MONROE COUNTY DEPARTMENT OF HEALTH and the U.S. GEOLOGICAL SURVEY

MONROE COUNTY
John D. Doyle, County Executive

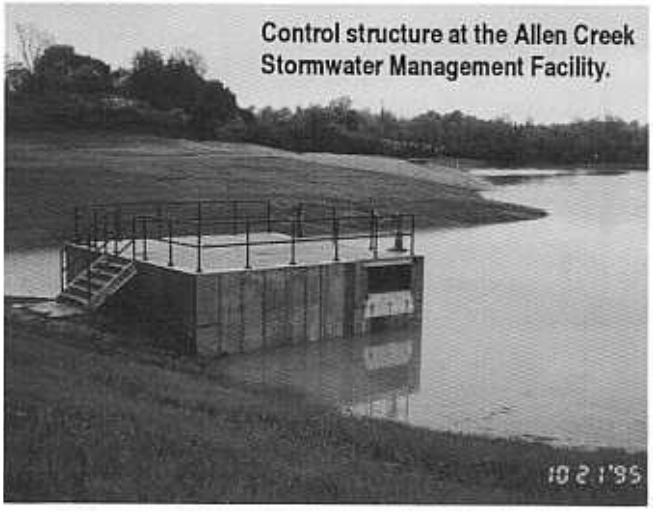
Working together to

Improve Water Quality *in* Monroe County

U S G S
U.S. Geological Survey

Issue 3 *Spring 1997*

What can we do to prevent our waters from becoming polluted from the effects of urbanization? The following examples describe what the Monroe County Environmental Health Laboratory and the U.S. Geological Survey (USGS) are doing to address water pollution and to improve water quality in Monroe County.



Control structure at the Allen Creek Stormwater Management Facility.

Allen Creek Stormwater-Management Facility is a Success

Flooding had been a common occurrence along the lower reaches of the East Branch Allen Creek in the Town of Pittsford. This changed during the summer of 1995 when the Allen Creek Stormwater-Management Facility (ACSWMF) between Jefferson Road and the Erie Canal was completed. This facility, originally proposed to provide storage of stormwater, also eliminates seasonal (May to October) Erie Canal diversions to augment low flow for irrigation purposes. The storage reduces the magnitude and frequency of flooding downstream while also improving water quality of the creek by trapping pollutants. Before construction of the facility, downstream areas became flooded several times per year. Residential areas near the Long Meadow subdivision south of Monroe Avenue became seriously flooded during the intense storms that occur, on average, once every two years. After construction of the facility, a 25 year storm in 1996 that should have produced 240 cubic feet per second (cfs) of flow in the channel north of the canal, produced less than 80 cfs and there was no flooding.

Concern over the frequency of flooding had prompted officials of the Irondequoit and Oak Hill Country Clubs to approach the Town of Pittsford about the ways the town planned to mitigate the flooding. The Town recognized that the creek-channel improvements proposed by the golf courses could lessen the severity of localized flooding, but could also cause more severe flooding downstream. The Town's comprehensive drainage plan, prepared in 1982, identified the possibility of constructing a stormwater management facility in a low-lying area south of the Erie Canal that could solve both the golf courses and other downstream flooding problems. With encouragement from Monroe County, the golf courses were willing to support this innovative solution. An intermunicipal agreement, signed in 1990 between the Town of Pittsford and Monroe County, provided the opportunity to integrate water-quality concerns into their drainage plans and policies. The USGS and Monroe County agreed to assist in examining the feasibility and benefits of a stormwater management facility upstream of the flood problem area that could manage stormflows without increasing flooding downstream of the golf courses. The USGS developed a stormflow model to simulate the East Branch Allen Creek watershed and to predict the effects the stormwater-management facility would have on floodflows and water quality. This effort resulted in commitments by the golf courses to partially fund the project.

