Hydrology, Sedimentology, and Biology of Ellison Park Wetland at the Mouth of Irondequoit Creek near Rochester, New York

By WILLIAM F. COON

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INCH-POUND TO INTERNATIONAL SYSTEM (SI) UNITS

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
	Area	
acre	0.4047	hectare
square foot (ft^2)	0.09290	square meter
square mile (mi^2)	2.590	square kilometer
	Volume	
cubic foot (ft^3)	0.02832	cubic meter
cubic yard (yd^3)	0.7646	cubic meter
acre-foot (acre-ft)	1,233	cubic meter
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
	Mass	
ounce, avoirdupois (oz)	28.35	gram
pound, avoirdupois (lb)	0.4536	kilogram
pound per square foot (lb/ft^2)	4,882	gram per square meter
ton, short (2,000 lb)	0.9072	megagram

INTERNATIONAL SYSTEM (SI) TO INCH-POUND UNITS

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch
millimeter (mm)	0.03937	inch
meter (m)	3.281	foot
kilometer (km)	0.6214	mile
	Area	
hectare (ha)	2.471	acre
square meter (m^2)	10.76	square foot
square kilometer (km^2)	0.3861	square mile
	Volume	
cubic meter (m^3)	35.31	cubic foot
cubic meter (m^3)	1.308	cubic yard
cubic meter (m^3)	0.0008107	acre-foot
	Flow rate	
cubic meter per second (m^3/s)	35.31	cubic foot per second
	Mass	
gram (g)	0.03527	ounce, avoirdupois
kilogram (kg)	2.205	pound avoirdupois
gram per square meter (g/m^2)	.0002049	pound per square foot
megagram (Mg)	1.102	ton, short (2,000 lb)

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given either in:
milligrams per liter (mg/L) ≈ micrograms per gram (mg/g) = parts per million (ppm); or
micrograms per liter (µg/L) ≈ micrograms per kilogram (µg/kg) = parts per billion (ppb)

National Geodetic Vertical Datum of 1929 (NGVD) is a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

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By William F. Coon

Abstract

The Ellison Park wetland, near the mouth of Irondequoit Creek in Monroe County, N.Y., forms a transition zone between the riparian environment of the creek and the lacustrine environment of Irondequoit Bay, an embayment of Lake Ontario. The wetland's proximity to the city of Rochester and its location at the downstream end of an urban and suburban watershed makes it vulnerable to contamination from several sources. Hydrologic, sedimentological, and biological characteristics of the wetland were studied during 1990-94 to provide background data for use in wetland protection and management. The water-surface elevation of nearby Lake Ontario affects water levels in Irondequoit Bay and the adjacent Ellison Park wetland, and water levels in the wetland, in turn, affect many of the hydrologic, sedimentological, and biological processes therein.

Surface-water flows and ground-water levels were monitored. Median daily flow through the wetland was 90 ft^3/s (cubic feet per second). Overbank flows (typically those exceeding 1,000 ft^3/s) occur twice yearly on average. The wetland attenuates storm-runoff peaks. Time-of-travel studies indicate that stormflows that are confined to the main channel of Irondequoit Creek (up to a bankfull discharge) pass through the wetland in less than 3.5 hours with minimal lateral dispersion. Larger flows result in dispersion (partly through increased diversion to the Millrace channel just north of Blossom Road and partly by overbank flow from the main channel) into the cattail-covered backwater areas of the wetland, where the water can be detained from 3 to 15 hours.

The chemical quality of surface water, ground water, and atmospheric deposition also were monitored. Surface water had high concentrations of sulfate, chloride, zinc, and copper; atmospheric deposition had elevated specific conductance and low pH; and ground water had elevated specific conductance, sodium, chloride, and hardness. These data were generally comparable to data collected at several times during 1979-89 in the Irondequoit Creek basin and to data collected elsewhere within the United States.

Sediment-particle size was measured at 11 sites within the wetland; sand is the predominant bed material in the main channel of Irondequoit Creek, and silt and clay with high concentrations of organic matter cover the backwater areas of the wetland. A historical sedimentation rate of 3 mm/yr (millimeters per year) near the mouth of Irondequoit Creek is inferred from measurements of the net rate of postglacial isostatic rebound of the Lake Ontario basin and the consequent rise in water-surface elevation along the southern shore of the lake; recent rates of sedimentation range from 1.9 to 4.9 mm/yr and reflect local differences in the depositional environments within the wetland, as well as the effects of episodic deposition and subsequent resuspension and removal of sediment. Chemical analyses of three sediment samples indicate (1) relatively high concentrations of four metals (barium, manganese, strontium, and zinc), and four polynuclear aromatic hydrocarbons (chrysene, fluoranthene, phenanthrene, and pyrene), and (2) the presence of environmentally persistent organochlorine pesticides (chlordane, dieldrin, and degradation products of DDT) and polychlorinated biphenyls. The sediment carried from this urbanized watershed and deposited in the Ellison Park wetland contains high percentages of fine-grained particles and organic matter and thus facilitates the accumulation of these compounds.

The dominant plant species in the Ellison Park wetland is *Typha glauca* (cattail). The presence of several other plant species, and measurements of cattail density, height, and biomass, indicate a diverse and highly productive floral ecosystem. Chemical analyses of cattail tissue indicate that concentrations of selected chemical constituents are generally greater in below-ground tissue than in above-ground tissue and that the Ellison Park vegetation contains high concentrations of sodium, iron, aluminum, and manganese.

The wetland supports a diverse fish community and provides spawning and(or) rearing habitat for at least 16 species. The primary macroinvertebrate food sources for fish in the wetland are chironomids (midges) and corixids (true water bugs). Eleven other species of aquatic insects, crustaceans, worms, and crayfish were identified from fish-stomach contents. Abundant populations of painted turtles and snapping turtles thrive in the wetland. A survey conducted during the 1980's identified 95 species of birds in and around the wetland area; seven additional bird species were identified in a 1991-92 study. Of these, 28 species probably or definitely use the wetland for breeding.

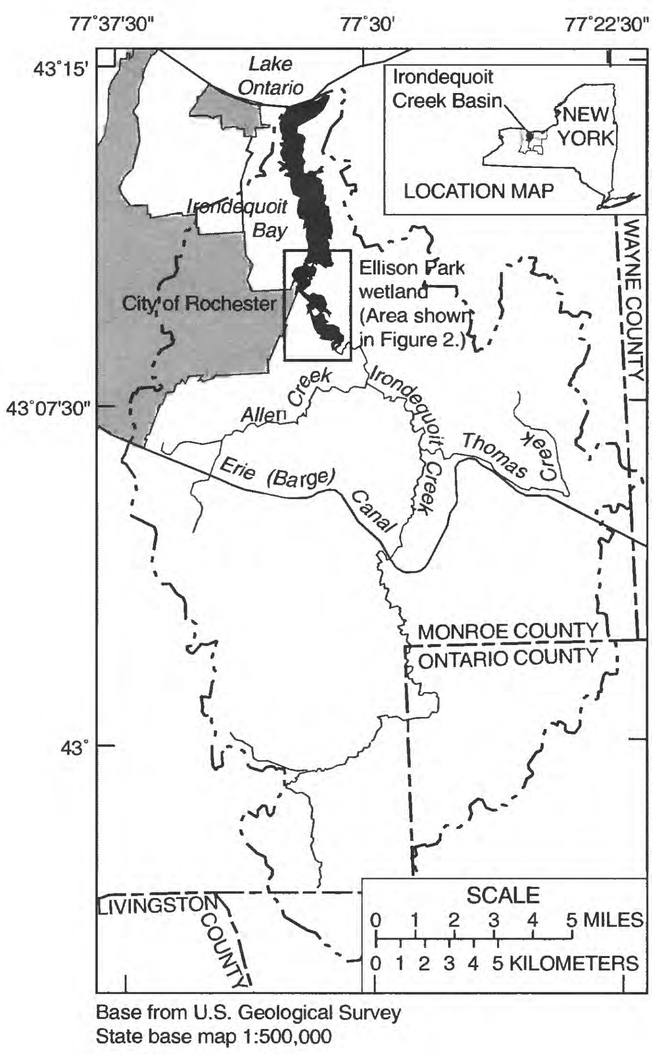


Figure 1. Location and major geographic features of Irondequoit Creek basin, Monroe County, N.Y.

INTRODUCTION

The Irondequoit Bay watershed, which lies southeast and east of the City of Rochester, N.Y., covers an area of 169 mi^2 (fig. 1). Of this area, 151 mi^2 is drained by Irondequoit Creek, which terminates at the south end of Irondequoit Bay, . The upstream (southernmost) part of the Irondequoit Creek basin is dominated by forested and agricultural areas, but a large part of the rest of the basin has become urban and residential (O'Brien and Gere, 1983). Sedimentation and eutrophication of Irondequoit Bay have become a major public concern, and Irondequoit Creek is the source of nutrients that support summertime algal blooms, and of sediment to which heavy metals and organic compounds can adhere.

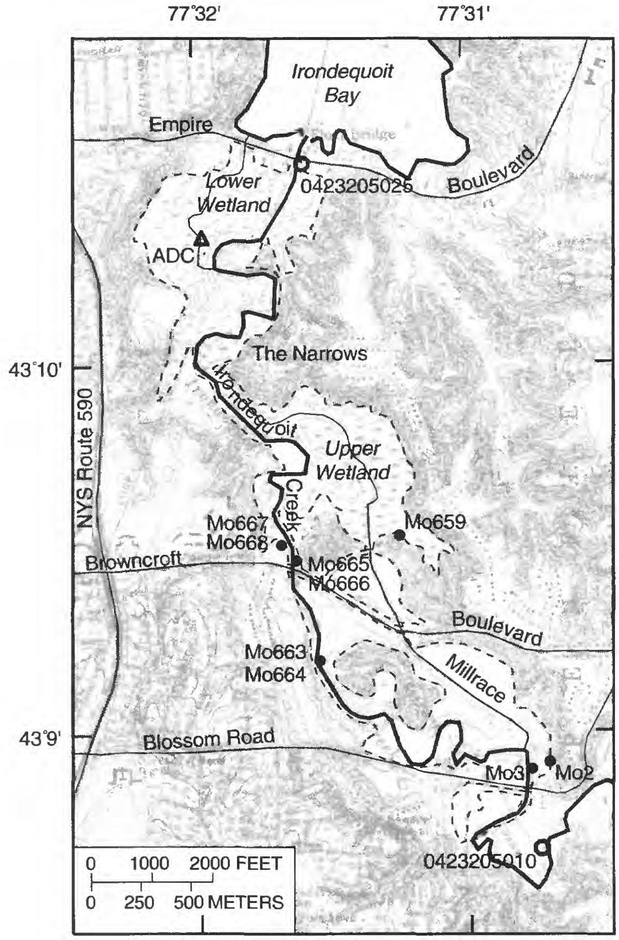
The Irondequoit Creek basin has been studied extensively during the past 20 years by the U.S. Geological Survey (USGS) and by several county departments and university researchers in an attempt to obtain data on the chemical quality and flow characteristics of the creek for use in identifying contaminant sources and evaluating the effects of remediation measures. As a result of these efforts, Monroe County has: (1) decreased the use of road-deicing salts (Diment and others, 1974; Bubeck and Burton, 1989); (2) routed sewage and storm runoff out of the basin to a central wastewater-treatment facility; (3) enacted zoning and construction ordinances to control storm runoff and erosion; (4) evaluated the capacity of in-stream flow-attenuation basins for storage and infiltration of stormwater (Zarriello and Surface, 1989); (5) constructed runoff-detention basins in residential developments to reduce concentrations of sediment and chemical constituents in stormwater (Zarriello and Sherwood, 1993; Zarriello, 1996); and (6) maintained a network of water-quality and streamflow-monitoring stations in the basin. Additional efforts to mitigate eutrophic conditions in Irondequoit Bay include a pilot study on the application of alum to the bay sediments to reduce the release of phosphorus from bottom sediments (Monroe County Department of Health and others, 1984; W.W. Staubitz and R.C. Bubeck, U.S. Geological Survey, written commun., 1995), and artificial oxygenation of the Bay's hypolimnion to improve conditions for game fish (Richard Burton, Monroe County Department of Health, oral commun., 1995).

The hydrologic characteristics of the Irondequoit Creek basin were studied during 1979-81 as part of the Nationwide Urban Runoff Program (NURP) (O'Brien and Gere, 1983; Zarriello and others, 1985; Kappel and others, 1986). One goal of that study was to assess the effect of storm runoff and its associated nutrients and contaminants on the quality of water in Irondequoit Bay. The Irondequoit Creek basin was unique among those studied in the NURP program because it contains an in-stream wetland (fig. 2). After several best-management practices for control of contaminants in urban runoff had been evaluated, this wetland, near the mouth of Irondequoit Creek, was identified as the most cost-effective control measure to reduce nutrient loads to the bay (O'Brien and Gere, 1983).

As a result, Monroe County proposed during the mid-1980's the installation of a flow-control structure on Irondequoit Creek at a point halfway through the wetland to cause stormwater dispersal and detention in the upstream (southern) part of the wetland. Implementation of such a measure required data on present hydrologic and biological conditions within the wetland as a basis for future comparisons and management decisions. Therefore, the USGS, in cooperation with Monroe County Environmental Health Laboratory (MCEHL), began a 4-year study in 1990 to document the hydrologic characteristics and ecological condition of the wetland to provide baseline data from which to assess the effect of flow modification on the wetland.

Purpose and Scope

This report documents the hydrologic, sedimentological, and biological characteristics of the Ellison



Base from scanned U.S. Geological Survey Rochester East, NY 1:24,000, 1978

EXPLANATION

--------	Wetland Boundary
O 0423205010	Streamflow-measurement and water-quality analysis site. Number is USGS streamflow gage number.
▲ ADC	Atmospheric-deposition collector
● Mo2	Observation well and identification number

Figure 2. Locations of data-collection sites in Ellison Park wetland, Monroe County, N.Y. (General location is shown in fig. 1.)

Park wetland. The report (1) summarizes water-surface-elevation and streamflow data; chemical quality of surface water, ground water, and atmospheric deposition; and traveltime and patterns of flow dispersal through the wetland, and (2) presents stream-sediment particle-size analyses, estimated sedimentation rates, and sediment-quality data. It also discusses results of studies of flora and selected fauna and includes an appendix containing presents chemical data for surface water, ground water, and atmospheric deposition are given in the appendix.

Acknowledgment

Thanks are extended to the employees of the Monroe County Environmental Health Laboratory who assisted in the maintenance and operation of the streamflow and water-quality-monitoring sites and analyzed water samples.

