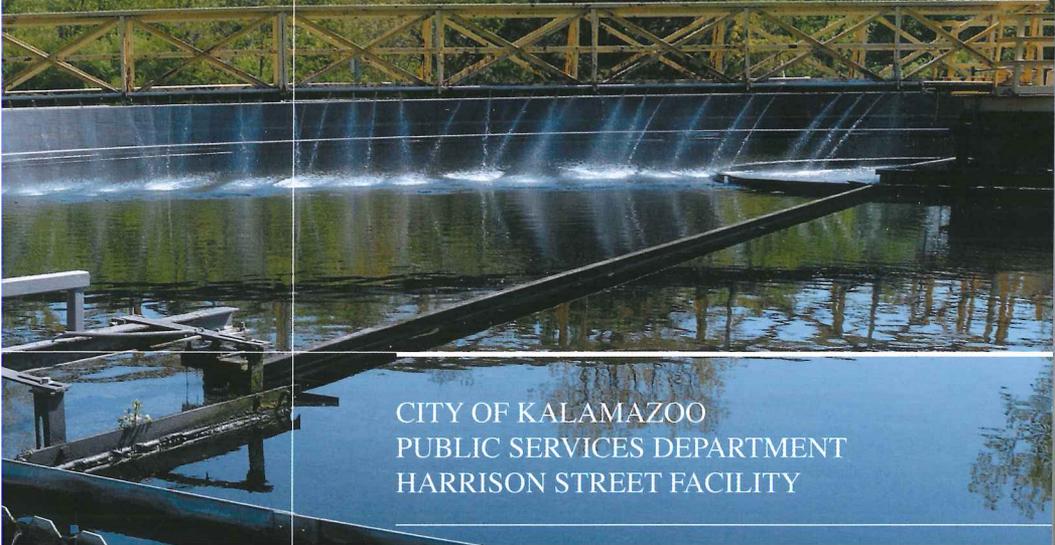


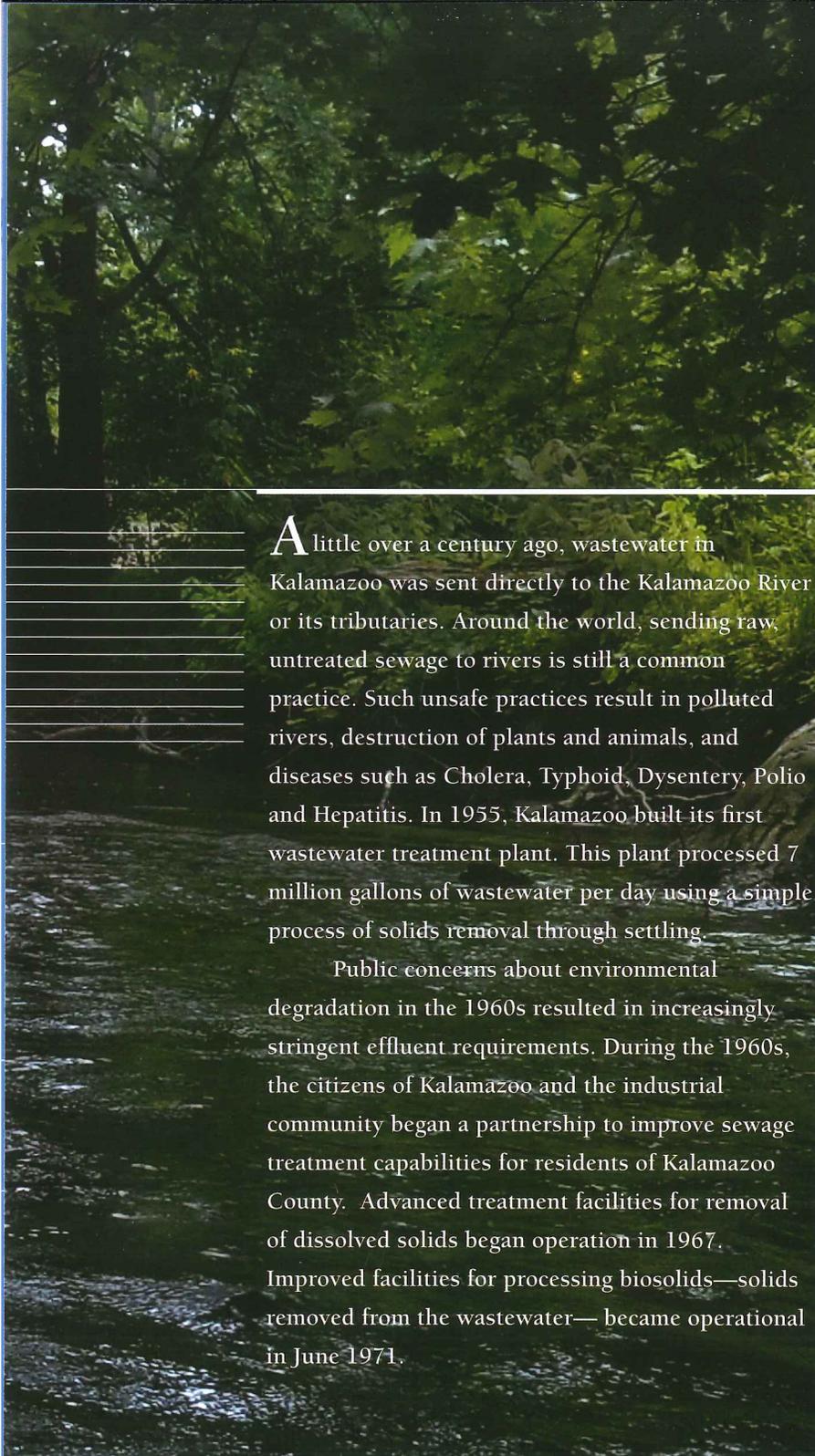
THE CITY OF



# KALAMAZOO REGIONAL WATER RECLAMATION PLANT



CITY OF KALAMAZOO  
PUBLIC SERVICES DEPARTMENT  
HARRISON STREET FACILITY



A little over a century ago, wastewater in Kalamazoo was sent directly to the Kalamazoo River or its tributaries. Around the world, sending raw, untreated sewage to rivers is still a common practice. Such unsafe practices result in polluted rivers, destruction of plants and animals, and diseases such as Cholera, Typhoid, Dysentery, Polio and Hepatitis. In 1955, Kalamazoo built its first wastewater treatment plant. This plant processed 7 million gallons of wastewater per day using a simple process of solids removal through settling.

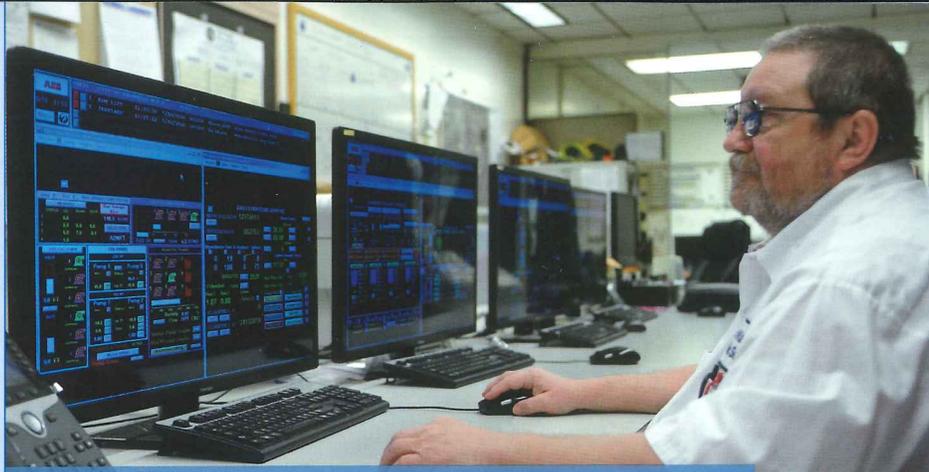
Public concerns about environmental degradation in the 1960s resulted in increasingly stringent effluent requirements. During the 1960s, the citizens of Kalamazoo and the industrial community began a partnership to improve sewage treatment capabilities for residents of Kalamazoo County. Advanced treatment facilities for removal of dissolved solids began operation in 1967. Improved facilities for processing biosolids—solids removed from the wastewater— became operational in June 1971.

With the passage of the Clean Water Act in 1972, Congress made a commitment to restore the nation's water resources. Projections indicated that effluent requirements would become more restrictive and sanitary service needs of communities would increase. Again, the citizens of Kalamazoo worked with the environmental and industrial communities, this time conducting pilot studies to determine the most cost-effective means of meeting current and future requirements. With federal assistance, the community embarked on a long series of construction projects to upgrade the Kalamazoo plant. This development was completed in 1987.

The City of Kalamazoo Water Reclamation Plant (KWRP) currently provides treatment services to more than 150,000 residents in 18 Kalamazoo area municipal jurisdictions.

The KWRP uses an innovative treatment system to treat a variety of pollutants in concentrations that most other plants cannot. The plant incorporates powdered activated carbon (PAC) treatment into its secondary process. With a PAC process, the plant treats wastewater from a variety of industries without the need for pretreatment.