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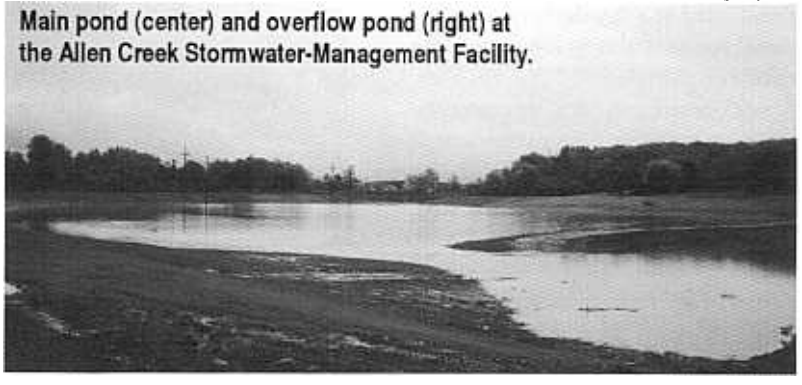
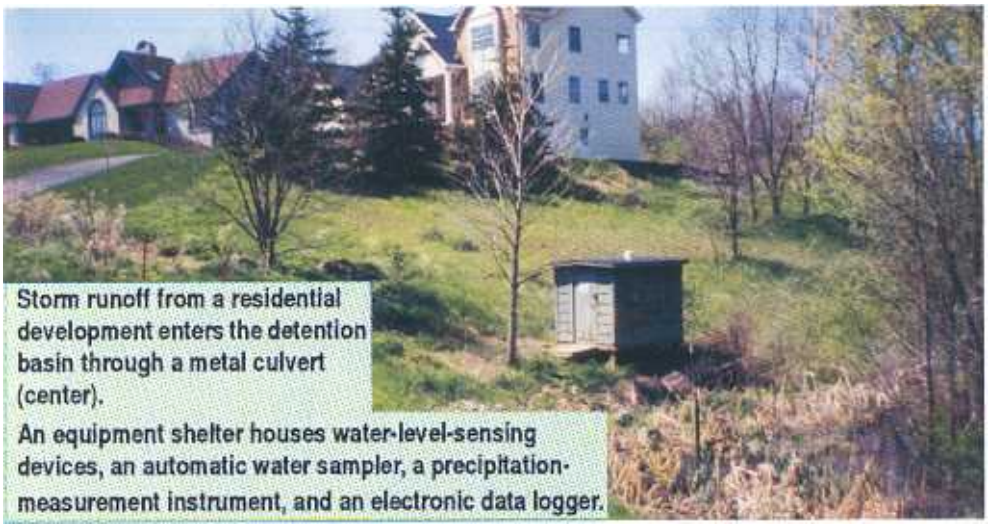

Main pond (center) and overflow pond (right) at the Allen Creek Stormwater-Management Facility.

Look inside this issue...



Storm runoff from a residential development enters the detention basin through a metal culvert (center).

An equipment shelter houses water-level-sensing devices, an automatic water sampler, a precipitation-measurement instrument, and an electronic data logger.