ELLISON PARK WETLAND

The wetland, near the mouth of Irondequoit Creek (fig. 2), forms a transition zone between the riparian environment of the creek and the lacustrine environment of Irondequoit Bay. The wetland encompasses about 423 acres (DeGaspari and Bannister, 1983), most of which lies within the boundaries of Monroe County's Ellison Park (fig. 2), and henceforth is referred to as the Ellison Park wetland. The wetland is bounded by steep valley sides on the east and west and by Irondequoit Bay to the north. DeGaspari and Bannister (1983, p. 3) define the southern extent of the wetland as that area that lies at or below an elevation of 250 ft. The wetland converges on the creek just south of Blossom Road (fig. 2). The wetland extends northward from Blossom Road, surrounds two large sand hills of glacial lacustrine origin (Kappel and Young, 1989) on either side of Browncroft Boulevard, then occupies the entire valley floor northward to Irondequoit Bay.

The width of the wetland ranges from 2,500 ft north of Browncroft Boulevard to about 200 ft at a natural constriction locally referred to as "the Narrows" (fig. 2). This constriction is caused by a resistant glacial deposit that impedes lateral erosion of the eastern valley wall. North of this point, the wetland expands to a maximum width of more than 2,500 ft and ends at the mouth of Irondequoit Creek, just north of Empire Boulevard, at the south end of Irondequoit Bay. The manmade boundaries (Browncroft and Empire Boulevards), the steep valley sides, and the constriction at the Narrows impart an hourglass shape to the main area of the wetland, which is vegetated predominantly by cattails, and separates the wetland into an upper segment (south of the Narrows) and a lower segment (north of the Narrows).

Hydrology

Irondequoit Creek enters the wetland area in a single channel, then branches into two channels about 600 ft downstream from Blossom Road (fig. 2). The main channel meanders to the west side of the valley and roughly follows the valley wall until it passes under Browncroft Boulevard. A smaller channel, locally referred to as the Millrace (because it was formerly the outlet raceway for a flour mill on the east bank of the creek just upstream of Blossom Road), takes a more direct path northward to Browncroft Boulevard. Two culverts (48- and 36-in. diameters) permit diversion of flow to the Millrace just downstream from Blossom Road. Little flow passes through the corrugated-metal culverts during low-flow periods because they are elevated above the bottom of the main channel; this design ensures sustained flow in the main channel during low-flow periods but permits the diversion of excess stormflow into the Millrace during high-flow periods.

The conveyance of the Millrace is limited by the channel cross-sectional area for within-bank flows, and by the bridge opening at Browncroft Boulevard for overbank flows. The main channel of Irondequoit Creek conveys more flow than the Millrace channel because it is larger and has a lower bottom elevation. Discharges measured at Browncroft Boulevard in 1982 and 1991 indicate that, for discharges of 600 to 800 ft^3/s, the main channel conveys 73 to 84 percent of the total flow, and that the percentage of flow in the Millrace decreases as the total discharge increases.

Both channels flow into the upper wetland, north of Browncroft Boulevard (fig. 2), where the main channel remains near the west side of the wetland. Flows in the main channel are contained by banks that are higher than the cattail-covered areas beyond. These natural levees are a result of sediment deposition that occurs as overbank flow velocity decreases and sediment is trapped by the dense wetland vegetation along the levee tops.

An extension of the Millrace channel that occupies the east side of the upper wetland (fig. 2) is shallower than the main channel and does not have well-defined banks. High flows are not confined to this channel and easily move into and through the adjacent cattail areas. The shallow bed and the deposition of debris can alter the flow path through the wetland; for example, the open-water channel cut a new path through a cattail-covered area between

1988 and 1991. The channel through this southeastern part of the wetland ends in a large ponded area that connects with the main channel at two points.

Irondequoit Creek flows through the Narrows along a single channel, then enters the lower wetland (north of the Narrows), where it stays near the eastern side of the valley as it meanders northward. The channel divides halfway through the lower wetland, and a small part of the flow passes through the shallower western section (fig. 2). More than 100 years ago, the creek entered Irondequoit Bay through a southward extension of the embayment along the west side of the valley, and a wooden float bridge spanned the channel at the present location of Empire Boulevard (Maude Frank, Town of Penfield Historian, oral commun., 1995). At present, only a 5-ft box culvert remains along this western channel to convey water under Empire Boulevard. The culvert carries insignificant amounts of water during low-flow periods but can convey up to about 5 percent of large flows (unpublished data on file in the Ithaca, N.Y., office of the USGS). The main channel of Irondequoit Creek apparently was rerouted to the eastern side of the valley around 1890 (Patricia Wayne, Town of Irondequoit Historian, oral commun., 1995) to facilitate construction of Empire Boulevard, and now passes under Empire Boulevard 900 ft east of the culvert, where a short channel connects the northern end of the wetland with the southern end of Irondequoit Bay.

Wetland conditions in Ellison Park are wholly or partly dependent on the surface elevation of Lake Ontario, which is maintaied within a narrow range through regulation by control structures on the St. Lawrence Seaway. Lake Ontario water-surface elevation directly or indirectly affects: (1) the hydrographic characteristics of Irondequoit Creek near its mouth, (2) dispersal and traveltime of flow through the wetland, (3) sedimentation rates in the wetland, (4) plant diversity and the distribution of cattails (the dominant plant species in the wetland), (5) faunal diversity in the wetland, and (6) fish movement through the wetland. Data collected during 1960-94 indicate that Lake Ontario's median surface elevation was 246.0 ft above National Geodetic Vertical Datum (NGVD) and that, half the time, the lake's surface elevation was between 245.3 ft and 246.8 ft, NGVD. Data collected at the Empire Boulevard station during 1990-94 indicate that water-surface elevations in the wetland fluctuated only 4.1 ft, from 245.2 ft to 249.30 ft, NGVD. Annual high-water levels occur during May and June, and low-water levels from November through February.

Streamflow

Streamflow is measured at the upstream and downstream ends of the wetland. The upstream site (USGS stream-flow-gaging station 0423205010 in fig. 2) is 4,000 ft (channel distance) above Blossom Road and is within Ellison Park. The discharge is computed from a continuous record of stage and a stage-to-discharge relation developed from discharge measurements made in the channel nearby or, during high flows, from one of two bridges downstream. The downstream site (station 0423205025) is at Empire Boulevard, in the short channel that connects the wetland to Irondequoit Bay. Discharge computation for this site is more complex than for the upstream (Blossom Road) site because the fluctuating surface elevation of Irondequoit Bay causes continuous and variable backwater. Water velocity in this channel is measured with an acoustic velocity meter (AVM). The AVM velocity reading is correlated with the mean velocity in the channel as calculated from discharge measurements made from the Empire Boulevard bridge. Discharge is computed from this relation and from the relation between stage and flow area. Daily mean discharges for both stations are published annually in the USGS water-resources data reports for western New York State (for example, Hornlein and others, 1995).

Hydrographic Characteristics

Stormflow hydrographs for Irondequoit Creek above Blossom Road and at Empire Boulevard (fig. 3) reflect the geomorphic characteristics of the channels at these sites and the effect of the intervening wetland area. Stormflows at Blossom Road are characterized by rapid increases in stage and discharge and by sharp peaks, whereas stormflows at Empire Boulevard often have little effect on stage. Even when discharge increases by a factor of 20, the response in stage is sometimes imperceptible (fig. 3A) owing to the backwater effect of Irondequoit Bay causing inundation of the channel to a depth beyond that necessary to efficiently convey flows. Therefore, as discharge increases, water levels in the channel respond slowly, if at all, until the entire flow area becomes effective in conveying water.

The discharge hydrograph (fig. 3B) indicates that the peak flow at Empire Boulevard, which has been adjusted to include estimated flow through the culvert west of the main channel, typically lags behind that at Blossom Road. The peak at Empire Boulevard is attenuated because (1) the gradient of the channel through the wetland is lower than it is above Blossom Road, and (2) dispersal of flow into the ponded areas of the wetland provides temporary storage. Temporal variations in these hydrographic characteristics result from variations in storm patterns over the basin and the effect of snowmelt.

Flow Duration and Extremes

Daily mean discharges for Irondequoit Creek above Blossom Road for the period of record (1982-94) were used in an analysis of flow duration. Median daily discharge in the creek is 90 ft^3/s. Median flows (based on monthly daily discharges) range from 54 ft^3/s during the summer to 169 ft^3/s in April (fig. 4), and daily discharges range from 60 to 147 ft^3/s half the time. Most of the major high flows in the basin result from spring rain and snowmelt; other peak flows result from summer thunderstorms. Overbank flows in the wetland occur twice a year on average and usually exceed 1,000 ft^3/s. The maximum discharge for the 13-year period of record at the Blossom Road site was 1,710 ft^3/s on April 2, 1993; the minimum recorded discharge was 28 ft^3/s in 1982.

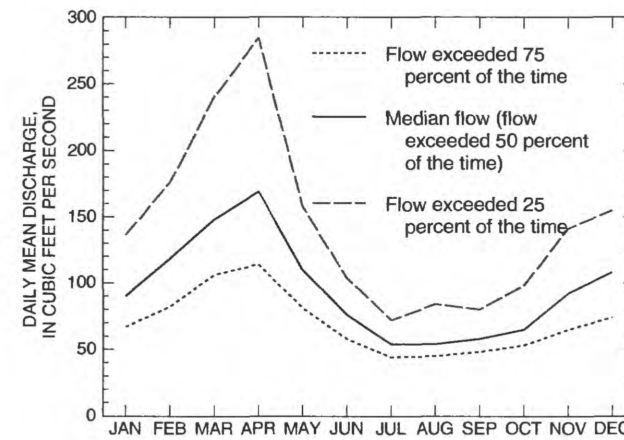


Figure 4. Duration of streamflow at Irondequoit Creek above Blossom Road, Rochester, N.Y., 1982-94

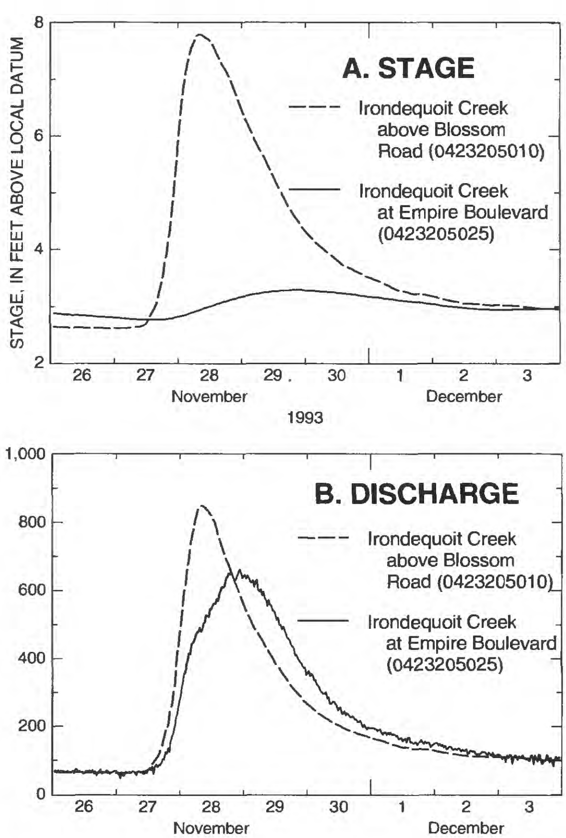


Figure 3. Stage and discharge of Irondequoit Creek above Blossom Road and at Empire Boulevard,near Rochester, N.Y., November 26-December 3, 1993. A. Stage. B. Discharge.

Time of Travel

Time-of-travel studies were conducted previously on Irondequoit Creek and some of its tributaries by Dunn (1962), and the time of travel along the reach from Blossom Road through the wetland to the Narrows was measured on March 17, 1982 in conjunction with the Nationwide Urban Runoff Program (Kappel and others, 1986). Time of travel and flow dispersion from Blossom Road to Empire Boulevard were measured in the present study on March 28, 1991 and, within the eastern part of the upper wetland, on June 12, 1991. These studies were conducted to (1) measure the time required for a "tagged" volume of water to travel from Blossom Road to the Narrows or Empire Boulevard along the main channel; (2) measure and compare the time required for the same water to move along the Millrace on the east side of the valley from Blossom Road to the Narrows; and (3) document the dispersion characteristics of water moving from the main channel and Millrace into the vegetated areas of the wetland. Rhodamine dye, a biologically inert tracer, was used in these studies in accordance with procedures outlined by Kilpatrick and Wilson (1988).

A severe ice storm on March 3 and 4, 1991, broke branches and felled trees into the channels between Blossom Road and Browncroft Boulevard. Discharge measurements at Blossom Road documented the backwater effect caused by this debris. The resulting flow impedance caused longer traveltimes in this part of the study reach on March 28, 1991 than were measured during the time-of-travel study on March 17, 1982. Traveltimes through the wetland downstream of Browncroft Boulevard were not affected by debris accumulation at this time.

Traveltimes and peak dye concentrations at the 23 sampling sites are presented in table 1; site locations and traveltimes are shown in figure 5. Measured discharges along the study reach and Irondequoit Bay water-surface elevations are given in table 2.

Water in the main channel of Irondequoit Creek that was tagged with rhodamine dye during high flows took about 2 hours to travel from Blossom Road to the Narrows and an additional 1.5 hours to reach Empire Boulevard. Tagged water in the Millrace took just over 1 hour to reach Old Browncroft Boulevard but

Table 1. Traveltimes of rhodamine dye and peak dye-tracer concentrations in Ellison Park reach of Irondequoit Creek, Monroe County, N.Y., 1982 and 1991

[Locations are shown in fig. 5. do, ditto; <, less than; >, greater than; --, no measurement made; ND, dye not detected above background levels. 1982 data from Kappel and others (1986).]