The KWRP currently receives a significant portion of its wastewater from industrial sources. Manufacturers that produce pharmaceuticals, organic chemicals, spices and food additives, as well as projects associated from groundwater clean-up and remediation of contaminated groundwater directly benefit from the PAC process. By providing these businesses with state-of-the-art, unique wastewater treatment, the KWRP helps the community attract and retain employers who offer employment opportunities to residents.



## ADMINISTRATION BUILDING CONTROL ROOM

### TYPICAL PLANT LOADINGS SINCE 2003

Influent Flow	<b>25.5 MGD</b>
Total Phosphorus	<b>1,956 lbs/day</b>
Total Suspended Solids	<b>77,537 lbs/day</b>
Ammonia	<b>4,620 lbs/day</b>
Biochemical Oxygen Demand	<b>94,154 lbs/day</b>

This is where a centralized computer system monitors processes within the plant and remote wastewater lift stations. Continuous monitoring enables the treatment to be varied in response to conditions within the plant and changing wastewater characteristics.

Treatment Operations Supervisors provide a key link between the computer and field operation staff.



## RAW WASTEWATER PUMPING AND SCREENING

Incoming wastewater is pumped by any combination of six different pumps—two 125 HP pumps, two 150 HP pumps, and two 200 HP pumps. Plant flow capacity is 53.8 MGD.

As the wastewater enters the plant, it is screened to remove large debris contained in the flow. Unless removed, the debris could damage pumps or equipment in the wastewater treatment facility.

The wastewater is then pumped to the primary treatment facilities. Computer control of the pumps stabilizes the flow rate and loading to downstream processes.

## PRIMARY TREATMENT FACILITIES

The municipal primary treatment facilities consist of two processes. Screening is the first of the processes and consists of two parts. In the first part, grit is removed as the wastewater flows through the two grit tanks. The heavy grit particles settle to the bottom of the tank. Air, which is injected into the flow, creates a spiral motion and ensures that lighter organic solids are not removed with the grit. The second part takes the flow through any of three fine screens to remove the smaller floating solids.

The second primary treatment is sedimentation. Wastewater flows to any of six sedimentation tanks. Here, under quiescent conditions, settleable solids are removed from the wastewater. The settled solids are moved to one end of the tank and pumped to the solids treatment facilities.

Wastewater is settled in up to six 0.5 million gallon settling tanks.



