# THE MONROE COUNTY PURE WATERS PROGRAM … A HISTORY

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## Introduction

Monroe County has always had an abundance of water resources. In addition to many creeks and ponds, Lake Ontario lies directly to the north of the county and Irondequoit Bay is located several miles to the east of the Genesee River, which splits the county. These resources contributed significantly to the initial settlement and continual development of Monroe County by providing water, power, transportation, and drinking water. Later, as the County and the City of Rochester developed, the county's water resources were also increasingly used for waste disposal.

Waterways contaminated with waste causes problems. In the early 1900s, water quality problems at Ontario Beach Park resulted in the development of a comprehensive sewerage system for the City of Rochester. Although there were continuous improvements to the methods of treating and disposing of sanitary sewage, by the 1960s, most of the County's water resources were affected by pollution.

### The 1960s Bring Change

Irondequoit Creek, which flows through picturesque Ellison Park, is a prominent park feature. In the 1960s, Irondequoit Creek frequently became septic as it flowed through the park during the warm summer months. This condition turned the creek gray and killed the fish living in the creek. The smell and appearance of Irondequoit Creek was a major factor in convincing the community that action was needed to restore and protect the waters of Monroe County.

Slater Creek, in the Town of Greece, also helped to draw community awareness to the problem. The creek was receiving effluent from a large sewage treatment plant. Although the treatment plant was removing much of the organic material, detergents passing through the plant unaltered caused the creek to be regularly covered in detergent foam. It was easy for the community to understand the effect of the treatment plant discharge not only on the creek, but also on nearby Lake Ontario.

These two factors, along with others, encouraged the community to develop a comprehensive plan to restore the quality of the county's surface waters and to protect those waters from future pollution problems.

In 1964, the Monroe County Board of Supervisors authorized the Comprehensive Sewerage Study of Monroe County. The study was financed by a $550,000 grant from the New York State Department of Health. The county was divided into four study areas, based on natural drainage basins. A separate engineering firm then studied each area and four quadrant studies were produced. The studies were completed in 1968 and were used as the basis for the Monroe County Pure Waters Master Plan.

## Pure Waters is Established

In 1967, the Monroe County Legislature appointed the 15-member Monroe County Pure Waters Agency. It was composed of engineers, lawyers, businessmen, conservationists, physicians, and public officials. The agency prepared the countywide Pure Waters Master Plan to address the county's sewerage needs through the year 2020 and also made recommendations for its implementation. The Master Plan report was issued in 1969. The guiding philosophy published in the report was that provision of sewerage is necessary for the continued economic growth of Monroe County and for the restoration and preservation of Monroe County's water resources. To accomplish these goals, the plan recommended the construction of a regional sewage conveyance and treatment system with sewage effluent discharge to Lake Ontario. This would eliminate the burden that existing effluent discharges placed on the creeks and streams in Monroe County.

## Suburban System - NWQPWD & IBPWD

The Northwest Quadrant and Irondequoit Bay Pure Waters Districts were established in 1968. Work began early in 1970 in both districts. The Northwest Quadrant system began operating in 1973. The system intercepted sewage flowing to nine existing sewage treatment plants eliminating their effluent discharges to the creeks and streams of the northwest part of Monroe County as well as to the near shore area of Lake Ontario. To protect the bathing and prime recreational areas of the lake, the discharge for the new Northwest Quadrant Wastewater Treatment Facility was tunneled under the lakeshore to a point about a mile from shore where the sewage effluent would mix well with Lake Ontario.

The Irondequoit Bay Pure Waters system began operation in 1976 with the completion of the upgraded Durand-Eastman Wastewater Treatment Facility. The Irondequoit Bay system was constructed to eliminate the most detrimental discharges to Irondequoit Creek and its tributaries first. The last of 14 sewage treatment plants was intercepted in 1987 although most of the plants were intercepted in the 1970s.