Sampling-site identification number and location		Elapsed time from time of dye injection to collection of peak-dye-concentration sample, in minutes			Peak dye concentration, in parts per billion	
		March 17, 1982	March 28, 1991	June 12, 1991	March 28, 1991	June 12, 1991
TT1	service road bridge above Blossom Road	0	0	--	--	--
TT2	Blossom Road	5	5	--	86	--
TT3	Millrace below Blossom Road	--	15	--	154	--
TT4	Millrace at Browncroft Blvd.	45	--	0	--	--
TT5	main channel at Browncroft Blvd.	65	87	--	31	--
TT6	Millrace at Old Browncroft Blvd.	70	64	36	24	96
TT7	Millrace extension into eastern part of upper wetland	--	95	--	14	--
TT8	eastern part of upper wetland above confluence with main channel	--	206	--	3	--
TT9	main channel above Narrows	--	125	--	26	--
TT10	the Narrows	110	--	--	--	--
TT11	Thompson Creek	--	155	--	15	--
TT12	main channel at Centola Point	--	< 171	--	16	--
TT13	western part of lower wetland	--	195	--	9	--
TT14	main channel at Empire Blvd.	--	214	--	9	--
TT15	west culvert at Empire Blvd.	--	378	--	1	--
TT16	eastern part of upper wetland	--	--	100	--	33
TT17	.........do.............	--	--	121	--	28
TT18	.........do.............	--	--	129	--	18
TT19	.........do.............	--	--	> 132	--	ND
TT20	.........do.............	--	--	155	--	18
TT21	.........do.............	--	--	170	--	4.6
TT22	.........do.............	--	--	> 191	--	ND
TT23	.........do.............	--	--	> 180	--	ND

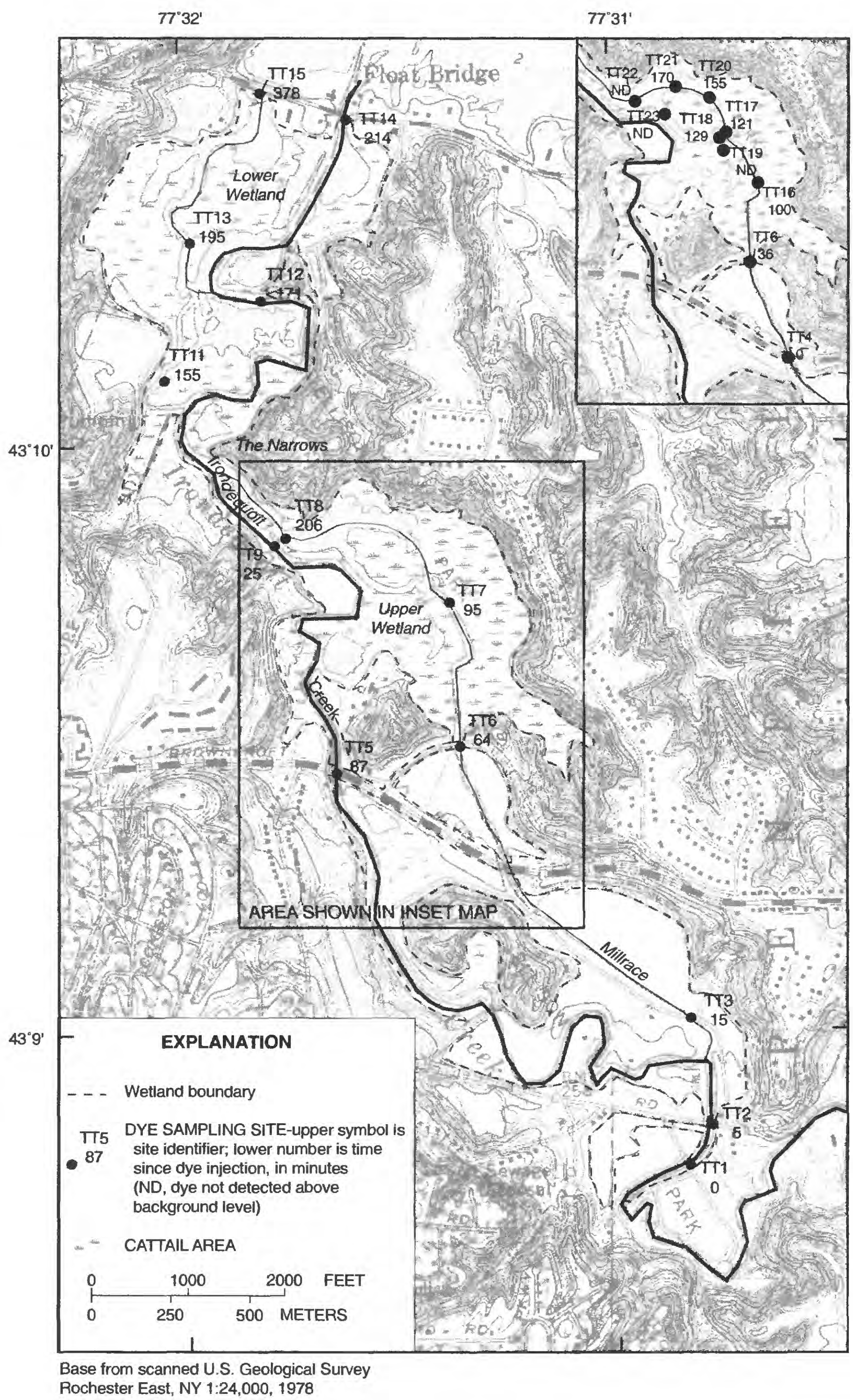


Figure 5. Locations of time-of-travel measurement sites in the Ellison Park wetland, Monroe County, N.Y., and traveltimes of dye tracer on: A. March 28, 1991. B (inset map). June 12, 1991.

required another 2.5 hours to reach a point just upstream of the Narrows. Tagged water at Empire Boulevard was first detected at the culvert west of the main channel almost 3 hours after the peak concentration in the main channel. Most of the water in the main channel seemingly moves quickly through the wetland, but water that leaves the main channel and flows into the backwater areas of the wetland moves more slowly and is detained in the wetland.

Flow Dispersion and Detention

Flow-dispersion studies conducted simultaneously with the time-of-travel studies indicate that, for within-bank flows (in the range of 600 to 800 ft^3/s), most of the water that passes the Millrace diversion just downstream of Blossom Road remains in the main channel, and very little disperses into the cattail areas of the wetland. Flow measurements made during the time-of-travel studies indicate that discharge in the Millrace constitutes only 16 to 27 percent of the total flow measured at Browncroft Boulevard (table 2).

Data from March 1991 and June 1991 suggest that diversion of high flows to the Millrace facilitates dispersion and, possibly, detention of water in the cattail-covered backwater area within the eastern part of the upper wetland downstream of Browncroft Boulevard. Two sampling points, TT8 and TT9 (table 1 and fig. 5A), which are separated by a narrow, cattail-covered berm and are an equal straight-line distance from the injection point, receive water through different routes. During the March 1991 study, a peak dye concentration of 3 ppb was measured at site TT8 (in the upper wetland area that is fed directly by flow from the Millrace) 81 minutes after a peak dye concentration of 26 ppb was measured at site TT9 in the main channel (table 1). During the June 1991 study (fig. 5B), when a high water-surface elevation in Irondequoit Bay (table 2) caused high backwater conditions, a peak dye concentration of 96 ppb at Old Browncroft Boulevard (site TT6) decreased to less than 5 ppb at the down-stream end of the study reach (site TT21) just over 2 hours later. Dye was undetected above background levels at site TT22, about 500 ft west of TT21 (table 1 and fig. 5B). These results indicate that water entering the eastern part of the upper wetland by way of the Millrace is detained in that area.

In the lower wetland, water that leaves the main channel and enters the northwestern part of the wetland is similarly impeded and detained. The peak dye concentration in the main channel at site TT14 (Empire Boulevard) during the March 1991 study was 9 ppb, but only 1 ppb was recorded just over 2.5 hours later at site TT15, at the northwest-outlet culvert 900 ft west of the main channel (fig. 5A). The dye concentration at this site was still above background levels more than 15 hours later, indicating a natural detention of stormflows when water was diverted to the backwater areas of the wetland.

Table 2. Discharges measured and water-surface elevations recorded in 1982 and 1991 during time-of-travel studies in Ellison Park reach of Irondequoit Creek, Monroe County, N.Y.

[Locations are shown in fig. 2. ---, no measurement made.]

Measurement site	March 17, 1982[a]	March 28, 1991	June 12, 1991
Discharge, in cubic feet per second			
Blossom Road	740	633	400[b]
Main channel at Browncroft Boulevard	695	491	---
Millrace at Browncroft Boulevard	134	180	44.4
Total discharge at Browncroft Boulevard	829	671	---
The Narrows	799	---	---
Empire Boulevard	---	554[c]	---
Daily mean water-surface elevations, in feet above National Geodetic Vertical Datum[d]			
Lake Ontario at Oswego	245.4	247.1	247.6
Irondequoit Bay (at Empire Boulevard)	---	247.4	247.8

a Data from Kappel and others (1986)
b Discharge from recorded stage.
c Discharge is average of two measurements.
d National Geodetic Vertical Datum can be converted to International Great Lakes Datum by subtracting 1.2 ft.

Water Quality

Water-quality-monitoring stations were operated at the streamflow-monitoring sites (fig. 2). Automatic samplers, which extracted water samples from the channel (near the centroid of flow) hourly and stored them in refrigerated bottles, were maintained by Monroe County Environmental Health Laboratory (MCEHL). MCEHL analyzed the samples for chloride, sulfate, and the common forms of nitrogen and phosphorus. Samples collected during stormflows were analyzed additionally for total organic carbon, biochemical and chemical oxygen demand, alkalinity, specific conductance, suspended solids, and trace metals (cadmium, copper, lead, and zinc).

An atmospheric-deposition collector (ADC) was installed in the lower wetland about 1,700 ft south of Empire Boulevard (fig. 2) to collect samples monthly. These samples were analyzed by MCEHL for major inorganic ions that characterize wet deposition—nitrate, ammonia, phosphorus, orthophosphorus, sulfate, chloride, sodium, potassium, calcium, and magnesium (Bigelow and Dossett, 1988), as well as two trace metals—lead and zinc. Specific conductance and pH also were measured as overall indicators of precipitation quality.

Surface Water

Analyses of surface-water samples collected during 1991-94 at discharges above the median daily discharge of 90 ft^3/s at Blossom Road and Empire Boulevard are summarized in appendix table A-1. Nitrogen and phosphorus concentrations were within the range of those typically found in urbanized basins as reported by Hem (1985). Median concentrations of total nitrogen were 1.9 and 2.0 mg/L at the Blossom Road and Empire Boulevard monitoring sites, respectively, and median total phosphorus concentrations were about 0.2 mg/L at both sites (fig. 6). Specific conductance at the two sites (median values of 810 and 818 µS/cm, respectively) was high, as would be expected during periods of storm runoff, partly as a result of high concentrations of dissolved solids (sulfate and chloride). High chloride concentrations generally showed a seasonal pattern—concentrations usually were below 100 mg/L during the summer and fall but exceeded 100 mg/L and were as high as 390 mg/L during the winter. This pattern likely reflects wintertime use of road-deicing salts in the basin, the effect of which has been documented by Diment and others (1974). High concentrations of zinc in urban areas are commonly related to its wide distribution in the environment from industrial uses and to its high solubility (Hem, 1985). High zinc concentrations in the Irondequoit Creek basin (median value 60 µg/L, maximum 370 µg/L) might also be due partly to dissociation of zinc sulfide from the dolomite that underlies part of the basin and also is within the overlying glacial deposits and local soils (Kappel and others, 1986, p. 34). Cadmium concentrations generally were below the analytical detection limit (1 µg/L).

Comparison of 1991-94 chemical concentrations of above-median flows at the upstream (Blossom Road) site with those at the downstream (Empire Boulevard) site (fig. 6) indicated higher median concentrations of ammonia and orthophosphorus at the downstream end of the wetland than at the upstream end, whereas median concentrations of ammonia-plus-organic nitrogen and total phosphorus were lower. The median values and ranges of nitrate-plus-nitrite, as well as sulfate and chloride, were similar at both sites. The ranges of copper, lead, and zinc concentrations differed between the two sites, but the median concentrations were similar.

Atmospheric Deposition

Average annual precipitation in the Rochester area is about 31.5 in., including an average snowfall of about 85 in. (O'Brien and Gere, 1983, p. 30). Atmospheric deposition was collected in a remote location within the lower wetland, 1,700 ft from the nearest road (fig. 2). Under normal operating conditions, the atmospheric-deposition collector (ADC) separates the wet component (wetfall), which includes all forms of precipitation, from the dry component (dryfall), which includes dew, frost, fog, and gravitationally settled particles during periods of no precipitation.

Monthly analyses of atmospheric deposition were divided into wetfall, dryfall, and bulk analyses (appendix table A-3). The wetfall and dryfall samples collected from April through September 1992 were analyzed separately but, because battery failure frequently left both sides of the ADC exposed, the results were stored as if from bulk or composite samples (table A-3, part C). During this period, some samples contained unusually high concentrations of many constituents, presumably through contamination from bird excrement and mud. This was particularly evident in the June-July 1992 bulk sample (table A-3, part C) but was probably a source of error for other samples collected during 1992. Comparison of wetfall with dryfall data from 1992-94 (table 3) suggests that wetfall was slightly more acidic than dryfall and had generally lower concentrations of most constituents. Wetfall values of specific conductance and concentrations of nitrogen and sulfate were neither consistently higher nor lower than dryfall values.

Chemical concentrations of atmospheric deposition from Ellison Park were compared with data presented by (1) Hem (1985), who summarized the results of atmospheric-deposition analyses of samples collected from more than 90 sites randomly located throughout the conterminous United States,

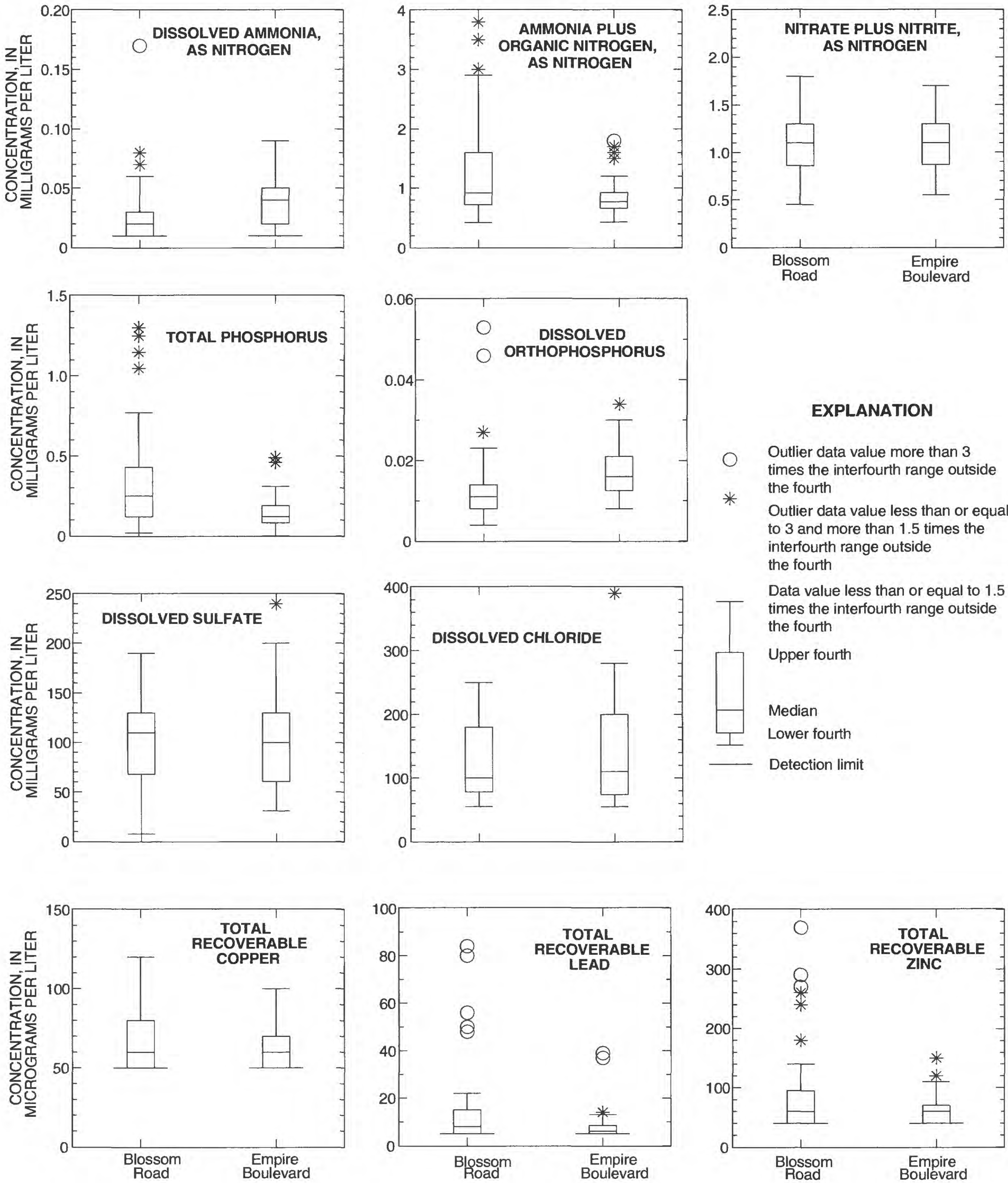


Figure 6. Concentrations of selected constituents in surface-water samples collected during above-median flows from Irondequoit Creek above Blossom Road and at Empire Boulevard, near Rochester, N.Y. 1991-94 (Site locations are shown in fig. 2)

Table 3. Median chemical values for wetfall and dryfall collected in the Ellison Park wetland, Monroe County, N.Y., October 1992 through September 1994

[Concentrations in milligrams per liter (mg/L) except where noted; μS/cm, microsiemens per centimeter; $CaCO_3$, calcium carbonate.]