Created Wetlands Mitigate Effects of Storm Runoff

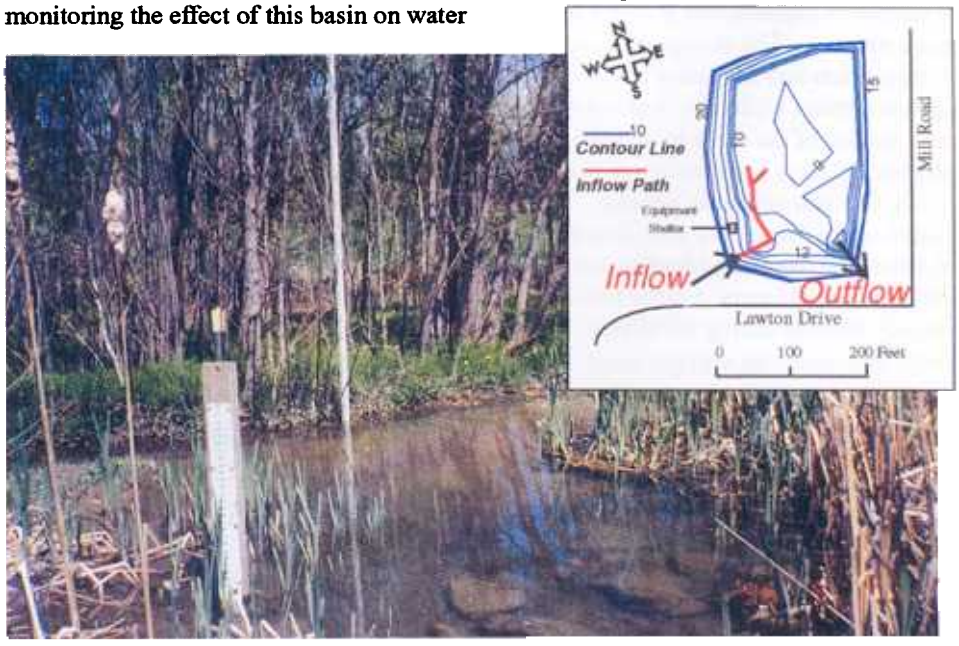
The Nationwide Urban Runoff study conducted on Irondequoit Bay and its drainage basin recommended the use of urban stormwater management measures to decrease phosphorus loads in storm runoff. These measures included the enactment of erosion control ordinances on the basis of performance standards, infiltration of stormwater to the upper soil layers in areas of new developments, and the use of wetlands throughout the Irondequoit Bay watershed. Many areas of the watershed lack soils that are suitable for infiltration, and contain no natural wetlands which could be used for stormwater treatment. With minor modifications, however, dry detention basins that have been required in post-1965 developments for runoff-volume control provide a setting for artificial wetlands for stormwater treatment.

Monroe County Department of Health and the USGS have been studying the effects of stormwater-detention basins on stream-water quality. Data were collected at a dry detention basin in a small residential development in the Town of Perinton during 1986-89. This basin was considered "dry" because it did not have standing water year-round and was inundated only during periods of storm runoff. The study showed that the design of the flow outlet, which controlled the release of stormwater, determined the basin's effectiveness in removing nutrients from the water. Upon comparison with vegetated detention basins, the study also indicated that wetland vegetation enhances removal processes.

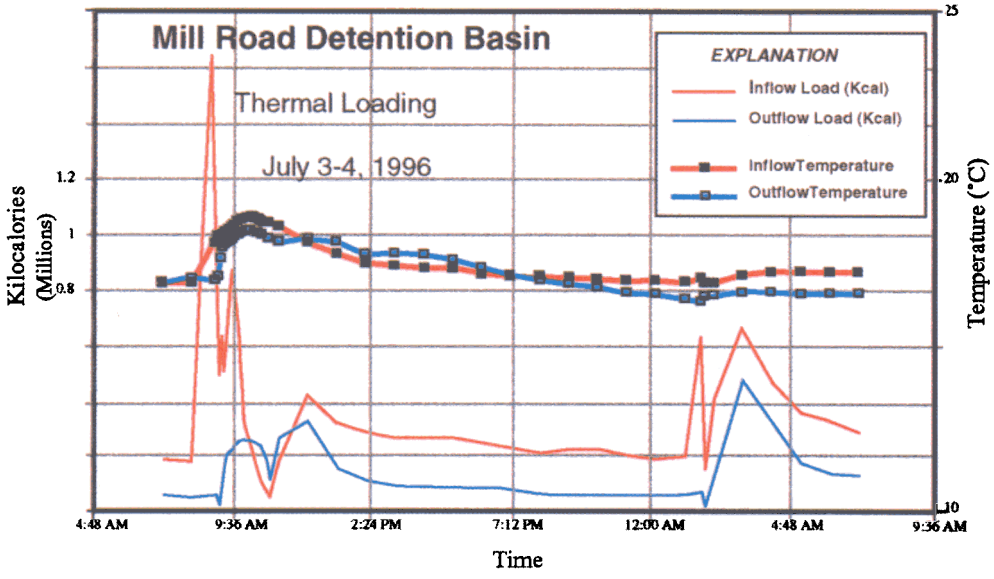
A 1993 study on East Branch Allen Creek in the Town of Pittsford (see page 1) simulated the effects that a stormwater-management facility (which includes a detention basin) would have on peak flows and water quality. From 1994 to present, Monroe County and the USGS have been studying another detention basin, which receives runoff from a small residential area in the Town of Pittsford. In addition to monitoring the effect of this basin on water quality, this study is also examining the basin's effect on water temperature. Located at the intersection of Mill Road and Lawton Drive (see illustration below), this basin is unique in that it is vegetated with well-established and diverse flora ranging from mosses and grasses to large willow trees. This "mature" detention basin, whose outlet is much smaller than its inlet, provides several potential benefits:

