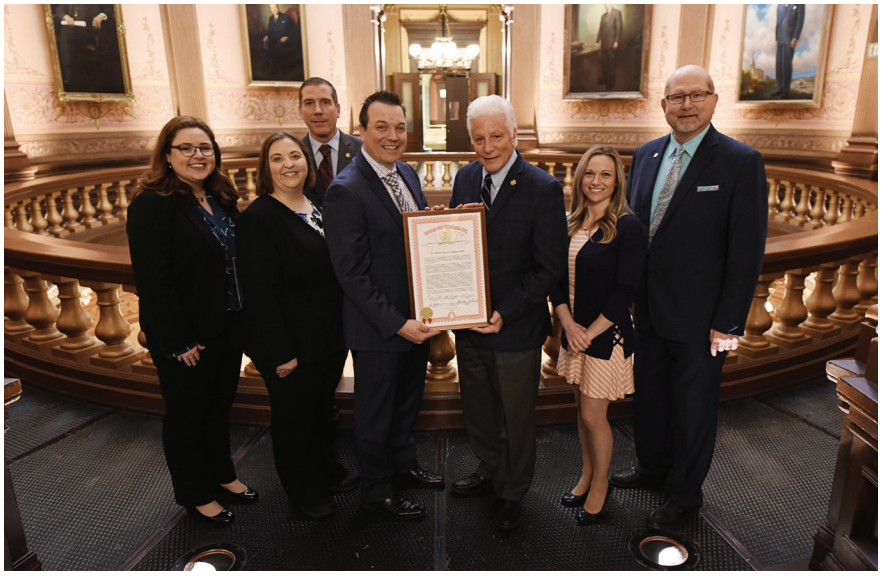
In 2020, the City of Warren received the PUMP award from MWEA. The City received this award due to the continued path toward excellence. The City recently

Plant Name	City of Warren WWRF
First Started Operation	1959
Average Day Flow	22 MGD
Design Flow	50 MGD Average – 100 MGD Peak
Number of Lift Stations Serving the Plant	1
Primary Treatment Process	Rectangular Primary Clarifiers
Grit Removal	Gravity Settling Channels
Secondary Treatment Process	Conventional Activated Sludge with BNR
Tertiary Treatment Process	Sand Filtration
Biosolids Treatment Process	Incineration
Ultimate Disposal	Ashes to Land Fill
Effluent Discharge To:	Red Run Drain to Clinton River
Number and Breakdown of Staff	40 Total (four mechanics, three electricians, three engineers, four lab staff, 13 operators, three IT, four IPP, four administration, two trainees)
Annual Budget	$11 million General Fund and $5 million Capital Improvement
Adopt-A-School Program	Working with Van Dyke Public Schools (not happening yet, as COVID-19 halted process)

performed many energy efficient upgrades and changed hiring practices, always striving toward better stakeholder input of the facility.

The City continues to have a state-of-the-art treatment facility that has a design capacity of 50 MGD per day and can handle a peak flow, during wet weather events, of 100 MGD. The City of Warren Water Recovery Facility regularly treats 22 MGD of wastewater.

Service area includes 34 square miles of the City of Warren with only one lift station in the collection system and has 497 miles of sewer pipe varying is size from 42 to 84 inches.



Preliminary Treatment

Bar Screens: Three mechanically cleaned bar screens with ½ inch openings are available to remove large debris and trash. Each screen is capable of handling flow up to 90 MGD. The screenings are trucked to a landfill.

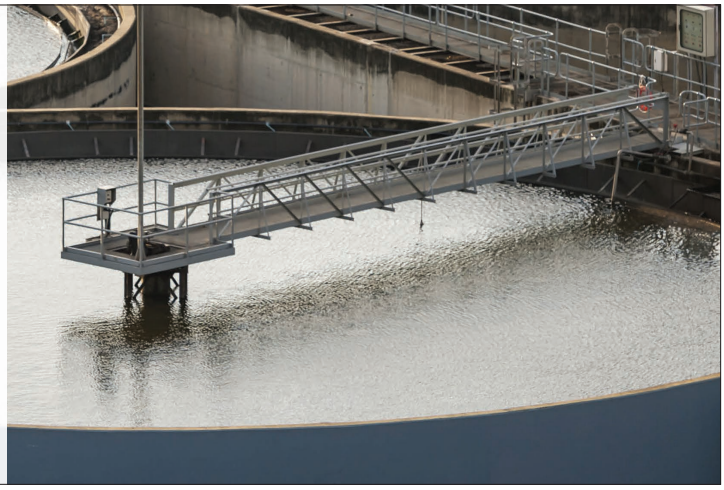
Raw Sewage Pumping Station: After screening, eight raw sewage pumps lift the sewage 65 feet to the grit removal structure. The total pumping capacity is about 200 MGD.