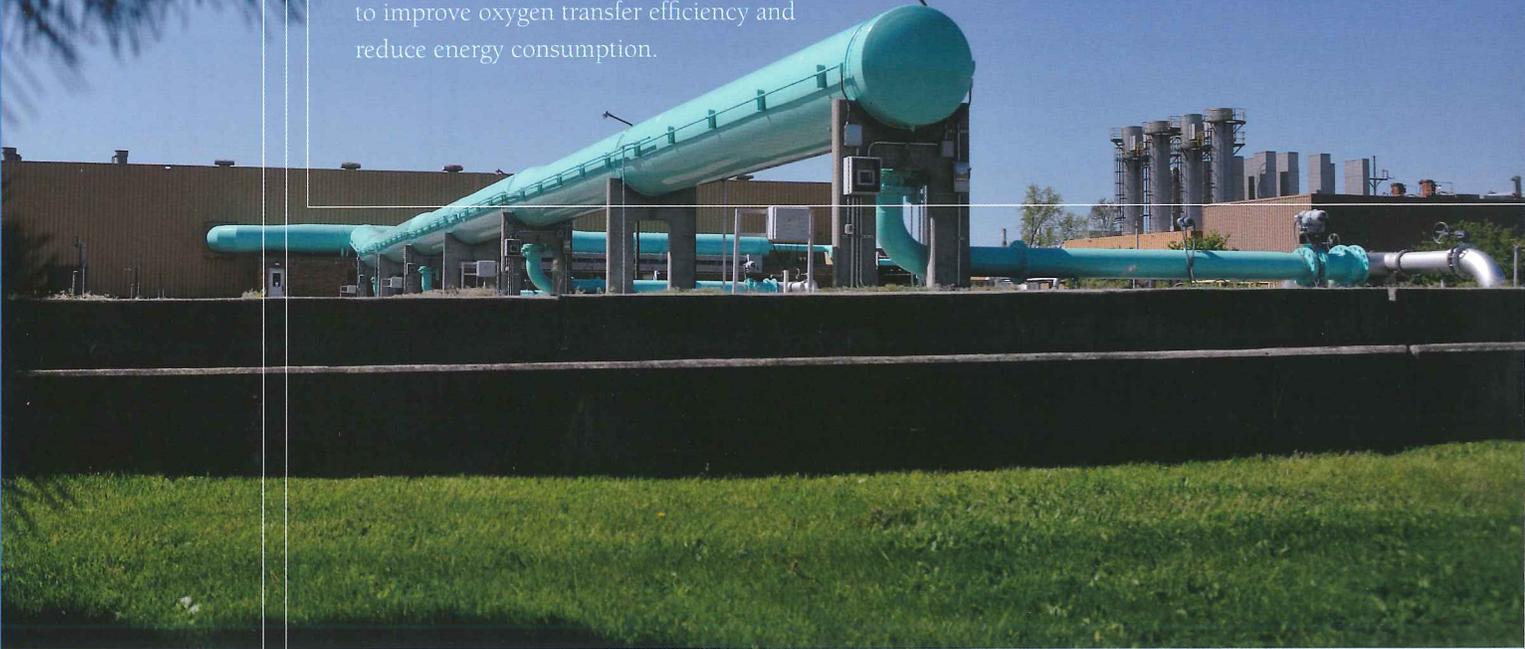
## SECONDARY TREATMENT WITH POWDERED ACTIVATED CARBON

Primary treatment effluent flows to the secondary treatment facility. This process is designed to remove the dissolved and finely divided impurities. This process is often referred to as “biological treatment” since it utilizes various microorganisms to treat the wastewater.

Wastewater is treated biologically with aeration and carbon addition in up to nine 2.03 million gallon aeration tanks.

## AERATION TANKS

In secondary treatment, the wastewater is combined with bacteria and powdered activated carbon (PAC) to make a slurry called mixed liquor. This slurry flows through Anaerobic, Anoxic, and Aerobic conditions to remove phosphorous and nitrogen biologically in large rectangular basins. Bacteria use the organic solids as food for metabolism and production of new cellular material. PAC plays an important part, since it adsorbs those impurities which inhibit bacterial growth or are not easily "digested" by bacteria. It also acts as a weighting agent to enhance settling characteristics. PAC also improves nitrification by improving surface area for the microorganisms. Fine bubble diffusers are utilized to improve oxygen transfer efficiency and reduce energy consumption.



## FINAL CLARIFICATION TANKS

Carbon and bacteria are removed by settling in tanks, which follow the aeration process. The settled slurry of bacteria and PAC are removed from the bottom of the tank and returned to the beginning of the secondary process. A portion of the slurry is again combined with wastewater entering the secondary treatment facilities and the remaining portion of the returned slurry is pumped to the solids treatment facility.

### TYPICAL REMOVAL EFFICIENCY AFTER SECONDARY AERATION

Total Phosphorus	<b>93%</b>
Total Suspended Solids	<b>95%</b>
Ammonia	<b>98%</b>
Biochemical Oxygen Demand	<b>99%</b>



Wastewater is aerated by a combination of two 1350 HP blowers and two 2500 HP blowers.



After biological treatment in secondary, wastewater is settled in up to seven clarifiers—four 1.85 million gallon clarifiers and three 1.18 million gallon clarifiers.