(1) attenuation of peak discharges downstream through detention and gradual release of storm-flows;
(2) retention of sediment and sediment associated pollutants;
(3) improved water quality as a result of nutrient uptake by bacteria, phytoplankton, and algae living on wet plant surfaces; collectively called biofilm; and
(4) management of water temperatures by detention and shading.

The types of flora and the basin design characteristics differ among the many detention basins that have been installed throughout Monroe County to mitigate the effects of storm runoff. Studies such as these will help to identify which combination of design characteristics will provide the greatest benefits.✦



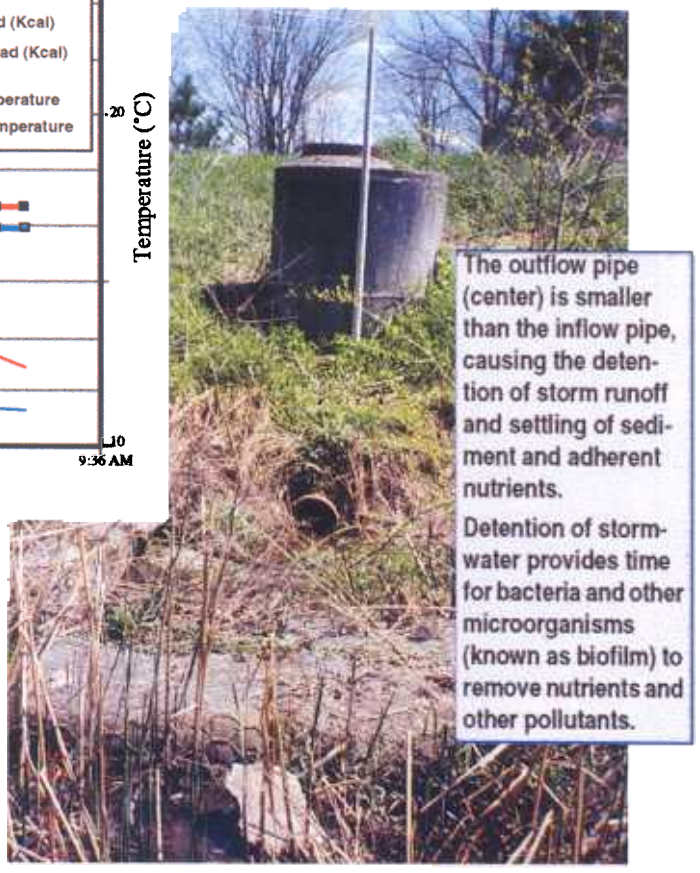
The detention basin is diversely vegetated with grasses, trees, and typical wetland plants such as cattails. Microscopic plants in water-covered areas add to the floral diversity. Summer foliage shades the ponded water and should lower water temperatures.



