BATAVIA WASTEWATER TREATMENT FACILITIES: THE CULMINATION OF A LONG EFFORT

In July, 1990, initial treatment of wastewater was begun at the new wastewater treatment facilities which serve the City and a portion of the Town of Batavia. Completion of the new facilities represents the culmination of a long term effort on the part of the City and Town to provide upgraded treatment of wastewaters from the City and Town prior to discharge to Tonawanda Creek. The new facilities also enable the moratorium against new sewer connections to be lifted, thereby enhancing the City and Town's opportunities to expand their economic growth.

The new treatment facilities are constructed on approximately 500 acres of land bordering the Conrail railroad tracks east of Donahue Road and north of Rose Road and replace the City's old mechanical wastewater treatment plant which was located on the south bank of Tonawanda Creek east of River Street.

The City began initial planning efforts to improve the degree of treatment provided to wastewaters from the City and Town in the mid-1970's. This effort was prompted by City and State concerns regarding the inability of the existing wastewater treatment plant to provide adequate treatment of wastewaters during periods of high flows to the plant as well as by the imposition of more stringent treatment requirements by the Department of Environmental Conservation with respect to of the treated wastewaters discharged to Tonawanda Creek.

Initial study and planning efforts focused upon upgrading or replacing the City's existing mechanical treatment facility with a similar facility. However, estimates indicated that the project costs, particularly with regard to annual operation and maintenance of the new facility, would place a tremendous burden upon the City and its customers. Accordingly, an expanded study effort was conducted in the early 1980's to evaluate a much wider range of treatment alternatives to determine if a more cost-effective treatment system could be found. The new study effort resulted in the recommendation that the City construct a treatment system using a series of wastewater treatment lagoons instead of a mechanical treatment plant. While the lagoon system requires the use of a significantly larger land area, overall costs to the City and its customers are expected to be nearly one-third less. This cost savings is largely the result of an estimated savings of nearly fifty percent with regard to annual operation and maintenance costs.

Based upon the results of the new study, the City authorized its engineers to begin final design of the recommended treatment lagoon system in the fall of 1986. Upon completion of the final design plans and contract documents, including review and approval by State and Federal agencies, the project was advertised for construction bids in December, 1987. Bids were received in January, 1988, and construction contracts were awarded in April, 1988. Construction of the new treatment facilities required a period of approximately two and one-half years. In July, 1990, Batavia's wastewaters were diverted to the new facilities, culminating a process which began nearly 15 years earlier.

DESCRIPTION OF THE FACILITIES

The new Batavia Wastewater Treatment facilities include an Operations Center Building, a total of nine wastewater treatment lagoons, and a series of three shallow man-made wetlands.

Wastewater is pumped to the treatment facilities from the new Central Wastewater Pump Station located near the center of the City. This pump station houses three 77 and three 200 horsepower submersible wastewater pumps and has the capacity to pump up to 16,250 gallons per minute, or 24 million gallons per day, to the treatment facilities. Average design flows from the pump station to the treatment facilities are 5.5 million gallons per day.

The flow from the Central Pump Station enters the treatment facilities at the Operations Center. Here, the wastewater flow is measured and preliminary treatment consisting of screening and grit removal take place. Screening is provided to remove rags and other larger solids from the wastewater to prevent their accumulation in the wastewater lagoons. The screening is accomplished by means of an automatic self-cleaning mechanical screen designed to capture solids larger than approximately 1/4 inch diameter.

After screening, the flow passes through an aerated grit removal chamber. In the grit chamber, a spiral flow pattern created by air diffusers located on one side of the chamber causes small stones and sand present in the wastewater to settle to the bottom of the chamber as a grit slurry. The grit slurry is removed from the chambers by means of pumping and is dewatered to provide a comparatively dry grit for disposal. The dewatered grit and the screenings removed by the mechanical screen are discharged to a waste disposal trailer for burial at an approved landfill site.