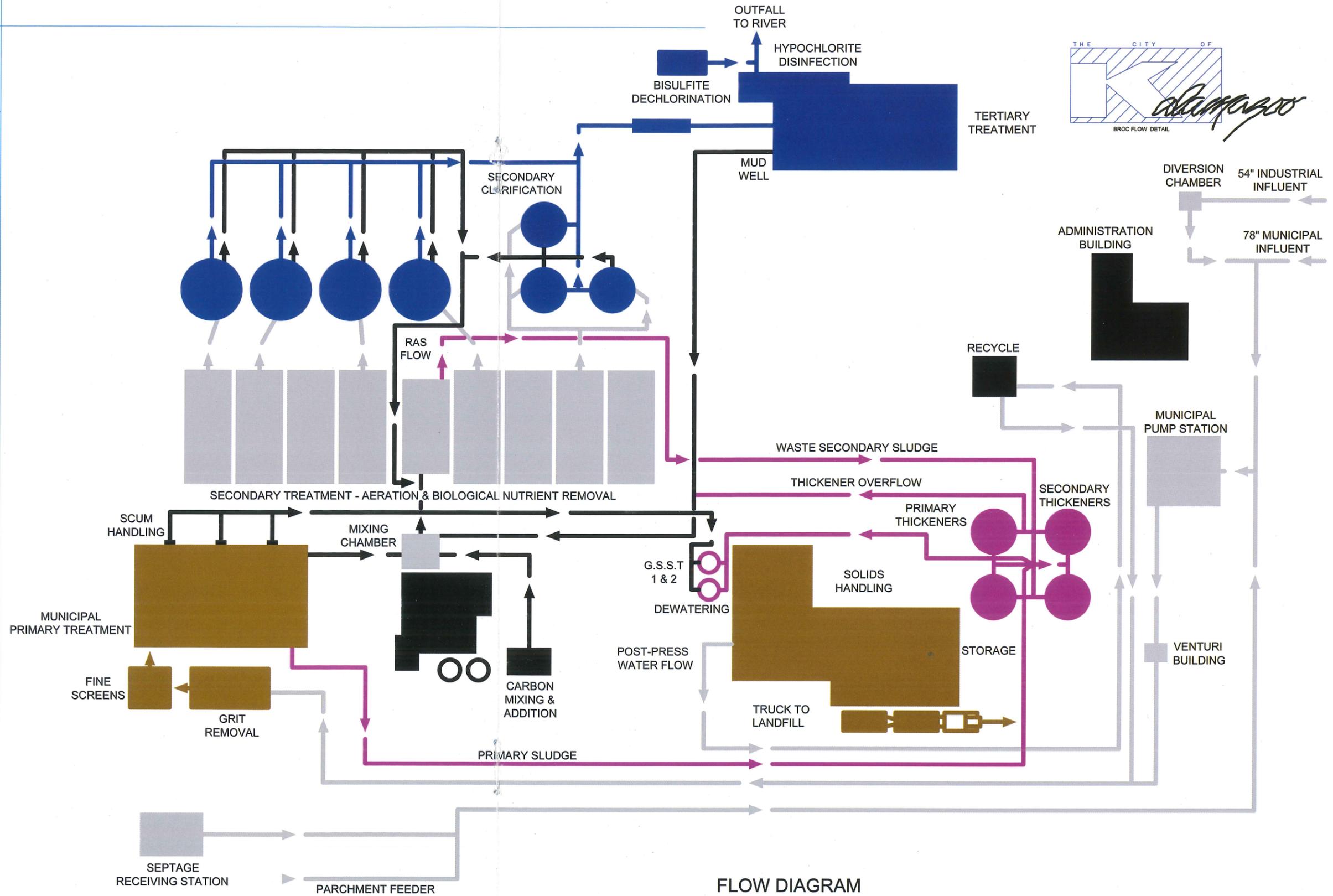
# WASTEWATER TREATMENT PATHWAY AT THE KALAMAZOO WATER RECLAMATION PLANT

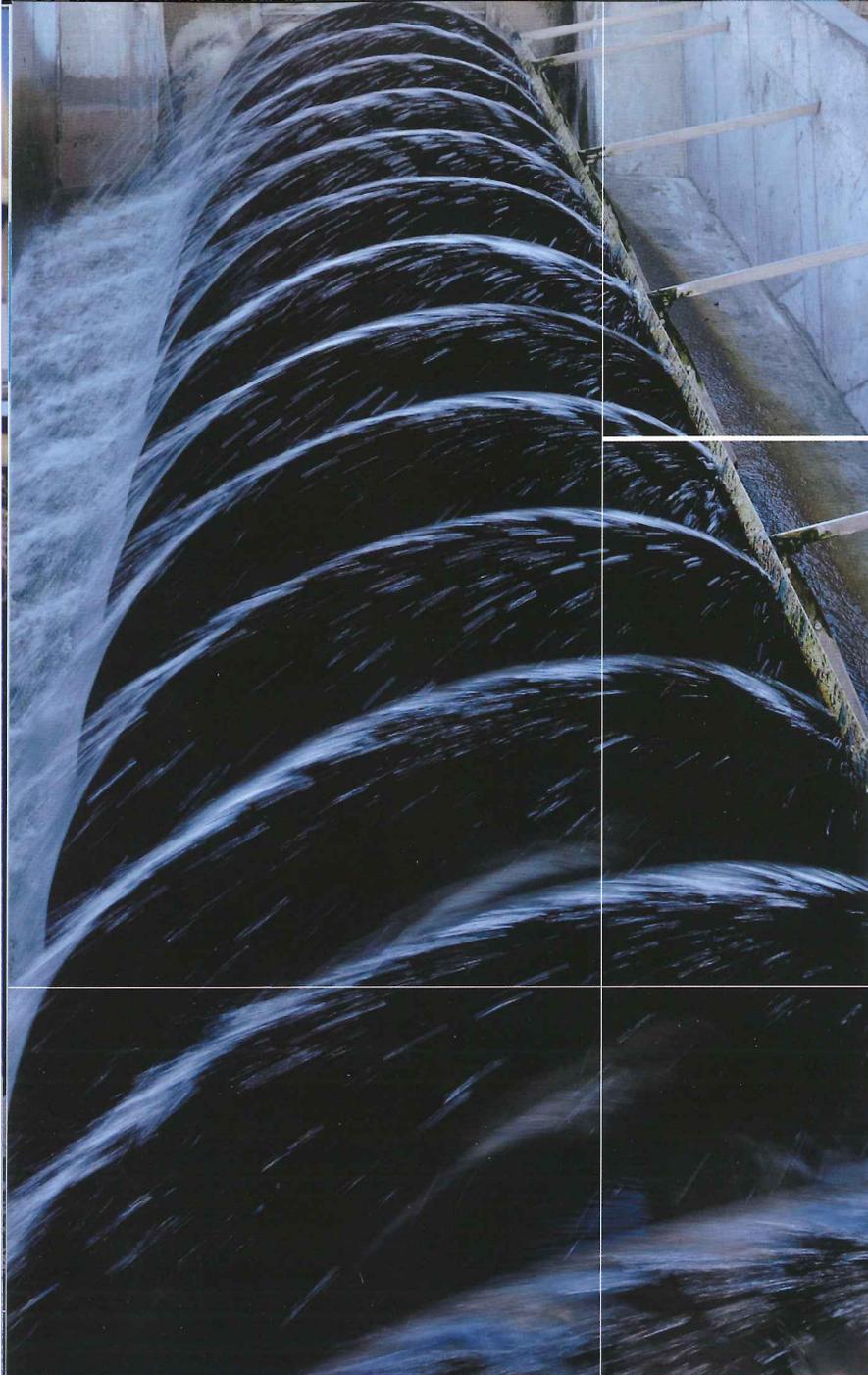
## 1. Water Purification Pathway:

Wastewater that enters the treatment plant comes mainly from two sources. We all create dirty water, whether it's from the dishwasher, bathtub, drinking fountain, drain or, of course, the toilet. Industry produces a lot of wastewater through a variety of cleaning, cooling and manufacturing processes. It is all screened and settled together (Primary Treatment) to remove settleable solids. Virgin carbon is added at the mixing chamber prior to Secondary Treatment where the wastes are broken down by biological processes and adsorbed by activated carbon. The waste is then settled again (Secondary Clarification) to remove more solids. It then flows to Tertiary Treatment where it undergoes Rapid Sand Filtration, is chlorinated to kill bacteria, and is dechlorinated to remove excess chlorine that could be harmful to organisms in the receiving stream. This highly polished effluent is discharged to the Kalamazoo River.

## 2. Biosolids Treatment Pathways:

Primary and Secondary solids are gravity thickened separately and pumped to the Solids Handling Facility (SHF). Solids are dewatered by belt presses. The dewatered solids are hauled away and landfilled.





## TERTIARY TREATMENT AND FILTERS

Tertiary treatment consists of ten gravity sand filters which remove small suspended solid particles and fugitive carbon remaining from secondary treatment. In order to reach the filters, the wastewater must be lifted by five screw pumps at the Tertiary Pump Station.

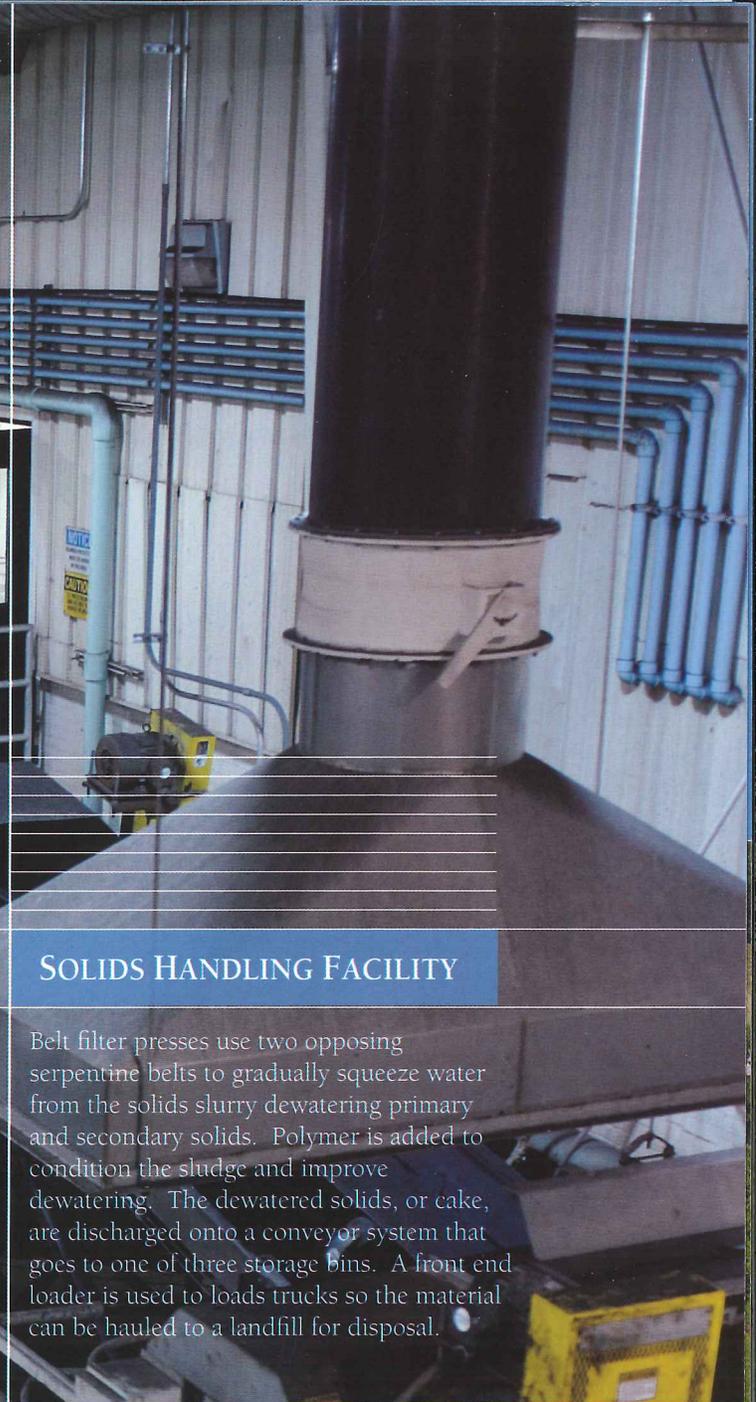
The tertiary filters remove solid particles as the wastewater passes through the small voids in the sand. The solid particles that become trapped on the filter surface are removed by backwashing. The filtered water is then chemically disinfected to destroy disease causing organisms. Following disinfection, the flow is dechlorinated prior to discharge to the Kalamazoo River.