This graph illustrates the relation between inflow and outflow water temperatures and the thermal loads* computed from temperature and discharge during and after a summer storm at the Mill Road detention basin in Monroe County. Note that:

1. **Outflow water temperatures are generally cooler than inflow temperatures, except in the afternoon and early evening; and**
2. **The outflow thermal load is less than that of the inflow thermal load because the ponded water undergoes night time cooling and because the outflow discharge is less than the inflow.**

*Thermal load is the total calories of heat for a given volume of water.



The outflow pipe (center) is smaller than the inflow pipe, causing the detention of storm runoff and settling of sediment and adherent nutrients.

Detention of stormwater provides time for bacteria and other microorganisms (known as biofilm) to remove nutrients and other pollutants.

Continued from page 1

The East Branch Allen Creek watershed encompasses a 10.2-square mile area, mostly in the Town of Pittsford, but extending into the Towns of Mendon and Henrietta. The storm runoff model developed by the USGS simulates stormflow by dividing the watershed into segments that represent discrete land uses and drainage characteristics. The flow model was calibrated to stormflows that had been measured at the East Branch Allen Creek streamflow-gauging station since 1990 and with data from several nearby rain gauges (see map on page 4). Once the model was satisfactorily calibrated, stormflows that occur on average once every 2, 10, 25, 50, and 100 years were simulated with and without the stormwater-management facility. Simulating storms of differing magnitudes indicates which design provides the maximum benefits over the widest range of flow conditions and thereby maximizes the cost/benefit ratio of the project. Simulations of peak stormflow indicated that the facility would significantly decrease the frequency and duration of flooding. For instance, peak flows that previously occurred once every 10 years below the facility would now occur only once every 25 years.

Model simulations of stormflow and water-quality changes clearly demonstrated the benefits of a stormwater-management facility. In addition to providing flood control, the facility also helps improve water quality by trapping sediment, particulate matter, and associated water polluting contaminants carried by storm runoff. Model simulations indicated that the facility could decrease the suspended-sediment concentrations by almost 70% and associated phosphorous loading by 40%. Suspended sediment causes sedimentation related habitat losses and phosphorous contributes to problems in Irondequoit Bay, e.g. algae blooms, that impair recreational uses.

An agreement among the Town of Pittsford, the two golf courses, and the Environmental Protection Agency (USEPA) to jointly fund construction of this facility was signed and the facility design was completed by the town engineer. Since its completion, the Allen Creek Stormwater Management Facility has proved its value several times, most notably during the 1996 heavy spring rains, which resulted in only minimal flooding below the facility for a short period.

The upstream end of this facility is being developed as a cattail- and bulrush-vegetated wetland. The mature wetland/detention system is expected to improve water quality, attenuate peak flow, and augment low streamflows. The benefits of the facility will continue to be monitored by the Monroe County Environmental Health Laboratory. All participants are hopeful that this project will serve as a model for future watershed-management planning. ✦

The model and its application are described in a USGS report titled "Simulated Effects of a Stormwater-Detention Basin on Peak Flows and Water Quality of East Branch Allen