In addition to the funding provided by the state government for the quadrant studies, both the state and federal governments funded the planning, design, and construction of the comprehensive sewerage system for the suburban areas of Monroe County. The state and federal share of the project cost was approximately 80 percent resulting in a local share of approximately 20 percent. Receipt of state and federal aid for the project allowed the Pure Waters program in implement a comprehensive regional sewer system rapidly at a cost that was affordable for the community.

# City of Rochester

Sewerage planning for the City of Rochester was an important part of the quadrant studies and of the Master Plan. The main problem in the City was a combined sewer system that conveys both storm water and sanitary sewage in a single pipe. Although the system functioned well for the most part, during periods of rain it became overloaded. Overflow points were established in the system to relieve the overloaded condition during rainstorms to prevent sewage from backing up into homes. Most of these overflow points discharged untreated sewage to the Genesee River—although there were also overflows to Irondequoit Bay and the Barge Canal.

The City of Rochester was already working on solutions to the overflow problems when the Master Plan was published. It was also developing a plan to upgrade its Durand-Eastman Sewage Treatment Plant (renamed the Frank E. VanLare Wastewater Treatment Facility). The Pure Waters program, working in conjunction with the City of Rochester, formed the Rochester Pure Waters District in 1971 to supervise and finance the construction of the treatment plant upgrade. The district was also to develop and implement a solution to the combined sewer overflow problem. The upgraded plant would additionally serve the Irondequoit Bay Pure Waters District and part of the Town of Henrietta. The plant was upgraded from primary treatment to secondary treatment and completed in 1976.

## Combined Sewer Overflows … A Solution

During 1972, the staff of the Division of Pure Waters was greatly increased. Personnel were added to the Division for construction management, for operations, and for planning/design work. After becoming responsible for the operation and maintenance of the Rochester sewerage system in the summer of 1972, the division began to assess the problem of combined sewer overflows (CSOs) through a detailed review of the operation of the overflow system and of already completed studies. The Comprehensive Sewerage Study and the Master Plan had generally addressed the problem. Additionally, the City of Rochester had hired the engineering firm of Black & Veatch to prepare a comprehensive report to supplement the Comprehensive Sewerage Study to specifically address the problem of combined sewer overflows. The Black & Veatch report recommended the construction of holding basins for the storage and treatment of combined sewer overflows. The holding basins (open tanks) were to be constructed near the major overflow locations.

After completing a detailed review of the system and the existing studies on the combined sewer overflow problem, the Division of Pure Waters decided that additional study was needed. Consulting engineers were hired to study upgrading of the portions of the existing sewer network. The principal concerns of the studies were upgrading the existing system to minimize flooding caused by overloaded sewers and to provide sufficient storage for the volume of runoff, to reduce or eliminate overflows.

In a pioneering effort, a reality-approximating mathematical model was used to simulate the behavior of the sewer system allowing the consultants to address in detail the principal concerns of the study. The entire sewer system was modeled and levels of surcharge and overflow were developed for various size storms. This allowed the development and testing of various alternatives.

## The Benefits of a Tunnel System

These studies resulted in the recommendation for the Rochester Pure Waters District to construct a storage/conveyance tunnel system completing the principal planning for the project by the end of 1975. At that time, another local tunnel project (the Cross-Irondequoit Tunnel) was nearing completion—proving the feasibility of tunnel construction through machine mining. The layout of the tunnels was determined primarily by locating the tunnels beneath points of the sewer network that were overloaded, as determined by an existing overflow or by a proposed overflow point identified through analysis of the mathematical model of the existing network.

Another result of the studies was a detailed plan for the upgrading of the existing sewer network to minimize flooding. The recommended improvements would improve the system in conjunction with the tunnels. The consultants were able to predict how the upgraded system would operate using the mathematical models. Comparison of the before and after operating conditions in this part of the existing sewer network allowed the consultants and the District to illustrate the benefits of the proposed improvements.