### TYPICAL REMOVAL EFFICIENCY AFTER TERTIARY SAND FILTRATION

Total Phosphorus **96.4%**  
Total Suspended Solids **99%**  
Ammonia **98.8%**  
Biochemical Oxygen Demand **99.4%**



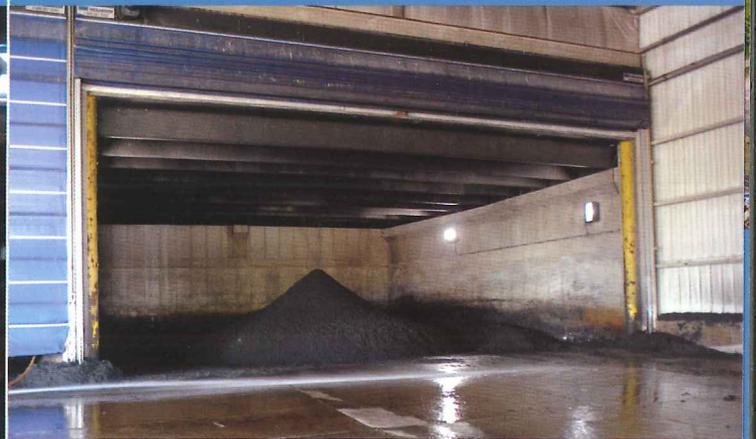


## SOLIDS HANDLING FACILITY

Belt filter presses use two opposing serpentine belts to gradually squeeze water from the solids slurry dewatering primary and secondary solids. Polymer is added to condition the sludge and improve dewatering. The dewatered solids, or cake, are discharged onto a conveyor system that goes to one of three storage bins. A front end loader is used to load trucks so the material can be hauled to a landfill for disposal.