Constituent or physical property	Wetfall	Dryfall
Specific conductance (μS/cm)	44	41.5
pH (standard units)	4.2	4.85
Acidity (as $CaCO_3$)	6.0	5.2
Ammonia (as N)	.60	.32
Ammonia + organic nitrogen (as N)	.64	.8
Nitrate + nitrite (as N)	.72	.845
Phosphorus	.025	.130
Orthophosphorus (as P)	.006	.0385
Calcium, dissolved	.58	1.30
Calcium, total	.685	1.80
Magnesium	.15	.45
Sodium	.16	.30
Potassium	.08	.18
Chloride	.60	.93
Sulfate	5.0	6.0
Lead	6	8
Zinc	40	40

and (2) Peters and Bonelli (1982), who presented chemical compositions of bulk deposition collected during the winter of 1980-81 at 179 sites in the north-central and northeastern United States. Concentrations of most constituents measured at the Ellison Park atmospheric-deposition site were near or slightly above the median values reported by Peters and Bonelli (1982) but were within the ranges of concentrations reported by Peters and Bonelli (1982) and by Hem (1985).

Wetfall and dryfall samples also were collected at three sites in the Irondequoit Creek basin during 1980-81; concentrations of phosphorus, nitrogen, lead, and chloride are presented in Zarriello and others (1985). Concentrations of these four constituents measured in Ellison Park samples during 1993-94 exceeded the range of average seasonal concentrations measured in 1980-81, but the median concentrations obtained during 1993-94 were within the ranges reported for 1980-81 (table 4).

Ground Water

Ground-water levels and chemical quality were monitored at nine observation wells near Blossom Road and Browncroft Boulevard (fig. 2). Three paired-well installations permitted comparison of water levels and water quality at two depths in the aquifer at a given location. Water levels were measured monthly by MCEHL personnel. Ground-water movement in the unconfined aquifer in the area is from the valley walls toward Irondequoit Creek and northward toward Irondequoit Bay (Yager and others, 1985). High water levels in the creek might cause short-term recharge to the streambank and flood-plain deposits, but generally the Ellison Park wetland is a ground-water discharge point (Kappel and Young, 1989).

Ground-water samples were collected periodically and analyzed by MCEHL for specific conductance, dissolved oxygen, alkalinity, nitrogen, phosphorus, calcium, magnesium, sodium, potassium, chloride, sulfate, iron, and manganese (appendix table A-2). The high values of specific conductance and hardness probably reflect high concentrations of sodium, chloride, calcium, and

Table 4. Concentrations of selected atmospheric-deposition constituents at three sites in Irondequoit Creek basin, 1980-81, and in Ellison Park wetland, 1992-94, Monroe County, N.Y.

[Concentrations in milligrams per liter. 1980-81 data from Zarriello and others (1985).]

	Wetfall concentration			Dryfall concentration		
	1980-81 Irondequoit Creek basin	1992-94 Ellison Park wetland		1980-81 Irondequoit Creek basin	1992-94 Ellison Park wetland	
Constituent	Average seasonal range	Range	Median	Average seasonal range	Range	Median
Total phosphorus	0.006 - 0.104	0.005 - 0.14	0.025	0.008 - 0.432	0.015 - 2.05	0.130
Ammonia-plus- organic nitrogen (as N)	.225 - 1.47	.14 - 3.3	.87	.327 - 2.20	.10 - 24	.80
Lead	.007 - 0.019	.004 .025	.006	.006 - 0.063	< 5 - 9	.008
Chloride	.116 - 8.79	.20 - 2.6	.60	.292 - 28.0	.20 - 9.2	.93

magnesium. Specific conductance ranged from 510 µS/cm at well Mo659 to 23,100 µS/cm at well Mo664, and hardness ranged from 90 mg/L (as calcium carbonate, $CaCO_3$) at well Mo659 to 6,900 mg/L at well Mo664. Nitrogen and phosphorus concentrations were typical of urban environments and comparable to those measured in some of the Ellison Park wells during the mid-1980's (Kappel and Young, 1989). Alkalinity ranged widely from 29 mg/L $CaCO_3$ at well Mo659 to 1,060 mg/L $CaCO_3$ at well Mo667. High alkalinity concentrations are probably derived from the carbonate sedimentary bedrock that underlies the area.

Data from two wells (Mo2 and Mo3) provided a basis for assessment of changes in ground-water quality over the past 9 years (table 5). Data were collected quarterly and divided into two periods—1986-89 and 1990-94. The generally lower median and maximum values during the latter period suggest an overall improvement in ground-water quality.

Table 5. Chemical quality of water from two wells in Ellison Park wetland, Monroe County, N.Y., 1986-89 and 1990-94

[Locations are shown in fig. 2. Concentrations in milligrams per liter except where noted; µS/cm, microsiemens per centimeter; $CaCO_3$, calcium carbonate; <, less than. 1986-89 data from Johnston and Sherwood (1994) and unpublished data on file at Ithaca, N.Y., office of the U.S. Geological Survey.]

Constituent or physical property	1986-89			1990-94		
	Median	Maximum	Minimum	Median	Maximum	Minimum
A. Well Mo2 (local well number)						
Ammonia (as N)	0.040	0.100	0.020	0.030	0.055	< 0.010
Ammonia + organic nitrogen (as N)	0.48	0.92	0.18	0.28	0.54	0.13
Nitrite + nitrate (as N)	0.010	0.300	< 0.010	0.050	0.120	< 0.050
Total phosphorus	0.060	0.190	0.020	0.025	0.063	0.010
Orthophosphorus (as P)	< 0.005	0.008	< 0.005	0.002	0.037	< 0.002
Specific conductance (µS/cm)	1,020	1,080	918	888	1,060	807
pH (standard units)	7.6	7.8	7.4	7.7	7.8	7.4
Alkalinity (as $CaCO_3$)	202	235	198	180	200	170
Hardness (as $CaCO_3$)	330	400	300	300	320	280
Calcium	90	110	84	82	90	74
Magnesium	24	30	21	21	23	15
Sodium	83	90	74	70	80	58
Potassium	2.0	2.6	1.5	1.5	2.1	1.2
Chloride	170	190	140	140	150	110
Sulfate	75	100	72	74	88	38
Iron	0.89	4.50	0.27	0.40	1.60	0.20
B. Well Mo3 (local well number)						
Ammonia (as N)	< 0.010	0.020	< 0.010	< 0.010	0.010	< 0.010
Ammonia + organic nitrogen (as N)	0.38	0.88	0.13	0.26	0.77	< 0.10
Nitrite + nitrate (as N)	0.540	0.740	0.150	0.454	0.590	0.050
Total phosphorus	0.030	0.235	0.010	0.010	0.030	0.005
Orthophosphorus (as P)	< 0.005	0.006	< 0.005	0.004	0.006	< 0.002
Specific conductance (µS/cm)	1,390	1,500	995	1,300	1,330	1,270
pH (standard units)	7.5	7.7	7.2	7.6	7.8	7.3
Alkalinity (as $CaCO_3$)	250	303	240	240	250	240
Hardness (as $CaCO_3$)	420	470	390	380	390	370
Calcium	120	130	110	110	130	100
Magnesium	30	38	28	27	33	25
Sodium	130	150	120	130	130	80
Potassium	3.3	4.3	2.6	2.8	5.2	2.1
Chloride	260	270	250	230	250	220
Sulfate	90	160	78	80	100	15
Iron	0.800	3.20	0.15	0.15	0.46	0.07

Sedimentology

Bed-material particle sizes were analyzed to characterize particle-size distribution and sediment-depositional environments within the wetland. An attempt was made to measure the current rate of sediment accumulation in the wetland and to compare this rate with an estimated historical sedimentation rate. Four fine-grained sediment samples were collected from three sites in backwater areas of the wetland and analyzed for major and trace elements and organic chemicals, including organochlorine compounds and polynuclear aromatic hydrocarbons.

Particle Size and Distribution

Bed material was sampled at 11 sites in the wetland (fig. 7) to document particle-size distributions at each site and the areal variation in depositional environments within the wetland. Sites were selected that would represent average bottom-material composition along the main channel and in the backwater areas of the wetland. Site GS8, just downstream from the Narrows, was selected because it contains coarse material (larger than 4 mm) that is found nowhere else in the wetland. Eight sediment samples were separated by sieving into the standard size classes defined by the ranges listed in table 6. The coarse material collected at site GS8 by random grab sampling (Wolman, 1954) was measured with a tape. In conjunction with chemical-quality analyses, three samples (GS5, GS6, and GS10) from backwater areas of the wetland were analyzed more precisely by the sieve and pipet methods (Guy, 1969), wherein the sand and coarse fractions are separated by sieving, and the silt and clay fractions are analyzed by the pipet method, which measures the concentration of a suspension at a predetermined depth as a function of settling time. The size distributions of all sediment samples are listed in table 7.

Table 6. Classification and range of particle sizes.
[From Spencer (1972, p. 163). >, greater than; <, less than.]

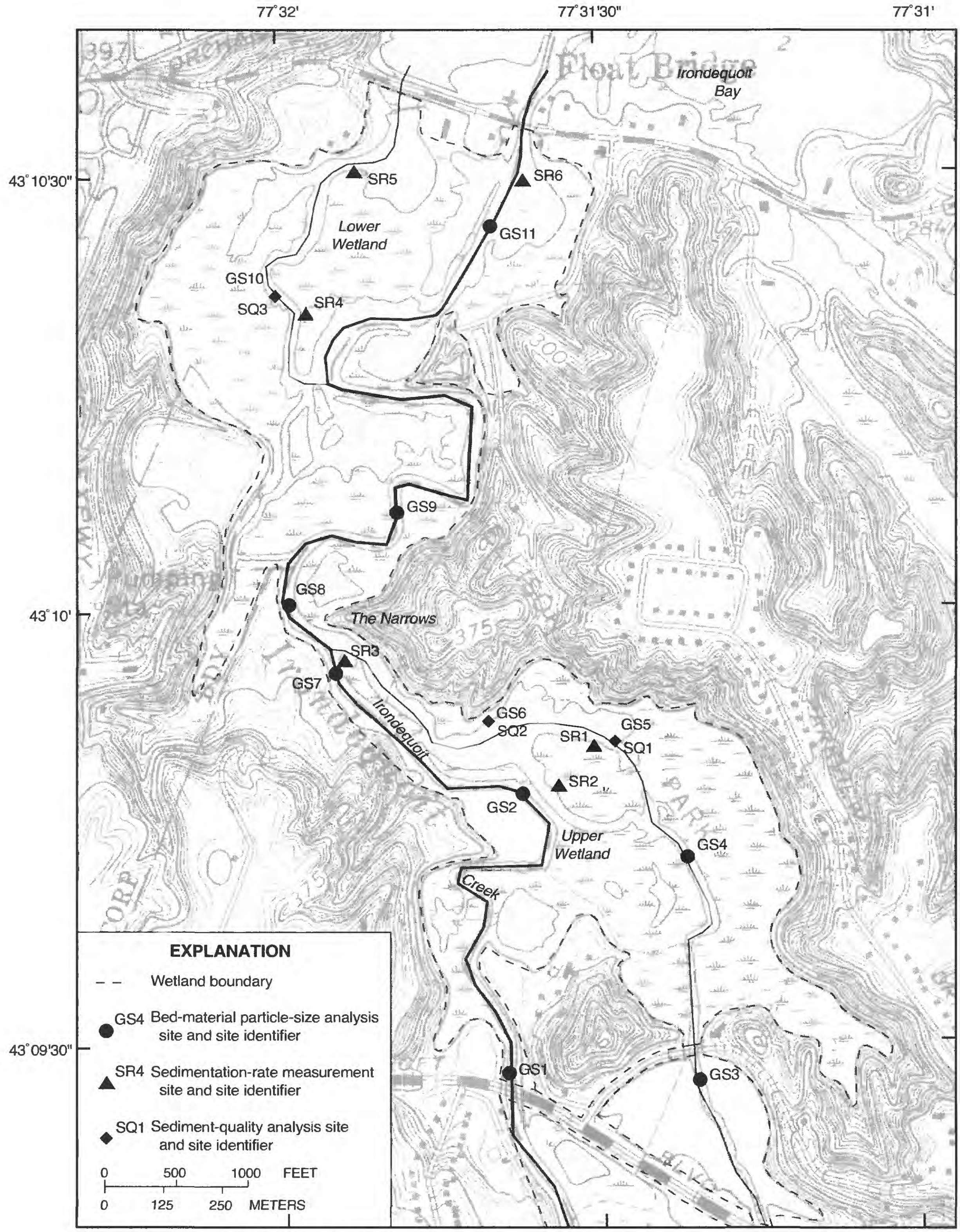
Class	Size range, in millimeters
Boulder	> 256
Cobble	64 - 256
Pebble	4 - 64
Granule	2 - 4
Sand	0.062 - 2
Silt	0.004 - 0.062
Clay	< 0.004

Sand is the predominant bed material in the main channel throughout the wetland, except at the Narrows (sample GS8), where erosion of underlying glacial deposits has resulted in coarse bed material (table 8). Silt and clay are the predominant bed

Table 7. Size distribution of sediment samples from Ellison Park wetland, Monroe County, N.Y., by percentage of particles finer than index-particle size
[Sampling locations are shown in fig. 7. mm, millimeters]

Sample number	Type of analysis[a]	Index particle size, in millimeters: 85	30	11	4	2	1	0.5	0.25	0.125	0.062	0.031	0.016	0.008	0.004	0.002
		Percentage of particles finer than particle size given above														
GS1	S			100	99	96	88	66	23	11	4					
GS2	S				100	99.9	98.5	52	31	15	2					
GS3	S				100	99.6	99.1	97.1	87	77	55					
GS4	S				100	99.9	99.7	95.6	86	74	48					
GS5	S/P					100	99.99	99.96	99.84	99.28	92.39	89.04	62.58	37.11	21.62	11.55
GS6	S/P						100	99.65	99.16	97.35	88.69	76.46	54.03	34.23	24.76	16.46
GS7	S			100	98.2	97.6	95	86	75	62	18					
GS8[b]	G/S	100	72	59	52	50	45	33	13	8	4					
GS9	S				100	99.7	97.6	87	73	57	13					
GS10	S/P					100	99.93	99.77	99.38	97.87	82.35	35.47	32.41	19.93	14.80	10.91
GS11	S				100	99.6	98	93	75	45	16					

a G, tape measurement of material larger than 11 mm;
S, sieve analysis of material between 11 and 0.062 mm;
P, pipet analysis of material smaller than 0.062 mm.
b Percentages are approximate; weight of fraction larger than 30 mm was estimated.