Grit Chamber: The grit chamber consists of three covered channels. The chamber removes coarse inorganic solids to reduce wear on operating mechanisms and limit solids build-up in the primary settling tanks. The grit and screenings are trucked to a sanitary landfill.

Primary Treatment

Primary Settling Tanks: Flow from the grit chamber is directed to eight primary settling tanks with a total capacity of 1.7 million gallons. Detention in these tanks results in removal of approximately 60% of the suspended solids and 40 percent of the five-day biochemical oxygen demand (BOD_5). Settled solids are collected and pumped to the sludge processing facility.

Retention Basin: During wet weather, flows greater than the treatment plant hydraulic capacity of 60 MGD are diverted to a 50 million gallon retention basin. On rare occasions during large storms, the



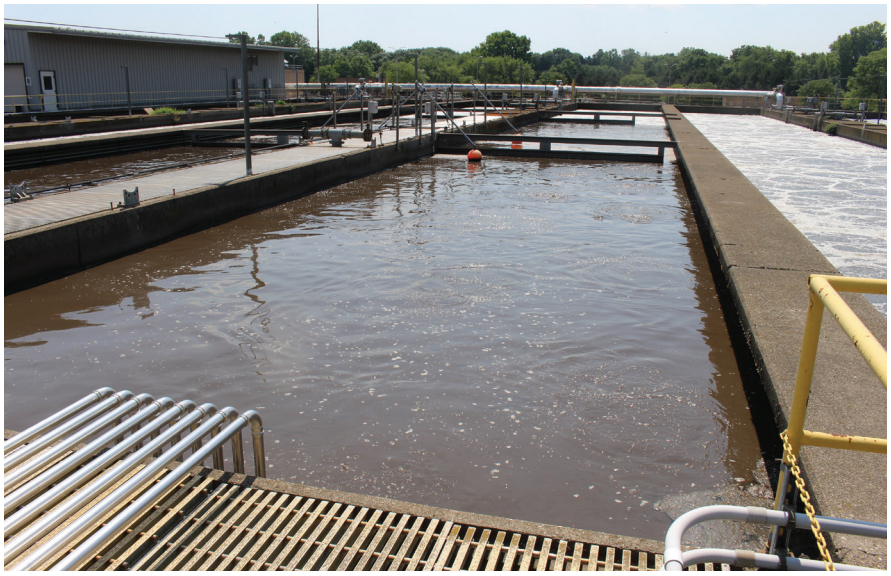
basin overflows. Overflow from the basin is mixed with tertiary effluent, chlorinated and discharged to the Red Run Drain.

When the storm ends, retained flow in the basin is returned to the plant for treatment. During dry periods, the basin can also be used to store sewage with high concentrations of harmful contaminants, which may result from industrial spills, accidents, or illegal dumping. If this occurs, the sewage is returned at a controlled rate for treatment.

Secondary Treatment

Aeration Tanks: This treatment stage consists of a single-stage activated sludge system, which provides removal of both the carbonaceous and nitrogenous oxygen demanding organics. Treatment at this stage is in four of six aeration tanks with a detention time of 4.5 hours at design flow. Two tanks operate as plug flow anoxic aeration reactors and two tanks as complete mix aeration basins. Ferric chloride is added for sulfide control and phosphorus removal at the plant influent pumping station. However, ferric chloride or alum can also be fed at the aeration tanks if required for alternate phosphorus removal.

Secondary Settling Tanks: After aeration, the flow is directed to eight settling tanks, with a total volume of 4.9 million gallons. The solids settle in these tanks. Some of the settled solids from the secondary settling tanks are returned to the aeration tanks for reuse. Excess solids from the settling tanks are transferred to the sludge handling facility. Effluent from these tanks is then pumped to the rapid sand filters for tertiary treatment.



Tertiary Treatment

Secondary Effluent Pumping Station: This station discharges the effluent from the secondary clarifiers to the rapid sand filters. Four vertical mixed flow turbine pumps are utilized, each with 20 MGD capacity.

Mixed Media Filters: Twelve mixed media filter units with a total filter bed area of 8,640 square feet are used at this stage. Filtered water, stored in a 220,000-gallon reservoir, is used to backwash the filters. Waste wash water containing solids removed from the filters is returned to the aeration tank for processing.