From the grit chamber, the wastewater flows to the treatment lagoons. The first three treatment lagoons are designated Aerated Ponds 1, 2, and 3. Each of these ponds has a surface area of approximately 10.5 acres, an operating depth of about 20 feet, and holds nearly 60 million gallons of water. Normally, the aerated ponds are operated in series so that the flow is from Pond 1 to Pond 2 to Pond 3. However, the system design also allows the flow to the ponds to be equally split between Ponds 1 and 2 or any one of the ponds to be bypassed. The aerated ponds serve *as* the primary treatment step in the removal of oxygen consuming materials (termed biochemical oxygen demand, or BOD) present in the wastewaters. Nearly 85 percent of the BOD present in the wastewaters is removed in the aerated ponds. In order to provide sufficient oxygen and mixing in the aerated ponds to support the biological activity necessary for removal of the BOD, a total of 466 air diffusers are located on the bottom of the ponds. Air is supplied to the diffusers by means of three 200 horsepower air compressors which are located in the Operations Center Building, each of which has the capacity to deliver approximately 1800 cubic feet of air per minute to the diffusers. Normally, only one or two of the compressors are needed to provide the necessary air to the system.

After leaving the aerated ponds, alum (aluminum sulfate) is added to the wastewater to assist in the removal of phosphorus present in the wastewater. The alum joins with the phosphorus to form an

aluminum phosphate compound. This compound in turn settles out of the wastewater in the subsequent treatment ponds. The removal of phosphorus is an important step in the treatment process since phosphorus is a key nutrient which contributes to the growth of excessive weeds and algae in streams and lakes. Through the use of alum to chemically precipitate the phosphorus as well as natural settling and biological activity in the treatment ponds, approximately 90 percent of the phosphorus present in the wastewater will be removed before the treated wastewater is discharged to Tonawanda Creek, reducing the phosphorus level in the treated effluent to less than one part per million.

The partially treated wastewater from the aerated ponds next flows to the two secondary ponds. Each of the secondary ponds has an area of approximately 45 acres and is designed to operate at depths varying from 4 to 8 feet. At their maximum depth of 8 feet, the secondary ponds have a total volume of approximately 235 million gallons. The secondary ponds provide further removals of the BOD and suspended solids present in the wastewater by means of natural biological activity and settling. Also, the majority of the phosphorus present in the wastewater settles out in these ponds. The secondary ponds also assist in the removal of nitrogen present in the wastewater. Nitrogen removal is important, particularly during the summer months, to reduce both nutrient loadings and potential oxygen demands on the receiving stream.

The final ponds in the treatment system consist of four tertiary ponds. The tertiary ponds range in size from approximately 23 acres to 38 acres and are designed to operate at depths ranging from 3 feet minimum to 12 feet maximum. The total potential volume of the tertiary ponds at their maximum depth of 12 feet is about 475 million gallons. The tertiary ponds further reduce BOD, suspended solids and nitrogen present in the wastewater by means of natural biological activity and settling. In addition, the variable depth of the ponds allow the plant operators to use the pond storage capacities to adjust the final outflow from the pond system to insure that the treated wastewaters protect the quality of Tonawanda Creek during periods of extreme low flows in the Creek.

As a final step in the treatment process, a series of three man made wetland areas are provided through which flows up to 2.5 mgd can be directed. The wetlands range in size from 5.4 to 14.4 acres and total about 27 acres. Normally, flow from the tertiary ponds will meet or exceed the degree of treatment required of the treatment system. However, during the summer months, the wetlands can be used to provide final polishing of the treated wastewater prior to discharge to Tonawanda Creek. The wetlands provide this additional degree of treatment of the wastewaters through the natural processes of screening, settling, and nutrient uptake.

The final treated effluent from both the tertiary ponds and wetlands are carried to Tonawanda Creek by means of a 36 inch gravity sewer which discharges to the Creek by the Walnut Street Bridge.

Facilities for monitoring the performance of the treatment system as well as performing

necessary maintenance and record-keeping are located in the Operations Center Building. Here, remote instrument and computer facilities enable the operators to monitor operation of the major equipment items, the pump stations, flows, and water depths in the various ponds. Sampling units are also provided to enable the operators to test both the incoming wastewater and the final treated wastewater. Most of the necessary testing is performed at the state certified laboratory which is a part of the Operations Center.

UNIQUE FEATURES

The new Batavia Wastewater Treatment Facility represents a unique and innovative means of addressing the present and future wastewater treatment needs of the City and Town. Although the individual treatment concepts used at the new facility have proven effective at other facilities in both the United States and Canada, the combination of several of these concepts into the overall Batavia treatment system make it unique. Among the unique and innovative aspects of the Batavia Facility are the following:

1. The Batavia Facility represents the largest use of multiple cell lagoons for municipal wastewater treatment in the New York area. Although wastewater lagoons have proved to be an effective and economical treatment means for many larger communities in the Midwest and Western areas of the country, they have not been widely used for larger communities in the eastern portion of the country. Therefore, the Batavia Facility will provide information which will be helpful to other communities seeking a possible alternative approach to wastewater treatment needs.