Based from scanned U.S. Geological Survey
Rochester East, NY 1:24,000, 1978

Figure 7. Locations of sediment data-collection sites in Ellison Park wetland, Monroe County, N.Y.

materials in the backwater areas of the wetland, especially in the eastern part of the upper wetland (samples GS5 and GS6) and in the western part of the lower wetland (sample GS10). The sediments in these areas also are high in organic matter (see sediment-quality data, table A-4, for sites SQ1, SQ2, and SQ3, which correspond to particle-size-analysis sites GS5, GS6, and GS10, respectively).

Table 8. Size distribution of sediment samples from Ellison Park wetland, Monroe County, N.Y., by percentage of particles that fall in major particle-size classes

[Locations are shown in fig. 7. --, percentage not determined.]

Sampling site and sample number	Percentage of sample that falls in given particle-size class				
	Larger than sand	Sand	Silt	Clay	Silt and Clay
GS1	4	92	--	--	4
GS2	0	98	--	--	2
GS3	0	45	--	--	55
GS4	0	52	--	--	48
GS5	0	7.61	70.77	21.62	92.39
GS6	0	11.31	63.93	24.76	88.69
GS7	2	80	--	--	18
GS8	50	46	--	--	4
GS9	0	87	--	--	13
GS10	0	17.65	67.55	14.80	82.35
GS11	0	84	--	--	16

Sedimentation Rate

The rate of sedimentation near the mouth of Irondequoit Creek has been calculated by Young (1992), and that for Irondequoit Bay by Schroeder (1985). Young (1992) used radiocarbon-dating techniques to estimate historical sedimentation rates from two sediment cores taken at the outlet of Irondequoit Bay and one core from the vicinity of Irondequoit Creek near Browncroft Boulevard; his results indicated the average historical sedimentation rate at the mouth of Irondequoit Creek to be 1 ft per 99 years, or 0.01 ft/yr (3 mm/yr). This rate is consistent with the rate of rise in the water-surface elevation and consequent deepening of the depositional pool along the southern shore of Lake Ontario in response to a differential rate of postglacial isostatic rebound of the Lake Ontario basin. The rate of glacial rebound at the northeastern end (outlet) of Lake Ontario is 1.25 ft per century and, at the southwestern end, is 0.25 ft per century (Clark and Persoage, 1970; Larsen, 1985). Because the lake outlet has been rising faster than the rest of the lake, the water level along the southern shore has been rising at a "differential" rate of about 1.00 ft per century. The rate of sediment accumulation in the vicinity of Irondequoit Bay, as computed by Young (1992), approximates this rate of water-level rise and the resulting deepening of the depositional pool in the area that encompasses the Ellison Park wetland and Irondequoit Bay. Recent and current sedimentation rates could have accelerated as a result of (1) increased erosion from development and agricultural activities in the basin, and (2) aggravated channel erosion resulting from increased runoff from impervious areas, and probably are greater than the historical sedimentation rate.

Schroeder (1985) used lead-210 and cesium-137 radioisotopic-measuring techniques on four bottom-sediment cores taken from Irondequoit Bay in 1980 and calculated yearly sediment-accumulation rates of 0.10 to 0.36 g/cm^2 on a dry-weight basis. The calculated thickness of sediment deposited between 1964 (the year of peak cesium-137 concentration in the atmosphere) and 1980 (when the samples were collected) (data from R.A. Schroeder, U.S. Geological Survey, written commun., 1995), indicates a current sedimentation rate of 2.8 to 3.7 mm/yr. The nonuniform and discontinuous accumulation of sediment reflected in this range of sedimentation rates is probably the result of preferential depositional environments for fine-grained particles and the episodic nature of erosion and deposition in the Irondequoit Creek watershed (Schroeder, 1985).

An estimate of the current rate of sediment accumulation in the Ellison Park wetland was made by anchoring 1-ft-diameter plastic disks in the wetland (locations shown in fig. 7) to provide reference surfaces from which sediment depths could be measured. The disks were placed in depositional environments in the cattail areas of the wetland, near the low-water edges of channels that carry stormflows, and were inspected periodically for changes in sediment thickness (table 9). Sediment thicknesses measured shortly after disk installation were generally larger than those measured later, but all measurements are considered representative of sediment deposition and removal in the vicinity of the disks and were used in sedimentation-rate calculations.

Organic matter, primarily duckweed and decaying cattails, as well as fine-grained sediment, accumulated on the disks in varying amounts. Sediment appears to be deposited and removed from the cattail-covered areas of the wetland in a pattern that would be expected for a system in a state of dynamic

Table 9. Sediment-thickness changes and net sedimentation rates at sedimentation-measurement sites in Ellison Park wetland, Monroe County, N.Y., 1991-95

[Locations are shown in fig. 7. mm, millimeter; yr, year; --, no data.]

Site number	Date of equipment installation	Change in thickness of sediment from previous inspection, in millimeters. +, sediment accretion; -, sediment removal						Net sediment thickness (mm)	Period of data collection (years)	Net sedimentation rate (mm/yr)
		9/92	10/92	9/93	9/94	10/94	6/95			
SR1	5/29/92	a	+2	+14	-7	b	-3	+6	3.08	1.9
SR2	5/29/92	c	+4	+11	c	b	-9	+6	3.08	1.9
SR3	5/29/92	+18	-2	0	-4	b	+3	+15	3.08	4.9
SR4	6/91	b	+20	-9	+4	b	b	+15	3.25	4.6
SR5	11/16/93	--	--	--	d	+30	d	+30	0.92	e
SR6	11/16/93	--	--	--	d	+9	d	+9	0.92	e

a Thin layer of organic matter only
b Sediment disk not inspected
c Sediment disk not found in dense cattail growth
d Sediment disk submerged\
e Sedimentation rate not computed; data-collection period too short

equilibrium—episodic deposition of a large quantity of sediment is followed, in subsequent years, by partial resuspension and removal. The net sedimentation rate over the period of data collection ranges from 1.9 to 4.9 mm/yr (table 9), with an overall average rate of 3.3 mm/yr. Lower rates were indicated for the backwater area of the upper wetland, and higher rates were indicated for areas just upstream of the Narrows and the backwater area of the lower wetland. These rates of sedimentation are comparable to the historical rate of 3 mm/yr calculated by Young (1992) for a 2,000- to over 11,000-year accumulation period, and encompasses the recent rate of 2.8 to 3.7 mm/yr computed from Schroeder's data (R.A. Schroeder, written commun., 1995) for sediment deposited during 1964-80.

Sediment Quality

The chemical quality of sediment in the Ellison Park wetland was assessed through an analysis of three fine-grained-sediment samples (plus one duplicate sample) collected from the backwater areas of the upper wetland (two sites) and lower wetland (one site) in October 1994. (Locations are shown in fig. 7.) These samples were analyzed for (1) major and trace elements (analytical methods are listed under Schedule 2400 in Timme, 1995), (2) polynuclear aromatic hydrocarbons by gas chromatography with a mass-spectrometric detector, and (3) organochlorine compounds by gas chromatography with electron-capture detectors (Wershaw and others, 1987). (Results are given in appendix table A-4.) Sampling sites were within long-term depositional areas and distant from channels that might carry high-velocity, erosive flows. Samples were collected under shallow water from the top 10 cm of sediment.

Results of sediment-quality analyses can be affected by the relative percentages of organic matter and fine-grained particles (silt and clay); therefore, additional samples (GS5, GS6, and GS10) were collected at each site for carbon and particle-size analyses. The samples in these depositional environments contained from 3.4 to 5.0 percent total organic carbon by weight (table A-4, part A) and more than 82 percent silt-size or smaller particles (table 8); these characteristics are conducive to rapid adsorption of organic compounds (Smith and others, 1988) and some metals (Hem, 1985). The measurements of particle size and carbon content permit comparisons of chemical quality between sites, as well as over time at a given site.

High concentrations of some metals (barium, manganese, strontium, and zinc) were found in the Ellison Park sediments (table A-4), but these were in the range expected for an urbanized watershed (E.C. Callender, U.S. Geological Survey, written commun., 1996). A previous sediment-quality study conducted by the USGS in 1980 on sediment cores from Irondequoit Bay included analyses of four samples for selected elements by X-ray fluorescence spectroscopy (R.A. Schroeder, written commun., 1995). Aliquots of sediment from selected depths were dated and analyzed to identify long-term trends in trace-metal concentrations and to document the effects of urbanization in the watershed on the sediment quality of the Bay (Schroeder, 1985). For example, concentrations of lead, copper, and zinc began to increase around 1940, peaked in the 1960's, and declined in the 1970's. The decline in metal concentrations in the 1970's might reflect a decrease in trace-metal loadings from the basin after elimination of point sources of contamination, that is, routing of sewage and storm runoff out of the basin for treatment (R.A. Schroeder, written commun., 1995). A second explanation could be dilution resulting from increased sedimentation rates (Schroeder, 1985).

Although the analytical method used to determine the element concentrations in the 1980 samples from Irondequoit Bay (x-ray fluorescence spectroscopy) differs from the method used for the 1994 Ellison Park wetland samples (atomic absorption spectrometry), comparison of the two data sets is valid (A.J. Horowitz, U.S. Geological Survey, oral commun., 1996). The mean concentrations of major and trace elements measured in the top 10 cm of the 1980 sediment cores are presented in table 10; this depth corresponds to that of the 1994 samples. No marked differences are evident except for calcium, lead, and strontium, which are markedly lower in the Ellison Park wetland samples (table 10).

Some polynuclear aromatic hydrocarbons, including chrysene, fluoranthene, phenanthrene, and pyrene, were found in high concentrations in the Ellison Park sediments, and persistent organochlorine pesticides (chlordane, DDD, DDE, DDT, and dieldrin) and polychlorinated biphenyls (PCB's) also were detected (table A-4, parts B and C). Concentrations of many of the polynuclear aromatic hydrocarbons (PAH's) were higher in the lower wetland (SQ3) (fig. 7) than in the upper wetland (SQ1 and SQ2). Many of these compounds are highly resistant to chemical or biological transformation and, therefore, are extremely persistent in the environment. Nonionic organic compounds, such as chlorinated insecticides, PCB's, and PAH's, have low aqueous solubility and strongly partition from solution to biota, particulate material, and dissolved organic matter (Smith and others, 1988). Therefore, the presence and magnitude of concentrations of these compounds in the organic-rich sediments at the downstream end of this highly urbanized watershed is not surprising, in that large chemical loads were continually discharged from many sewage-treatment plants before the 1980's, when a centralized wastewater-treatment system was installed in the basin. Nevertheless, the concentrations of many of the organo-chlorine pesticides and PCB's in Ellison Park sediments (table A-4, part C) are comparable to or lower than those measured in 14 studies in the United States during the 1970's and 1980's, as reported in Smith and others (1988, p. 33).

Table 10. Mean concentrations of selected elements in sediment samples from Irondequoit Bay (1980) and Ellison Park wetland (1994), Monroe County, N.Y.

[Locations of Ellison Park wetland sites are shown in fig. 7. ppm, parts per million. Irondequoit Bay data from R.A. Schroeder, U.S. Geological Survey, written commun., (1995). All samples are from top 10-centimeter depth.]

	Irondequoit Bay, 1980					Ellison Park wetland, 1994
	Core-site identification[a]					
Element	Deep	Ides	Center	West	Mean of four cores	Mean of three samples
Aluminum (percent)	4.0	2.6	5.4	8.0	5.0	4.9
Potassium (percent)	1.4	1.3	1.8	1.4	1.5	1.6
Calcium (percent)	14.6	16.0	10.6	10.6	13.0	6.0
Iron (percent)	2.40	1.94	2.75	2.48	2.39	2.6
Lead, ppm	98	117	94	136	111	66
Zinc, ppm	228	247	243	197	229	230
Copper, ppm	82	66	85	64	74	80
Titanium, ppm	1,900	1,840	2,680	2,350	2,190	2,600
Manganese, ppm	884	433	722	738	694	710
Strontium, ppm	686	681	499	530	599	400

a "Deep" core is from center of bay, about halfway between N.Y. State Route 104 and Lake Ontario;
"Ides" core is from from Ides Cove, on west side of northern half of bay;
"Center" and "West" cores are from center and west side, respectively, of southern half of bay just south of where Densmore Creek enters bay from the west.

Biology

Flora and fauna are integral components of the Ellison Park wetland and were assessed to characterize its ecological quality. The flora of the wetland were studied by DeGaspari and Bannister (1983) and by Bernard and Seischab (1991). Miller and Ringler (1992) studied the fish community of the wetland and also conducted a bird survey, turtle counts, and macroinvertebrate identification (through fish-stomach-contents analysis). A comprehensive survey of birds in the area was conducted during 1980-85 (Andrle and Carroll, 1988) as part of a statewide program to map breeding ranges of birds in New York State.