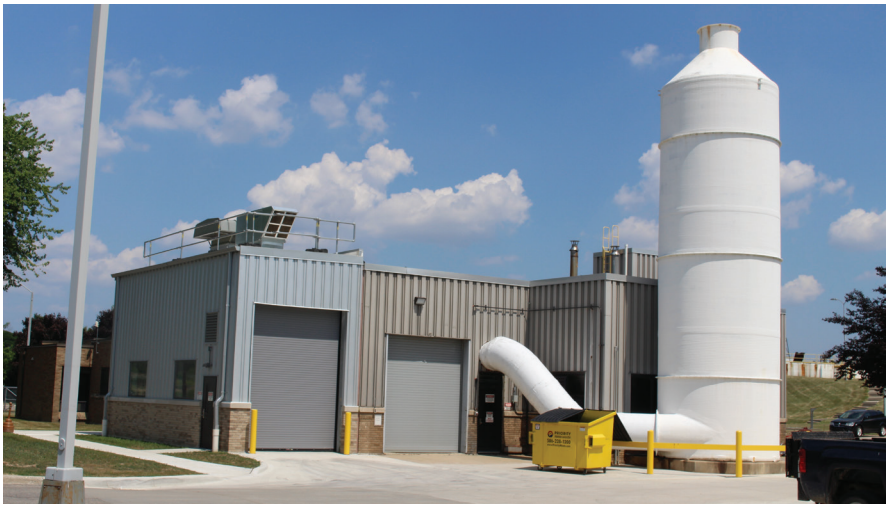
Disinfection: In 2010, the City of Warren replaced its chlorination system with a UV System. This process has two channels with four banks of bulbs (640 bulbs in total). The UV system is a safe and environmentally friendly way to disinfect wastewater. It provides disinfection of the final effluent against pathogens, bacteria and viruses before it discharges to the Red Run drain.

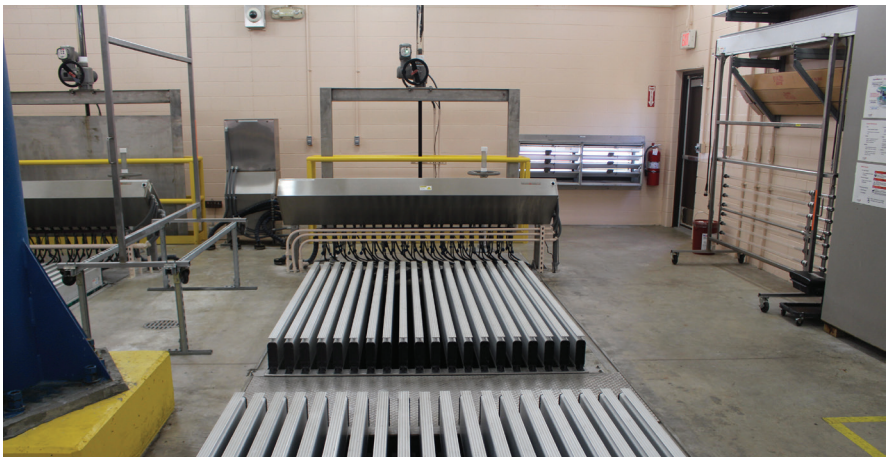
The city has a back-up system which uses hypochlorite and is able to deliver 10 gal/min. At the end of the chlorine contact tank the chlorinated effluent is dosed with 38% sodium bisulfite for dechlorination. The dechlorination system is capable of feeding 1,460 pounds/day by two 2.6 gallons per hour (gph) metering pumps. The sodium bisulfite reacts with the residual chlorine to reduce the concentration of total residual chlorine below the state imposed effluent standard of 0.038 mg/l.

Sludge Handling

Sludge Storage Tanks: Sludge resulting from the primary settling tanks is stored in four 68,000-gallon primary sludge storage tanks. Secondary sludge from the flotation thickeners is stored in two 204,000-gallon activated sludge storage tanks. The two sludges are mixed in three 50,000-gallon blended sludge storage tanks.

Belt Filter Presses: Blended sludge is thickened and dewatered by three 2.2-meter belt filter presses (BFPs) each with a gravity belt thickener stacked on top. Sludge is conditioned by the addition of a polymer coagulation agent to improve filterability prior to being fed to the filters. The resulting filter cake is discharged to a belt conveyor system for transport to the sludge incinerator.





Sludge Incinerator: Filter cake produced by the BFPs is incinerated in a 10 hearth 25”-9” diameter multiple hearth incinerator. Natural gas is used as a supplementary fuel. A counter-flow water impingement plate scrubber is provided to cleanse the exhaust gases before discharge to the atmosphere. Chlorinated plant effluent is used as a liquid medium in the scrubber system.

Ash Disposal: Ash from the furnace is discharged at the bottom and slurried using water discharged from the scrubber system. Slurried ash is pumped to two ash settling lagoons. Overflow water from the lagoons is returned to the treatment plant for processing. Dewatered ash is trucked from the ash lagoons to a landfill.