2. By incorporating the chemical precipitation of phosphorus into the lagoon system, the need for a separate chemical addition and precipitation facility has been eliminated. This significantly reduced both the construction and operating costs of the system.

3. The design of the secondary and tertiary ponds, as well as the outlet control structure, allows the plant operators to regulate the amount of treated wastewater discharged to Tonawanda Creek. This permits the operators to reduce or even stop the discharge of treated wastewaters during low flow, warm weather periods when the natural ability of the stream to accept the discharge is most limited. In addition, the long detention times and storage capacities of the ponds enable the system to adapt to unusual waste loadings or extended periods of high flows without any significant deterioration in the quality of the treated wastewater.

4. The man-made wetlands make use of the natural wetland processes of screening, settling and nutrient uptake for the final treatment and polishing of the wastewaters. By using these natural processes, the labor, energy, and maintenance costs normally associated with advanced treatment and polishing of the wastewaters are greatly reduced.

5. The lagoon system provides a low maintenance, natural treatment environment for treatment of the wastewaters, eliminating the need for full time, 24 how operational staffing of the facility.

In addition, several unique features have been incorporated into the design of the new Batavia Facility to address the special environmental concerns pertaining to the project areas. These include:

1. The creation and enhancement of three natural wetland areas totaling approximately 25 acres to mitigate impacts of the pond construction upon a limited amount of existing wetland areas.

2. The planting of approximately 60 acres of upland areas surrounding the ponds with special grasses, shrubs and trees to provide additional and improved habitat for wildlife in the areas surrounding the treatment ponds.

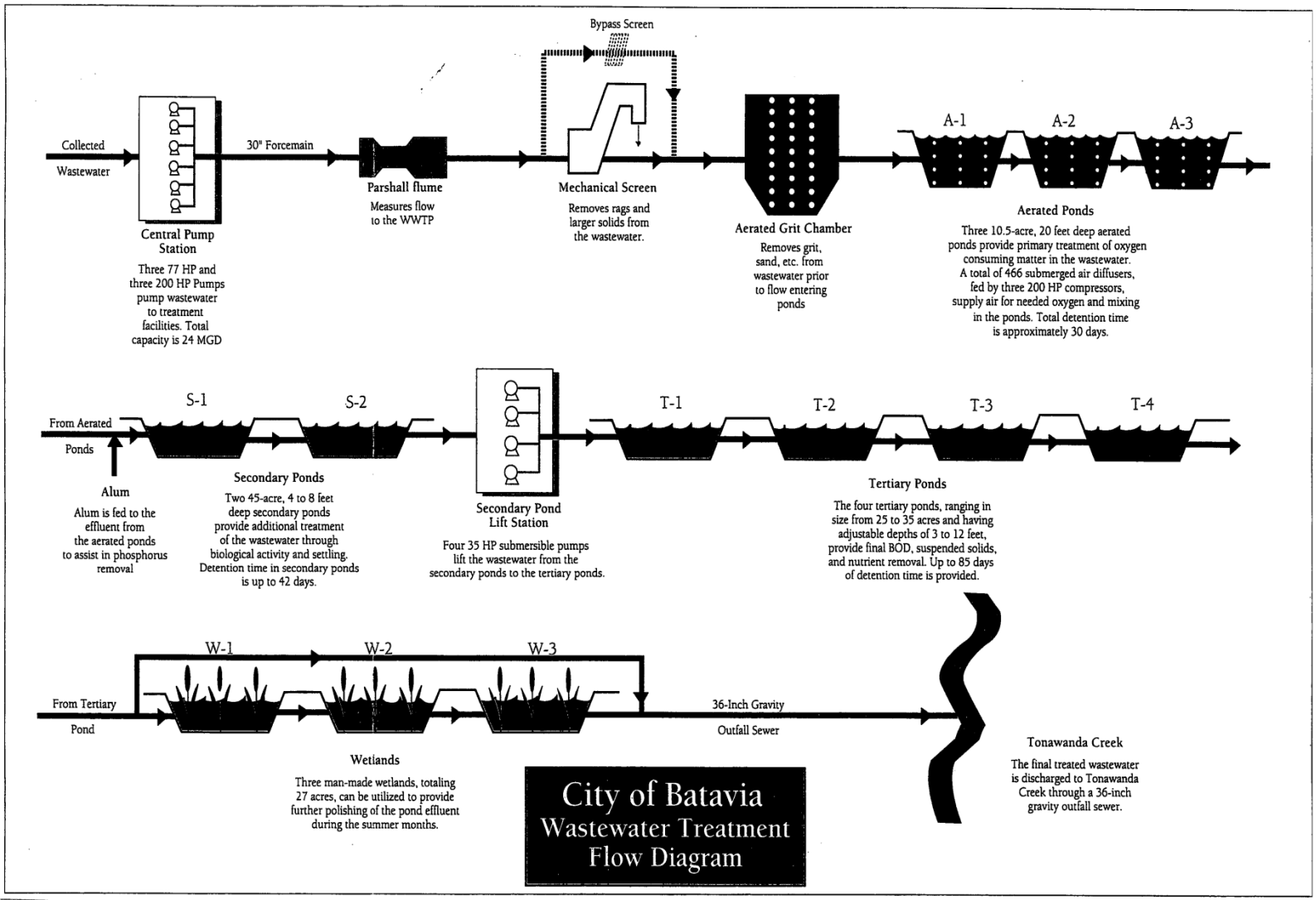
3. Creation of a strip of woody vegetation around the perimeter of the pond area to act as an isolation screen, windbreak, and off-road vehicular barrier.