Flora

DeGaspari and Bannister (1983) conducted a flora survey of the upper wetland area during the summer of 1983. The study area encompassed the part of the wetland that lies south of the Narrows in which land surface is at or below an elevation of 250 ft (fig. 2). The southern limit of this area is the Irondequoit Creek channel just south of Blossom Road. Seven categories of terrain and associated vegetation were identified. The dominant plant species in the "marsh" areas of the wetland were cattails, including broad-leaf cattails (*Typha latifolia*), narrow-leaf cattails (*Typha angustifolia*), and a hybrid species that has intermediate characteristics. Diverse plant communities were found in the areas of transition from wet to dry conditions on levees (narrow strips of ground along the main creek channel and 1 to 3 ft above water level) and along the perimeter of the wetland. No endangered, threatened, or rare species were identified.

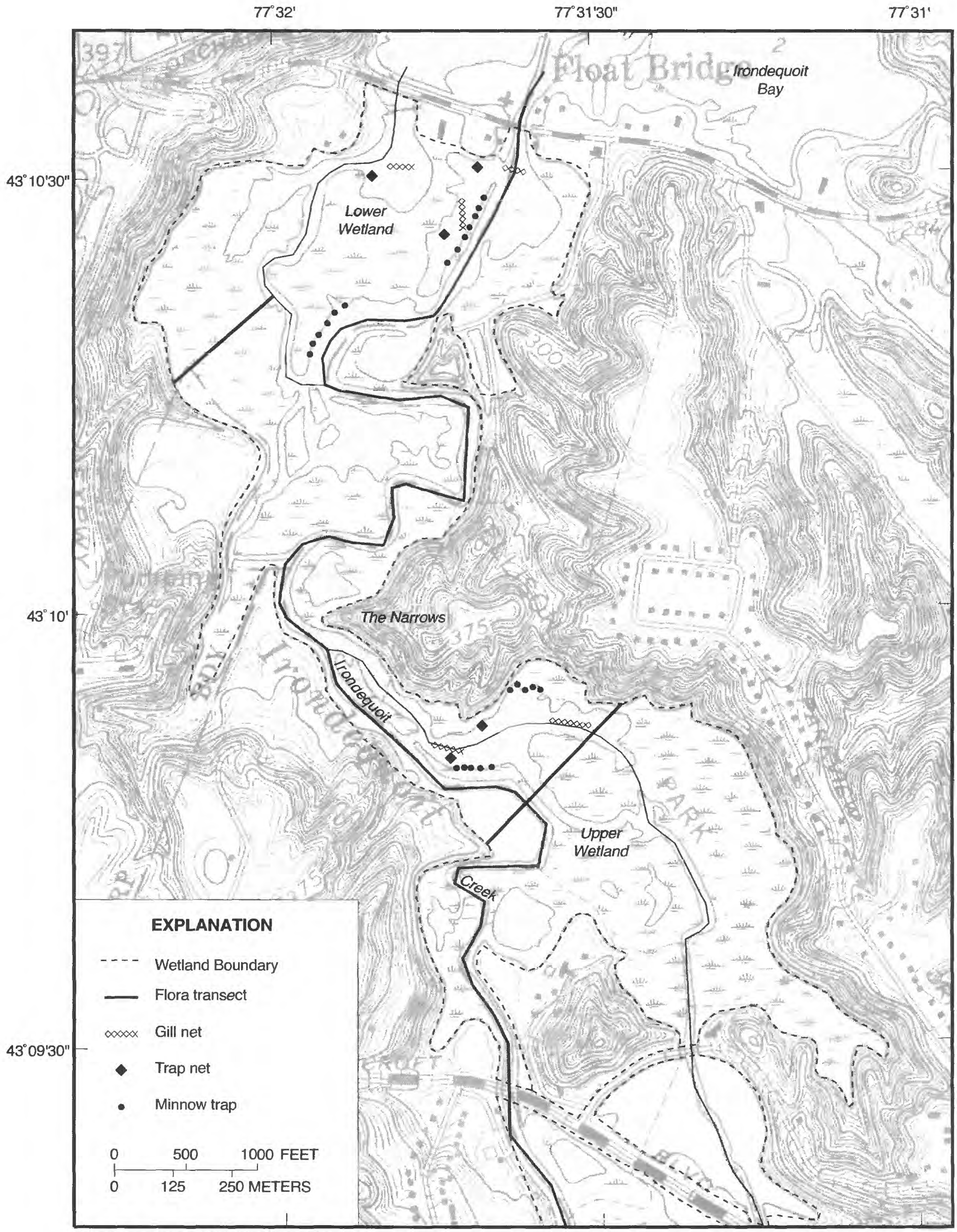
A comprehensive study of the wetland flora and vegetation between Empire and Browncroft Boulevards was conducted during 1991 by Bernard and Seischab (1991). The study included: (1) identification of individual species, (2) mapping of plant communities, (3) measurements of plant density and above- and below-ground biomass, and (4) chemical analyses of above- and below-ground tissues of cattails. Ten wetland plant communities were identified, mainly on the basis of frequency and duration of inundation. The dominant genus was *Typha*. Some taxonomists disagree on the speciation of cattails in the wetland (Bernard and Seischab, 1991); some assign the cattails in the area to three distinct species (*T. latifolia*, *T. angustifolia*, and *T. glauca*), whereas others believe *T. glauca* to be a hybrid of the other two. Bernard and Seischab (1991) identified the dominant cattail species as *T. glauca*. Only a few small areas clearly contained *T. latifolia*; *T. angustifolia* was not found in the area studied.

Typha dominates the major habitat in the wetland—flat, seasonally inundated areas at elevations just above the annual median water level. The greatest plant diversity is in dry habitats, either in high areas bordering streambanks within the wetland or along the border between wetland and upland. No rare or endangered species were found in the wetland.

Cattail Density and Biomass

Bernard and Seischab (1991) established one transect each across the upper and lower wetland areas (fig. 8), along which square-meter plots were located every 10 m and marked with 1.5-in PVC pipe. Thirty-one plots were marked in the upper wetland and 26 in the lower wetland. The height of the cattail shoots and the cattail density, the latter averaging 32 and 31 shoots per square meter in the upper and lower wetland areas, respectively, were measured at each of the plots during June or July 1991. Water depth was the primary factor controlling the density and growth of cattails; depths from 3 to 15 in. above the soil surface provided an environment most conducive to cattail growth (Bernard and Seischab, 1991, p. 10); drier or wetter conditions resulted in a decrease in cattail density, and drier conditions encouraged development of more diverse plant assemblages.

Typha biomass was measured between August 15 and September 10, 1991, and was found to be related to water depth and cattail density. Average above-ground biomass was 2,094 g/m^2 in the upper wetland and 2,368 g/m^2 in the lower wetland. Average below-ground biomass was 2,707 g/m^2 in the upper wetland and 3,291 g/m^2 in the lower wetland. From these data, Bernard and Seischab (1991, p. 11) estimated that the above-ground biomass of the well-developed cattail marsh in the Ellison Park wetland approaches 2,230 g/m^2, and the below-ground biomass approaches 3,000 g/m^2. Combining these two values gives a total biomass estimate of 5,230 g/m^2. Productivity estimates of freshwater marshes typically exceed 1,000 g/m^2 but can be as high as 6,000 g/m^2 (Mitsch and Gosselink, 1986). Thus, the Ellison Park wetland would be considered a highly productive floral ecosystem.



Base from scanned U.S. Geological Survey
Rochester East, NY 1:24,000, 1978

Figure 8. Locations of data-collection sites for flora and fish studies in Ellison Park wetland, Monroe County, N.Y., 1991-92

Plant-Tissue Analyses

Bernard and Seischab (1991) harvested vegetation from each of the permanently marked plots and analyzed above- and below-ground plant tissues for metals (copper, nickel, chromium, cobalt, molybdenum, zinc, aluminum, iron, lead, boron, and manganese) and nutrients (calcium, potassium, magnesium, sodium, phosphorus, and nitrogen) (table 11). Most elements, especially aluminum, sodium, and iron, were found in higher concentrations in the below-ground biomass than in the above-ground biomass; the average below-ground concentrations were: aluminum, 1,880 ppm; sodium, 10,000 ppm; and iron, 18,000 ppm (table 11). Elements whose above-ground concentrations were greater than below-ground values were manganese, potassium, nitrogen, and phosphorus. Data summarized by Hutchinson (1975) and Vitosh and others (1973) indicate that the concentrations of most constituents of the Ellison Park biomass generally were within ranges typical in aquatic plants; exceptions were manganese and sodium in above-ground tissues, and aluminum, iron, manganese, and sodium in below-ground tissues; concentrations of these constituents were higher than typically reported.

Table 11. Average dry-weight concentrations of selected elements in above- and below-ground biomass of *Typha glauca* collected in Ellison Park wetland, Monroe County, N.Y., 1991

[Data from Bernard and Seischab (1991). ppm, parts per million; < , less than. Percentage values are by weight.]

Element	Above-ground plant tissue	Below-ground plant tissue
Copper, ppm	5.3	15.6
Nickel, ppm	1.6	9.6
Chromium, ppm	1.4	6.0
Cobalt, ppm	< 0.1	0.6
Molybdenum, ppm	0.4	0.6
Zinc, ppm	17.5	59.8
Aluminum, ppm	17.3	1,880
Iron, ppm	67.4	18,000
Lead, ppm	0.6	18.9
Boron, ppm	12.1	132
Manganese, ppm	598	458
Sodium, ppm	3,600	10,000
Calcium, percent	1.0	1.3
Magnesium, percent	0.2	0.5
Potassium, percent	1.4	0.4
Nitrogen, percent	2.6	0.8
Phosphorus, percent	0.25	0.2

In comparing these results with the reported values for cattails at two other study sites (a natural marsh in South Carolina and a constructed wetland in New York receiving landfill leachate), Bernard and Seischab (1991, p. 8) noted that the chemical composition of the Ellison Park vegetation was generally within the range observed at the other sites, but that the Ellison Park plants had much higher concentrations of sodium, presumably as a result of winter road-salt application in the basin.

The standing stock of an element in an ecosystem is the total mass of that element computed as the product of the element's concentration and the total biomass of the ecosystem. Total average standing stocks of selected elements in the above- and below-ground tissues of the Ellison Park wetland were computed as follows: nitrogen, 69.3 g/m^2; phosphorus, 9.9 g/m^2; and potassium, 36.5 g/m^2. These high values reflect the large biomass of the wetland and are comparable to those of other *Typha glauca* communities for which similar data are available (Bernard and Seischab, 1991).

Fauna

A survey of fauna within the Ellison Park wetland conducted during 1991-92 by Miller and Ringler (1992) focused on the fish of the wetland but also collected data to characterize turtle, bird, and macroinvertebrate communities. This survey was intended to establish baseline information that could be compared with results of future studies to identify changes in the wetland fauna. Ornithological data were collected during 1980-85 by local ornithological groups in conjunction with a statewide program to identify breeding ranges of birds in New York State (Andrle and Carroll, 1988). Data from this census were used to characterize the bird population in the Ellison Park wetland.

Fish

Trap nets, minnow traps, and gill nets were used by Miller and Ringler (1992) to capture fish during July 1991 and May 1992 (fig. 8). Low-water conditions during September 1991 prohibited the use of trap nets; therefore a bag seine was used. Captured fish were identified, measured, and weighed. Results indicated a diverse fish community with at least 37 species (table 12). The most abundant species include alewife, gizzard shad, bluegill, pumpkinseed, black crappie, white perch, brown bullhead, bluntnose minnow, and spottail shiner. Other common species are carp, golden shiner, and largemouth bass. Ten rare species were identified by the capture of only one individual for each species during the three trapping periods. The main predators are bowfin and northern pike. The presence or capture of juvenile or spawning fish indicates that the wetland is a spawning and(or) rearing habitat for at least 16 fish species, and the presence of adults, together with known habitat requirements and life histories, indicates that six other species presumably use the wetland for spawning and rearing (Miller and Ringler, 1992). Brown bullhead appear to be year-round residents. The presence of migratory salmonids (brown trout and rainbow trout) indicates the wetland to be a pathway between spawning areas in Irondequoit Creek upstream of the wetland and Irondequoit Bay and Lake Ontario.

Seventeen species of fish were not randomly distributed throughout the wetland during either the July 1991 or May 1992 fish-capturing periods. Of

Table 12. Fish species identified in Ellison Park wetland, Monroe County, N.Y., 1991-92

[Data from Miller and Ringler (1992).]

Common name	Scientific name	Relative abundance	Uses wetland for spawning or rearing (yes, no, presumed) or migration only
Longnose gar	*Lepisosteus osseus*	Rare	No
Bowfin	*Amia calva*	Common	Yes
Alewife	*Alosa pseudoharangus*	Abundant	Yes
Gizzard shad	*Dorosoma cepedianum*	Abundant	Yes
Brown bullhead	*Ameiurus nebulosus*	Abundant	Yes
Quillback	*Carpiodes cyprinus*	Rare	No
White sucker	*Catostomus commersoni*	Uncommon	Yes
Shorthead redhorse	*Moxostoma macrolepidotum*	Rare	No
Goldfish	*Carassius auratus*	Uncommon	No
Common carp	*Cyprinus carpio*	Common	Yes
Rudd	*Scardinius erythrophthalmus*	Uncommon	No
Central stoneroller	*Campostoma anomalum*	Rare	Yes
Golden shiner	*Notemigonus crysoleucas*	Common	Yes
Spotfin shiner	*Cyprinella spiloptera*	Common	No
Emerald shiner	*Notropis atherinoides*	Uncommon	Yes
Rosyface shiner	*Notropis rubellus*	Rare	No
Spottail shiner	*Notropis hudsonius*	Abundant	No
Mimic shiner	*Notropis volucellus*	Rare	No
Bluntnose minnow	*Pimephales notatus*	Abundant	Presumed
Fathead minnow	*Pimephales promelas*	Rare	No
Rainbow trout	*Oncorhynchus mykiss*	Uncommon	Migration
Brown trout	*Salmo trutta*	Uncommon	Migration
Central mudminnow	*Umbra limi*	Rare	Presumed
Northern pike	*Esox lucius*	Common	Presumed
Trout-perch	*Percopsis omiscomaycus*	Uncommon	Presumed
Banded killifish	*Fundulus diaphanus*	Rare	No
Brook silverside	*Labidesthes sicculus*	Common	Presumed
White perch	*Morone americana*	Abundant	Yes
Green sunfish	*Lepomis cyanellus*	Rare	No
Pumpkinseed	*Lepomis gibbosus*	Abundant	Yes
Bluegill	*Lepomis macrochirus*	Abundant	Yes
Rock bass	*Ambloplites rupestris*	Uncommon	Yes
Smallmouth bass	*Micropterus dolomieu*	Uncommon	Yes
Largemouth bass	*Micropterus salmoides*	Common	Yes
Black crappie	*Pomoxis nigricans*	Abundant	Yes
Johnny darter	*Etheostoma nigrum*	Common	Presumed
Yellow perch	*Perca flavescens*	Uncommon	No

these species, four showed a consistent preference for either the lower or upper part of the wetland. Larger numbers of spotfin shiner, bluntnose minnow, and black crappie were captured in the upper wetland than in the lower wetland during both periods, whereas brown bullhead seemed to prefer the lower wetland (Miller and Ringler, 1992).