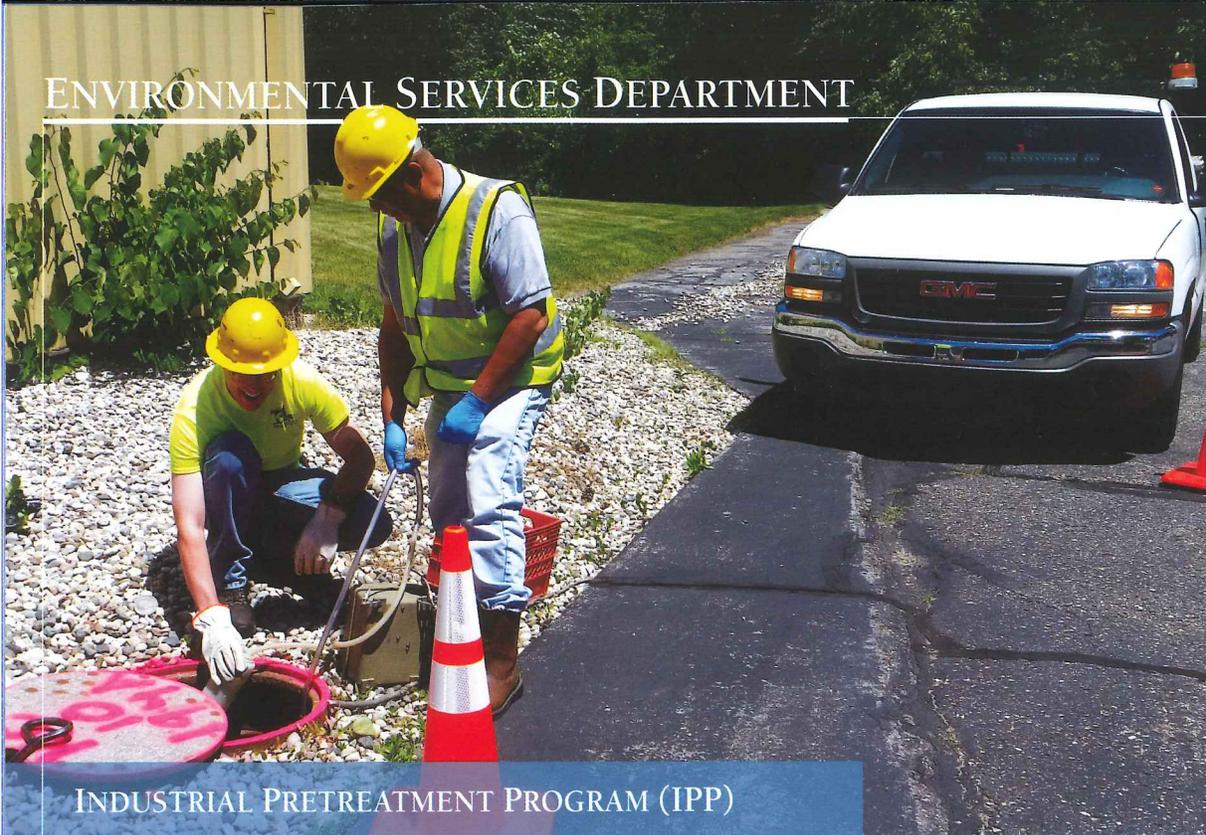


Solids removed in primary and secondary treatment are dewatered by up to four belt filter presses. Primary solids are typically dewatered to 27.3% TS and secondary solids are typically dewatered to 15.7% TS.



Plant produces about 222 wet tons of dewatered solids daily. These solids are hauled to regional Type II landfills.

# ENVIRONMENTAL SERVICES DEPARTMENT



## INDUSTRIAL PRETREATMENT PROGRAM (IPP)

The main objective of the IPP is to prevent introduction of pollutants into KWRP which would interfere with its operation or pass through the plant untreated. The IPP also improves the opportunities to recycle and reclaim municipal and industrial wastewaters and biosolids. The IPP accomplishes these objectives by controlling wastes at their sources before being discharged to the sewer system.

KWRP monitors 29 significant industrial users. Industry contributes over 20% of the flow and over 60% of the loading received daily at the Kalamazoo Water Reclamation Plant.



## LABORATORY FACILITIES

The plant laboratory is essential in monitoring the wastewater characteristics and for required Michigan Department of Environmental Quality reporting. The laboratory is well equipped with sophisticated instruments for water analysis and is staffed with highly qualified technicians.

The KWRP laboratory conducts over 100 analyses every day for wastewater treatment monitoring.

*How many regional stakeholders collaborate with the Water Reclamation Plant to ensure its success?*

Seventeen entities representing 22 governmental agencies regularly meet with the Kalamazoo Water Reclamation Plant to discuss the status of wastewater treatment in the region. We thank them for the key role they play in helping KWRP achieve its mission of outstanding wastewater treatment. These agencies include:

Charleston Township  
Cooper Township  
Kalamazoo Township  
Oshtemo Township  
Pavilion Township  
Schoolcraft Township  
Texas Township  
City of Galesburg  
City of Parchment  
City of Augusta  
Village of Vicksburg

Comstock Township  
City of Kalamazoo  
City of Portage  
Village of Mattawan  
South County  
Gull Lake Sewer Authority:  
*Barry Township*  
*Prairieville Township*  
*Richland Township*  
*Village of Richland*  
*Ross Township*



*How does wastewater get to the plant?*

Wastewater flows by gravity in pipes ranging from 4 inches to 72 inches in diameter through over 900 miles of sewer main. Occasionally, flow is pumped higher by 62 lift stations in the service area to flow again by gravity to the treatment plant.



Kalamazoo Regional  
Water Reclamation Plant  
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[www.Kalamazoocity.org](http://www.Kalamazoocity.org)