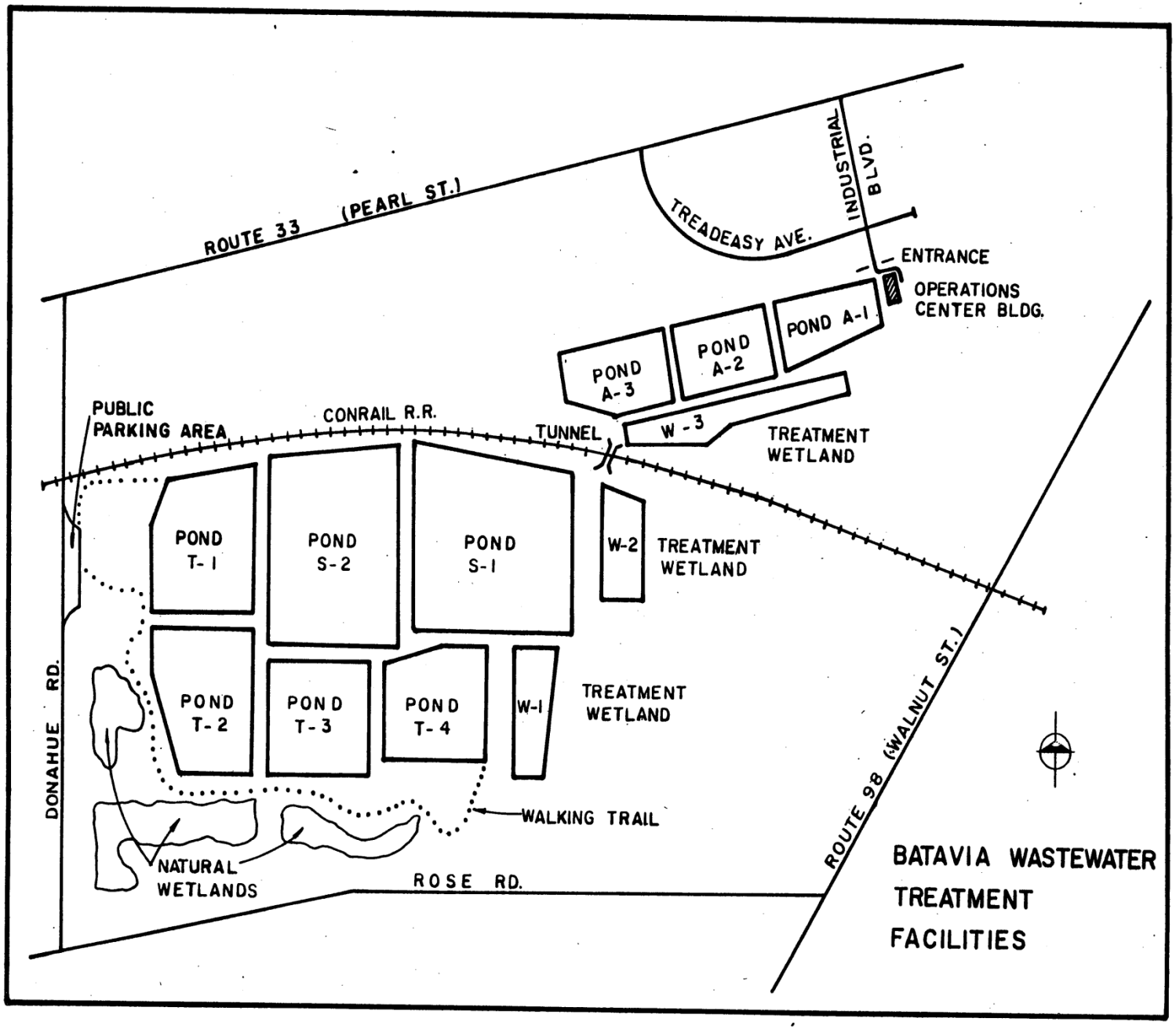
4. Provision of a maintained walking trail along the periphery of the pond site to provide recreational opportunities to the public. The trail is located to provide access to the newly created wetland areas as well as provide an overlook of the treatment ponds.