In comparison with the results of 10 surveys of fish in Irondequoit Bay that were conducted between 1937 and 1991, the present fish community of the Ellison Park wetland is more diverse than the Irondequoit Bay community has been since 1937. One reason could be that water quality in the wetland is improving and allowing recovery of several fish species, especially minnows and shiners (Miller and Ringler, 1992).

Macroinvertebrates

The aquatic macroinvertebrate community of the wetland was analyzed on the basis of the stomach contents of 99 fishes of 9 species (Miller and Ringler, 1992). Thirteen taxa of macroinvertebrates were identified, generally to the lowest taxonomic level possible. The predominant insect families were Chironomidae (midges) and Corixidae (true water bugs), which represented 82.5 and 14.5 percent, respectively, of the total insect population identified by this method. Other insect taxa included Trichoptera (caddis flies), Plecoptera (stone flies), Zygoptera (damsel flies), Veliidae (water striders), Hydrachnidia (water mites), Circulionidae (weevils). Other taxa identified were Cladocera (crustaceans: *daphnia, bosmina*), Copepoda (copepods), Amphipoda (scuds), Oligochaeta (earthworms), and Astracidae (crayfish). Although this sampling method provided general information on the macroinvertebrate community, the results cannot be considered comprehensive; the actual macroinvertebrate composition could be more diverse and also would change seasonally, depending on the availability of particular macroinvertebrates as food sources and on the selectivity of feeding fish (Miller and Ringler, 1992). Population estimates cannot be derived from data obtained by this method.

Birds

The New York State Department of Environmental Conservation and the Federation of New York State Bird Clubs conducted a statewide survey during 1980-85 to identify bird species and map the extent of their breeding ranges; results are summarized in the Atlas of Breeding Birds in New York State by Andrle and Carroll (1988). A compilation of the results of this study, presented as lists of species by survey area and breeding category, lists 95 species of birds as possible, probable, or confirmed breeders in the area that includes the Ellison Park wetland. Of these, 25 species typically or sometimes use wetland habitat for breeding, and of these, 16 are considered ground nesters (table 13).

During 1991-92, Miller and Ringler (1992) identified 30 species of birds by sight or call. Of these, 23 species are included in the list of species identified in the Ellison Park wetland during the 1980-85 statewide breeding survey, and 8 are listed by Andrle and Carroll (1988) as probable or confirmed Ellison Park wetland breeding birds (table 13). Of the 7 species that were not previously identified (within the wetland) in the statewide survey, three are wetland breeders: (1) the pied-billed grebe, which builds nests that are free-floating or anchored to emergent vegetation but whose breeding status in Ellison Park is uncertain (Robert Spahn, Genesee Ornithological Association, written commun., 1995); (2) the Canada goose, which has been observed on ground nests in the wetland; and (3) the American coot, which builds a floating platform attached to emergent vegetation, but probably does not use the Ellison Park wetland for breeding (Robert Spahn, written commun., 1995).

Most ground-nesting birds build nests near the water's edge, either free-floating (such as the pied-billed grebe), on dry ground amid the wetland vegetation (such as the mallard and common moorhen), or on slightly elevated tussocks of grass or dead vegetation (such as the American bittern and common snipe). Some birds, including the marsh wren, Virginia rail, and common yellowthroat, attach nests to emergent vegetation above the ground or water level, and others, such as the ring-necked pheasant, veery, and yellow warbler, prefer the drier nesting conditions along the margin of the wetland.

Turtles

Miller and Ringler (1992) identified abundant populations of both painted and snapping turtles in the wetland. Using a mark-and-recapture method, they estimated the population size of painted turtles to be 478 (± 227) in the upper wetland.

Table 13. Bird species that probably or definitely breed in the Ellison Park wetland, Monroe County, N.Y., 1992

Common name	Scientific name	Identified 1980-85[a]	Identified 1991-92[b]	Ground nesting	Nesting location
American bittern	*Botaurus lentiginosus*	X	X	Yes	On tussock or platform 4 to 18 inches above water level.
Least bittern	*Ixobrychus exilis*	X		Yes	Mat supported by previous year's emergent growth 1 to 4 feet above water.
Pied-billed grebe	*Podilymbus podiceps*		X	Yes	Free-floating or anchored to emergent vegetation; uncertain breeding status[c]
Canada goose	*Branta canadensis*		X	Yes	Dry ground or elevated spots.
Mallard	*Anas platyrhynchos*	X	X	Yes	Dry ground or elevated spots.
Blue-winged teal	*Anas discors*	X		Yes	Dry ground amid cattails; probably no longer present.[c]
Wood duck	*Aix sponsa*	X		No	Cavities in trees.
Ring-necked pheasant	*Phasianus colchicus*	X		Yes	Ground along dry edge of wetland.
Virginia rail	*Rallus limicola*	X		Yes	Above water or ground amid emergent vegetation.
Common moorhen	*Gallinula chloropus*	X		Yes	Near water level amid emergent vegetation.
Sora	*Porzano carolina*	X		Yes	About 6 inches above water amid emergent vegetation.
American coot	*Fulica americana*		X	Yes	Floating platform attached to emergent vegetation; uncertain breeding status[c].
Killdeer	*Charadrius vociferus*	X	X	Yes	Open gravelly areas along dry edge of wetland.
American woodcock	*Scolopax minor*	X		Yes	Dry ground along edge or elevated spots within wetland.
Common snipe	*Gallinago gallinago*	X		Yes	Dry ground or on grass tussock.
Spotted sandpiper	*Actitis macularia*	X	X	Yes	Ground along dry edge of wetland.
Belted kingfisher	*Ceryle alcyon*	X	X	No	Excavated hole in sandy bank.
Alder flycatcher	*Empidonax alnorum*	X		No	Brush and trees.
Willow flycatcher	*Empidonax traillii*	X		No	Shrubs.
Marsh wren	*Cistothorus palustrus*	X	X	No	1 to 3 feet above water lashed to vegetation.
Veery	*Catharus fuscescens*	X		Yes	Ground or low shrubs along wetland edge.
Blue-gray gnatcatcher	*Polioptila caerulea*	X		No	Trees.
Yellow warbler	*Dendroica petechia*	X		No	Shrubs or brush along wetland edge.
Cerulean warbler	*Dendroica cerulea*	X		No	Trees.
Common yellow-throat	*Geothlypis trichas*	X		No	Within few inches of ground attached to vegetation.
Red-winged blackbird	*Agelaius phoeniceus*	X	X	Yes	Near or above water surface or ground.
Swamp sparrow	*Melospiza georgiana*	X		Yes	Few inches above ground or 1 foot above water amid emergent vegetation.
Song sparrow	*Melospiza melodia*	X	X	Yes	Ground or elevated in catttails or low trees.

[a] Based on listing of species compiled during New York State Department of Environmental Conservation and the Fedeation of New York State Bird Clubs Breeding Bird Atlas Project (Andrle and Carroll, 1988) and on records from Robert Spahn, Genesee Ornithological Association, written commun., 1995)

[b] Miller and Ringler (1992)

[c] Robert Spahn, Genesee Ornithological Association, written commun., 1995

SUMMARY

The Ellison Park wetland, near the mouth of Irondequoit Creek in Monroe County, forms a transition zone between riparian and lacustrine environments. Its environmental quality has been affected by the large nearby urban area centered around Rochester. Hydrologic, sedimentological, and biological characteristics were studied to provide a background database for future reference in management and protection of this wetland resource.

Water levels in the Ellison Park wetland, which fluctuated only about 4 ft during 1990-94, are maintained through regulation of the water-surface elevation in Lake Ontario by control structures on the St. Lawrence Seaway. This water-level stability is a critical component of the wetland ecosystem and directly or indirectly affects: (1) the hydrographic characteristics of Irondequoit Creek near its mouth, (2) flow dispersal and traveltime through the wetland, (3) sedimentation rates, (4) plant diversity and the areal extent of cattails (the dominant plant species in the wetland), and (5) faunal diversity in and fish movement through the wetland.

Streamflow was monitored at the upstream and downstream ends of the wetland (above Blossom Road and at Empire Boulevard, respectively). Median daily flow through the wetland, based on 13 years of recorded data, was 90 ft^3/s; extreme flows range from a maximum of more than 1,700 ft^3/s to a minimum of 28 ft^3/s. Overbank flows (usually exceeding 1,000 ft^3/s) occur twice yearly on average. The wetland between the two monitoring sites attenuates storm-runoff peaks. Time-of-travel studies indicate that stormflows conveyed primarily in the main channel of Irondequoit Creek (up to a bankfull discharge of about 900 ft^3/s) pass through the wetland in less than 3.5 hours. Some diversion to the Millrace channel (just north of Blossom Road) occurs, but lateral dispersal from the main channel is minimal. Dispersion of larger flows (greater than 900 ft^3/s) occurs partly through increased diversion to the Millrace channel and by overbank flow from the main channel. Dispersed water moves into the cattail-covered backwater areas of the wetland, where it can be detained from 3 to 15 hours (the upper limit of detention time has not been determined).

Surface-water quality was monitored at both ends of the wetland, and atmospheric deposition was monitored in the lower wetland. Surface water had elevated concentrations of sulfate, chloride, zinc, and copper; atmospheric deposition had elevated specific conductance and low pH. Comparison with data from sites elsewhere in the United States indicates that the concentrations of these and other constituents in surface water and atmospheric deposition generally are within the range expected for an urbanized watershed. In addition, the atmospheric-deposition concentrations of selected elements are within the ranges measured in the Irondequoit Creek basin during 1980-81.

Ground-water levels and chemical quality were monitored at nine wells in the wetland. The direction of ground-water movement in the unconfined aquifer is from the valley walls toward Irondequoit Creek and northward toward Irondequoit Bay. High water levels in Irondequoit Creek might cause short-term recharge from the creek to the streambank and flood-plain deposits, but generally the wetland is a ground-water discharge area. High specific conductance and hardness values in ground water reflect residential and urban land use in the basin, as well as the chemical composition of local bedrock and glacial deposits.

Sediment particle sizes were measured at 11 sites within the wetland; sand is the predominant bed material in the main channel of Irondequoit Creek, and silt and clay, with a high concentration of organic matter, are predominant in the backwater areas. Sedimentation in the wetland was sporadic during 1991-95 and reflected a pattern of episodic deposition of a large quantity of sediment followed, in subsequent years, by partial resuspension and removal. Net sedimentation rates ranged from 1.9 to 4.9 mm per year. Radiocarbon dating of sediment cores from near the mouth of Irondequoit Creek suggests an average historical sedimentation rate of about 3 mm per year.

Three fine-grained sediment samples—two from the upper wetland and one from the lower wetland—were analyzed for major and trace elements.concentrations of barium, manganese, strontium, and zinc were elevated in relation to those in nonurbanized watersheds elsewhere in the United States. Comparison of these results with data collected from Irondequoit Bay in 1980 indicates no marked differences in the sediment quality at each location, except for calcium, lead, and strontium, which were markedly lower in the 1994 Ellison Park wetland samples. The samples were also analyzed for organic compounds.

Some polynuclear aromatic hydrocarbons, including chrysene, fluoranthene, phenanthrene, and pyrene, were detected in relatively high concentrations, and persistent organochlorine pesticides (chlordane, DDD, DDE, DDT, and dieldrin) and polychlorinated biphenyls (PCB's) were detected. The presence and magnitude of concentrations of these compounds are fairly typical of a depositional environment at the downstream end of a highly urbanized watershed in which the bottom sediment is characterized by high percentages of fine-grained particles and organic matter.

The dominant plant species in the Ellison Park wetland is *Typha glauca* (cattail), but diverse habitats, distinguished by the degree and frequency of inundation, support a wide variety of plant life. Cattail density, height, and biomass indicate a highly productive floral ecosystem. Analyses of cattail tissue indicate that concentrations of selected chemical constituents in below-ground tissue were generally higher than in above-ground tissue. The cattails contained higher concentrations of sodium, iron, aluminum, and manganese than are typical for aquatic plants. Total average standing stocks (or total mass of selected elements in the wetland vegetation) for above- and below-ground tissues were estimated to be: 69.3 g/m^2 of nitrogen, 9.9 g/m^2 of phosphorus, and 36.5 g/m^2 of potassium.

The Ellison Park wetland supports a diverse fish community with at least 37 species, 16 of which use the wetland for spawning and(or) rearing. Results of two fish-capturing periods in 1991 and 1992 indicate that four species show a preference for the upper or lower parts of the wetland. Spotfin shiner, bluntnose minnow, and black crappie were captured in larger numbers in the upper wetland, and the brown bullhead was captured in greater numbers in the lower wetland. The primary macroinvertebrate food sources for fish in the wetland are chironomids (midges) and corixids (true water bugs). Other macroinvertebrates identified include various aquatic insects, crustaceans, worms, and crayfish. The wetland also supports large populations of painted turtles and snapping turtles. A bird survey conducted during the 1980's identified 95 species of birds in and around the wetland area; seven additional species were identified in 1991-92. Of these 102 species, 28 probably or definitely use the wetland for breeding.

REFERENCES CITED

Andrle, R.F., and Carroll, J.R., 1988, The atlas of breeding birds in New York State: Ithaca, N.Y., Cornell University Press, 551 p.

Bernard, J.M., and Seischab, F.K., 1991, Flora and vegetation of the Irondequoit Creek and Buttonwood Creek wetlands: Unpublished report on file in the Ithaca, N.Y., office of the U.S. Geological Survey, 49 p.

Bigelow, D.S., and Dossett, S.R., 1988, Instruction manual NADP/NTN site operation: National Atmospheric Deposition Program, Natural Resource Ecology Laboratory, Fort Collins, Colo., Colorado State University, 102 p.

Bubeck, R.C., and Burton, R.S., 1989, Changes in chloride concentrations, mixing patterns, and stratification characteristics of Irondequoit Bay, Monroe County, New York, after decreased use of road-deicing salts, 1974-1984: U.S. Geological Survey Water-Resources Investigations Report 87-4223, 52 p.

Clark, R.H., and Persoage, N.P., 1970, Some implications of crustal movement in engineering planning: Canadian Journal of Earth Sciences, v. 7, p. 628-633.

DeGaspari, C., and Bannister, T.T., 1983, Survey of the Irondequoit Creek wetlands—possible effects of short-term impoundment of storm water behind a proposed flow-regulating structure at the Narrows: Irondequoit Bay Report No. 13, 21 p.