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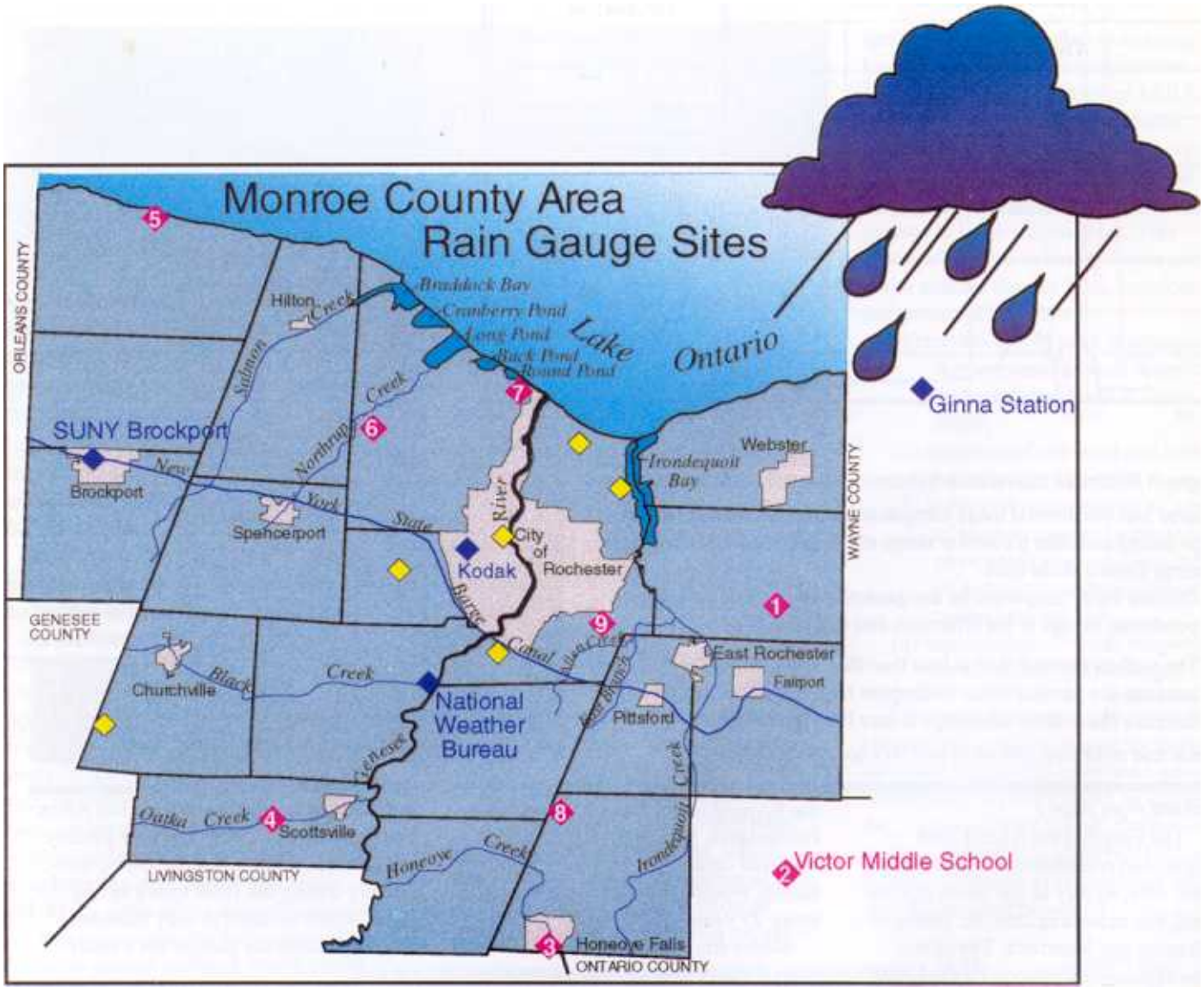
4157-NY, [redacted] by P.J. Zarriello.



RAIN GAUGE SITES

(Operators)

- Environmental Health Laboratory
- Pure Waters
- Others as identified

Do you know of additional data sets?
If so, please notify the Monroe County Environmental Health Laboratory.

This map features the locations of rain gauges operated by the Monroe County Department of Health and others, as indicated. Data collected from the Environmental Health Laboratory sites are published in the annual USGS data report *Water Resources Data—New York (Vol. 3) Western New York,* and in *Water Resources of Monroe County, New York, Water Years 1984-88, with Emphasis on Water Quality in the Irondequoit Creek Basin, Part 2, U.S. Geological Survey Water Resources Investigations Report 96-4054 by Johnston and Sherwood,* prepared in 1996 in cooperation with Monroe County Department of Health. A project is underway to electronically store water quantity and quality data such as precipitation, and to provide easy data access.

For more information contact:

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For a list of Monroe County reports published by the U.S. Geological Survey.

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