5. The pond system has also been designed to maximize the isolation of the actual treatment ponds from neighboring homes. Approximate isolation distances of 1,320 feet from the aerated ponds, 1,000 feet from the secondary ponds, and 500 feet front the tertiary ponds have been maintained to the nearest homes.

In summary, the new Batavia Wastewater Treatment Facilities represents the results of a long term effort to meet the wastewater treatment needs of the City and Town. The facility combines both treatment and environmental concepts that make it a unique, innovative treatment system that emphasizes the use of low energy, low maintenance treatment technologies to reduce costs to its users and also provides great flexibility to meet the varying, flow and wasteload conditions experienced by Batavia.

A location map showing the layout of the new wastewater treatment facilities and a flow diagram of the treatment process are presented on the following pages.


Bypass Screen
Collected
Wastewater
30" Forcemain
Parshall flume
Measures flow
to the WWTP
Mechanical Screen
Removes rags and
larger solids from
the wastewater.
Aerated Grit Chamber
Removes grit,
sand, etc. from
wastewater prior
to flow entering
ponds
A-1
A-2
A-3
Aerated Ponds
Three 10.5-acre, 20 feet deep aerated
ponds provide primary treatment of oxygen
consuming matter in the wastewater.
A total of 466 submerged air diffusers,
fed by three 200 HP compressors,
supply air for needed oxygen and mixing
in the ponds. Total detention time
is approximately 30 days.
Central Pump
Station
Three 77 HP and
three 200 HP Pumps
pump wastewater
to treatment
facilities. Total
capacity is 24 MGD
S-1
S-2
T-1
T-2
T-3
T-4
From Aerated
Ponds
Alum
Alum is fed to the
effluent from
the aerated ponds
to assist in phosphorus
removal
Secondary Ponds
Two 45-acre, 4 to 8 feet
deep secondary ponds
provide additional treatment
of the wastewater through
biological activity and settling.
Detention time in secondary ponds
is up to 42 days.
Secondary Pond
Lift Station
Four 35 HP submersible pumps
lift the wastewater from the
secondary ponds to the tertiary ponds.
Tertiary Ponds
The four tertiary ponds, ranging in
size from 25 to 35 acres and having
adjustable depths of 3 to 12 feet,
provide final BOD, suspended solids,
and nutrient removal. Up to 85 days
of detention time is provided.
W-1
W-2
W-3
From Tertiary
Pond
36-Inch Gravity
Outfall Sewer
Tonawanda Creek
The final treated wastewater
is discharged to Tonawanda
Creek through a 36-inch
gravity outfall sewer.
Wetlands
Three man-made wetlands, totaling
27 acres, can be utilized to provide
further polishing of the pond effluent
during the summer months.
City of Batavia
Wastewater Treatment
Flow Diagram


ROUTE 33 (PEARL ST.)
TREADEASY AVE.
INDUSTRIAL BLVD.
ENTRANCE
OPERATIONS CENTER BLDG.
POND A-1
POND A-2
POND A-3
W-3
TREATMENT WETLAND
PUBLIC PARKING AREA
CONRAIL R.R.
TUNNEL
POND T-1
POND S-2
POND S-1
W-2
TREATMENT WETLAND
POND T-2
POND T-3
POND T-4
W-1
TREATMENT WETLAND
DONAHUE RD.
WALKING TRAIL
NATURAL WETLANDS
ROSE RD.
ROUTE 98 (WALNUT ST.)
BATAVIA WASTEWATER TREATMENT FACILITIES