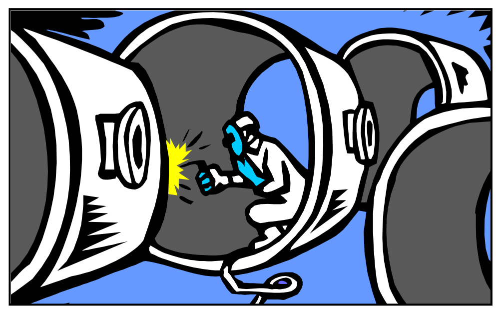
An additional benefit of the tunnel storage/conveyance system was the conveyance aspect of the tunnels. This provided immediate relief (less flow and less surcharge) to an old and undersized sewer system. In the event of failure of the antiquated sewer system in the City, sewage could also be conveyed to the treatment facility directly through the tunnel system.

Most of the major trunk sewers like the East Side Trunk Sewer were already at least 75 years old. In some areas these trunk sewers had been constructed out of multiple layers of brick and mortar to form a circular conduit. Failure of the Intercepting Trunk Sewer (built as a circular brick conduit under St. Paul Boulevard circa 1915) would require the Division of Pure Waters to find a way of immediately maintaining the normal flow of 75 million gallons per day (mgd). If the flow could not be maintained through the failed section, immediate repair would be necessary. If the failure occurred during the spring, summer or fall, flow rates in the trunk sewer in excess of 300mgd would occur during rainstorms. Construction of new overflow structures at points of overloading in the existing trunk sewer network would also allow the storage tunnels to function as a parallel conveyance system for most of the sewer system. Sewage could be diverted into the tunnels while repairs were made by division personnel or through a publicly bid contract.

Tunnel construction would also reduce the impact of the work on the community. Replacement of the combined sewer system with a separate system would have required digging up 75 percent of the streets in the city and would have cost more than twice as much. Improvements to the combined sewer system to provide the same capacity as the tunnel system by conventional trench construction of sewers would also have been extremely disruptive. Tunnel construction of the sewerage improvements limited the areas of the City impacted by the work to only those areas around drop shafts, access shafts, and control structures where surface construction work could not be avoided.

## Combined Sewer Overflow Abatement Program (CSOAP) a Reality

The Rochester District began intercepting combined sewer overflows shortly after the Cross-Irondequoit Tunnel began operation in 1977. Overflows to Irondequoit Bay were routed to the tunnel as much as possible to reduce the amount of sewage entering the bay. Construction began on the Genesee River Interceptor Southwest in 1977. For the next twelve years, the District constructed the main elements of two tunnel systems. The Irondequoit Bay system, Phase I, would protect Irondequoit Bay from sewage overflows. The Genesee River system, Phase II, would eliminate regular overflows to the Genesee River. The Irondequoit Bay system was completed and began operation in 1985. The Genesee River system began operation in 1989. Two additional tunnels were added to the system in 1990 and in 1992. Three additional tunnels proposed as part of the Genesee River system may be constructed in the future, if necessary.



In addition to the tunnel system, the Rochester District also planned, designed, and constructed Additional Treatment Facilities at the VanLare Wastewater Treatment Facility to rapidly treat the combined sewage collected in the CSOAP system. Improvements to the district's sewer system were also accomplished through the Best Management Practices program, which removed major bottlenecks in the system allowing more sewage to the conveyed to the treatment facility.

The state and federal governments funded the planning, design, and construction of the Combined Sewer Overflow Abatement Program and its associated programs. The state and federal share of the project cost was 87.5 percent resulting in a local share of approximately 12.5 percent. Receipt of state and federal aid for the project allowed the Pure Waters program to implement a sophisticated combined sewer overflow abatement system rapidly at a cost that was affordable for the community.

# Gates-Chili-Ogden Sewer District

The GCOSD was actually the first county sewer district and was formed in 1956. In 1972, when the staff of the Division of Pure Waters was expanded, operation of the district was integrated with other county districts. Work was already underway to upgrade the existing wastewater treatment facility from primary treatment to secondary treatment as recommended by the Master Plan.

Numerous improvements to the sewer system were also undertaken at the same time. The Master Plan improvements in the District were completed in 1976. Improvements in the GCOSD also received approximately 80 percent state and federal aid resulting in a local share of approximately 20 percent.

## Irondequoit Bay Pure Waters District

The IBPWD was formed in 1974 in accordance with the recommendations of the South Area Quadrant Study and the Pure Waters Master Plan. Improvements for the District consisted new interceptor sewers and pump stations to convey sewage to regional treatment plants then under construction. The Master Plan improvements in the District were completed in 1979.

Improvements in the SCPWD received approximately 80 percent state and federal aid resulting in a local share of approximately 20 percent.

# Rochester Pure Waters District
# CSOAP Facts

## Historical Summary

- System Design—initiated in early 1970s
- Construction start—1975, first section put into operation—1977 (Irondequoit Tunnel)
- East Side System—fully operational in 1985
- West Side System—partially operational 1989, fully operational 1993
- Entire System—fully operational 1993

### Total Expense:

Approximately $550 million for design and construction
Funding: 75 percent federal; 12.5 percent state; 12.5 percent local

### General Description of Operation:

The tunnels are designed to relieve Rochester's existing Combined Sewer System constructed 50 to 90 years ago. This existing sewer system was functionally designed (early 1900s) to discharge excess flows, or combined sewer overflows (CSOs) to local waterways during storm events (approximately 70 per year). The tunnel system is designed as both a storage facility and conveyance vessel so that delivery of these large volumes of flow can be effectively staged to the Frank E. VanLare Wastewater Treatment Facility. Storm water (runoff from rain and thaws) enters the City of Rochester's combined system (575 miles of sewers) through 25,000 catchbasins on city streets, parking lots and roof connections.

### Physical Components of the Tunnel System:

- 12-16 feet in diameter and 150 feet deep on average
- Approximately 30 points of connection (drop shafts) from the existing combined sewer system
- Total length—30 miles
- Total Storage Volume—175 million gallons
- West Side System connects to East Side System via a bridge pipe crossing that also serves as a recreational pedestrian connection of Maplewood and Seneca parks

## Construction Accomplishments:

The program phased out 35 overflow sites and over 30 small ineffective treatment plants. The enormous cost of digging up nearly 600 miles of city streets and replacing the existing combined sewers with a separate sewer system was avoided.

## Operational Accomplishments:

Through utilization of the constructed control points, the system is functioning as designed and, to a significant degree, even more effectively than anticipated. Since fully operational in 1993, the system has captured approximately 32 billion gallons of CSO that otherwise would have spilled into local waterways (annual average—3.75 billion gallons per year). Over 85 percent of this captured amount has received **full secondary treatment** (the discharge permit requires **primary treatment only**). The remaining 14.6 percent of flow received preliminary treatment and chlorination. Out of 50-70 wet weather events per year, only 1-2 extreme events generate flows that exceed tunnel capability. However, even during these extreme events, the system still captures more than 99 percent of the total volume of CSOs generated.

## Award:

In 1991, the Monroe County/Rochester Pure Waters District, in national competition, received the prestigious CSO Control Program Excellence Award from the U.S. Environmental Protection Agency.

## Environmental accomplishments:

According to monitoring performed by the Monroe County Department of Health in conjunction with the U.S. Geological Survey, water quality in the Genesee River has shown significant improvement over the timeframe of the tunnel system's operation. Although there are many possible factors that helped generate this improvement, the dramatic reduction in fecal coliform, the more that 50 percent reduction in phosphorus and zinc loading, and the increase in dissolve oxygen appear directly related to the nearly complete elimination of CSOs.