Diment, W.H., Bubeck, R.C., and Deck, B.L., 1974, Effects of de-icing salts on the waters of the Irondequoit Bay drainage basin, Monroe County, New York: *in* Coogan, A.H., ed., Fourth Symposium on Salt: Cleveland, Ohio, Northern Ohio Geological Society, v. 1, p. 391-405.

Dunn, Bernard, 1962, Hydrology of the Irondequoit Creek basin, Rochester, N. Y.: U.S. Geological Survey Open-File Report 65-046, 40 p.

Guy, H.P., 1969, Laboratory theory and methods for sediment analysis: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. C1, 58 p.

Hem, J.D., 1985, Study and interpretation of chemical characteristics of natural water: U.S. Geological Survey Water-Supply Paper 2254, 264 p.

Hornlein, J.F., Szabo, C.O., and Zajd, H.J., Jr., 1995, Water-Resources Data, New York, Water year 1994, volume 3--Western New York: U.S. Geological Survey Water-Data Report NY-94-3 (published annually), 326 p.

Hutchinson, G.E., 1975, A treatise on limnology, volume III, limnological botany: New York, N.Y., John Wiley and Sons, 660 p.

Johnston, W.H., and Sherwood, D.A. 1994, Water resources of Monroe County, New York, water years 1984-88, with emphasis on water quality in the Irondequoit Creek basin, part 1. Water-resources data: U.S. Geological Survey Open-File Report 93-370, 311 p.

Kappel, W.M., Yager, R.M., and Zarriello, P.J., 1986, Quantity and quality of urban storm runoff in the Irondequoit Creek basin near Rochester, New York, Part 2—Quality of storm runoff and atmospheric deposition, runoff-quality modeling, and potential of wetlands for sediment and nutrient retention: U.S. Geological Survey Water-Resources Investigations Report 85-4113, 93 p.

Kappel, W.M., and Young, R.A., 1989, Glacial history and geohydrology of the Irondequoit Creek valley, Monroe County, New York: U.S. Geological Survey Water-Resources Investigations Report 88-4145, 34 p.

Kilpatrick, F.A., and Wilson, J.F., Jr., 1988, Measurement of time of travel in streams by dye tracing: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter A9, 27 p.

Larsen, C.E., 1985, Lake level, uplift, and outlet incision, the Nipissing and Algoma Great Lakes: *in* Karrow, P.F., and Calkin, P.E., Quaternary evolution of the Great Lakes: Geological Association of Canada, Special Paper 30, p. 63-78.

Miller, D.J., and Ringler, N.H., 1992, Effects of storm water retention on the animal community of the upper and lower wetlands of Irondequoit Creek, Rochester, New York: Unpublished report on file in the Ithaca, N.Y., office of the U.S. Geological Survey, 50 p.

Mitsch, W.J., and Gosselink, J.G., 1986, Wetlands: New York, N.Y., Van Nostrand Reinhold, 539 p.

Monroe County Department of Health, Environmental Health Laboratory, and University of Rochester, Department of Geological Sciences, 1984, Irondequoit Bay—Ide's Cove lake restoration (314) - diagnostic/feasibility study: draft final report, 89 p.

O'Brien and Gere, 1983, Nationwide urban runoff program, Irondequoit basin study, final report: Rochester, N.Y., Irondequoit Bay Pure Waters District, 164 p.

Peters, N.E., and Bonelli, J.E., 1982, Chemical composition of bulk precipitation in the north-central and northeastern United States, December 1980 through February 1981: U.S. Geological Survey Circular 874, 63 p.

Schroeder, R.A., 1985, Sediment accumulation rates in Irondequoit Bay, New York, based on lead-210 and cesium-137 geochronology: Northeastern Environmental Science, v. 4, no. 1, p. 23-29.

Smith, J.A., Witkowski, P.J., and Fusillo, T.V., 1988, Manmade organic compounds in the surface waters of the United States - a review of current understanding: U.S. Geological Survey Circular 1007, 92 p.

Spencer, E.W., 1972, The dynamics of the earth—an introduction to physical geology: New York, Thomas Y. Crowell, 649 p.

Timme, P.J., 1995, National Water Quality Laboratory 1995 services catalog: U.S. Geological Survey Open-file Report 95-352, 120 p.

Vitosh, M.L., Warncke, D.D., and Lucas, R.E., 1973, Secondary and micronutrients for vegetables and field crops: Extension Bulletin E-486, Cooperative Extension Service, Michigan State University, East Lansing; *in* Donahue, R.L., Miller, R.W., and Shickluna, J.C., 1977, Soils - an introduction to soils and plant growth: Englewood Cliffs, N.J., Prentice-Hall, 626 p.

Wershaw, R.L., Fishman, M.J., Grabbe, R.R., and Lowe, L.E. (eds.), 1987, Methods for the determination of organic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chap. A3, 80 p.

Wolman, M.G., 1954, A method of sampling coarse riverbed material: American Geophysical Union, Transactions, v. 35, no. 6, p. 951-956.

Yager, R.M., Zarriello, P.J., and Kappel, W.M., 1985, Geohydrology of the Irondequoit Creek basin near Rochester, New York: U.S. Geological Survey Water-Resources Investigations Report 84-4259. 6 sheets, scale 1:24,000, .

Young, R.A., 1992, Summary report draft, Irondequoit Creek-Empire wetlands project radiocarbon dating lake level study: Unpublished report on file in the Ithaca, N.Y., office of the U.S. Geological Survey, 9 p.

Zarriello, P.J., 1996, Simulated effects of a stormwater-detention basin on peak flows and water quality of East Branch Allen Creek, Monroe County, New York: U.S. Geological Survey Water-Resources Investigations Report 95-4157, 34 p.

Zarriello, P.J., Harding, W.E., Yager, R.M., and Kappel, W.M., 1985, Quantity and quality of storm runoff in the Irondequoit Creek basin near Rochester, New York, Part 1—Data-collection network and methods, quality-assurance program, and description of available data: U.S. Geological Survey Open-File Report 84-610, 44 p.

Zarriello, P.J., and Sherwood, D.A., 1993, Effects of stormwater detention on the chemical quality of runoff from a small residential development, Monroe County, New York: U.S. Geological Survey Water-Resources Investigations Report 92-4003, 57 p.

Zarriello, P.J., and Surface, J.M., 1989, Simulation of changes in stormwater quality at four potential flow-attenuation sites in the Irondequoit Creek watershed, Monroe County, New York: U.S. Geological Survey Water-Resources Investigations Report 88-4106, 52 p.

Table A-1. Selected analyses of surface-water samples from Irondequoit Creek at upstream and downstream ends of Ellison Park wetland, Monroe County, N.Y., for flows above median daily discharge (90 cubic feet per second), March 1991 through December 1994

[Locations are shown in fig. 2. µS/cm, microsiemens per centimeter; DEG. C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than; --, no data.]

Part A. Irondequoit Creek above Blossom Road, Rochester, N.Y. (station 0423205010)

BEGIN DATE	BEGIN TIME	END DATE	END TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (µS/cm)	RESIDUE TOTAL AT 105 DEG. C, SUS-PENDED (mg/L)	RESIDUE VOLA-TILE, SUS-PENDED (mg/L)	NITROGEN, AMMONIA, DIS-SOLVED (mg/L AS N)	NITROGEN, AMMONIA + ORGANIC, TOTAL (mg/L AS N)
1991									
MAR 02	1005	910304	0305	440	890	926	91	0.020	2.6
MAR 07	1105	910308	1005	563	612	1,090	92	0.170	3.8
08	1320	--	--	409	697	--	--	0.040	0.72
11	1140	--	--	208	877	--	--	0.030	0.56
1992									
FEB 18	1020	920219	1320	144	1,280	--	--	0.030	0.63
FEB 19	1420	920220	0820	186	1,300	--	--	0.020	0.92
FEB 20	0915	920222	2015	160	1,170	--	--	0.020	0.95
FEB 22	2115	920224	0815	188	1,170	--	--	0.020	0.90
MAR 26	0915	920327	2015	609	--	964	84	0.020	2.9
MAR 27	2115	920330	0815	852	--	490	44	0.020	1.9
OCT 09	1330	921010	0430	299	708	227	38	0.070	1.6
OCT 10	0530	921013	1030	160	810	89	16	0.020	0.90
NOV 02	1030	921103	0930	312	813	--	--	<0.010	0.72
NOV 03	1030	921105	0430	342	684	76	11	<0.010	0.88
DEC 10	1100	921214	1000	120	1,420	10	<10	0.020	0.48
DEC 14	1205	921216	0505	140	1,230	14	<6	<0.010	0.46
DEC 16	0605	921217	1005	286	1,150	132	27	<0.010	1.7
DEC 17	1100	921218	0200	498	931	--	--	<0.010	1.1
DEC 18	0300	921221	1000	439	792	--	--	<0.010	1.2
1993									
FEB 04	1215	--	--	147	--	<7	<7	0.020	0.62
MAR 22	0920	930325	0820	307	--	84	10	0.020	0.84
MAR 25	0915	930329	0815	721	--	272	21	0.030	1.2
MAR 29	0925	930330	0025	1,270	575	369	23	0.040	1.1

DATE	NITROGEN, NO2+NO3, TOTAL (mg/L AS N)	PHOS-PHORUS, TOTAL (mg/L AS P)	PHOS-PHORUS ORTHO, DIS-SOLVED (mg/L AS P)	CHLO-RIDE, DIS-SOLVED (mg/L AS Cl)	SULFATE, DIS-SOLVED (mg/L AS SO_4)	CADMIUM, TOTAL RECOV-ERABLE (µg/L AS Cd)	COPPER, TOTAL RECOV-ERABLE (µg/L AS Cu)	LEAD, TOTAL RECOV-ERABLE (µg/L AS Pb)	ZINC, TOTAL RECOV-ERABLE (µg/L AS Zn)
1991									
MAR 02-04	1.10	1.05	0.010	130	7.7	2	90	50	240
MAR 07-08	0.470	1.25	0.006	69	43	1	70	84	260
08...	1.30	0.090	0.016	78	63	<5	<10	<5	40
11...	1.60	0.040	0.009	95	94	<1	<10	7	<40
1992									
FEB 18-19	1.40	0.065	0.008	230	120	<1	120	6	60
FEB 19-20	1.50	0.120	0.008	230	120	<1	50	20	40
FEB 20-22	1.80	0.075	0.008	180	130	<1	60	5	40
FEB 22-24	1.80	0.110	0.007	120	140	<1	60	6	40
MAR 26-27	1.30	1.15	0.008	140	73	1	90	56	290
MAR 27-30	1.60	0.690	0.012	110	58	<1	90	15	140
OCT 09-10	0.520	0.300	0.018	67	100	1	70	16	110
OCT 10-13	0.450	0.160	0.009	74	110	<1	40	6	60
NOV 02-03	0.750	0.110	0.008	78	110	1	50	7	50
NOV 03-05	0.530	0.270	0.012	60	75	3	100	10	40
DEC 10-14	1.30	0.035	0.005	250	130	<1	60	<5	<40
DEC 14-16	1.20	0.035	0.005	180	120	<1	80	<5	40
DEC 16-17	1.10	0.240	0.005	190	94	<1	70	6	60
DEC 17-18	0.960	0.250	0.007	140	58	<1	60	--	80
DEC 18-21	1.00	0.200	0.007	97	59	<1	50	--	70
1993									
FEB 04...	1.40	0.020	0.006	240	120	<1	<50	<5	<40
MAR 22-25	1.60	0.130	0.005	210	81	<1	100	5	50
MAR 25-29	1.20	0.270	0.010	120	48	<1	70	6	60
MAR 29-30	1.00	0.340	0.014	67	37	<1	120	20	80

Table A-1. Selected analyses of surface-water samples from Irondequoit Creek at upstream and downstream ends of Ellison Park wetland, Monroe County, N.Y., for flows above median daily discharge (90 cubic feet per second), March 1991 through December 1994--continued

Part A. Irondequoit Creek above Blossom Road, Rochester, N.Y. (station 0423205010)--continued

BEGIN DATE	BEGIN TIME	END DATE	END TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (µS/cm)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (mg/L)	OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (mg/L)	ALKA-LINITY, FIELD (mg/L AS $CaCO_3$)	RESIDUE TOTAL AT 105 DEG.C, SUS-PENDED (mg/L)	RESIDUE VOLA-TILE, SUS-PENDED (mg/L)	NITRO-GEN, AMMONIA DIS-SOLVED (mg/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (mg/L AS N)
1993												
MAR 29	0925	930331	0025	1,360	--	--	--	--	294	19	0.040	--
APR 01	0945	--	--	1,400	508	<2.0	--	146	205	18	0.060	<0.050
APR 05	0935	930408	0835	482	698	<2.0	--	198	--	--	<0.010	<0.050
JUN 05	0525	930605	2025	318	777	12	--	--	1510	158	--	--
JUN 05	2125	930606	1225	238	792	9.7	--	--	383	46	--	--
SEP 03	0035	930904	0035	159	654	7.2	--	127	639	73	0.010	<0.050
NOV 27	0805	931128	1305	431	824	3.5	37	179	370	45	<0.010	<0.050
NOV 28	1405	931129	0905	580	633	4.5	33	158	377	46	<0.010	<0.050
NOV 29	0905	931202	0805	203	852	2.3	16	195	83	<18	<0.010	<0.050
1994												
FEB 18	0920	940221	0820	320	1,580	2.3	35	196	297	37	0.070	<0.050
FEB 21	0920	940222	0820	818	801	3.3	--	138	--	--	0.080	<0.050
FEB 22	0905	940224	0905	392	881	<2.0	38	171	107	14	0.040	<0.050
MAR 21	0920	940323	0220	735	830	2.2	53	184	352	40	<0.010	<0.050
MAR 23	0320	940324	0820	959	579	2.1	31	146	264	25	<0.010	<0.050
MAR 24	0930	940324	2030	724	600	--	22	141	193	21	<0.010	<0.050
APR 12	1820	940414	0820	780	748	3.6	58	178	423	50	<0.010	<0.050
APR 14	0900	940418	0800	383	771	2.3	18	190	88	12	<0.010	<0.050
AUG 13	0925	940814	1225	148	895	2.7	28	180	218	30	<0.010	<0.050
AUG 14	1325	940815	0825	168	615	3.6	60	148	484	59	<0.010	<0.050
DEC 05	0940	941206	0240	264	764	<2.0	--	168	189	30	0.020	<0.050
DEC 06	0340	941207	2040	190	962	<2.0	--	199	82	15	0.020	<0.050
DEC 08	0915	941209	1615	138	1,200	<2.0	--	221	32	6	0.030	<0.050

DATE	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (mg/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (mg/L AS N)	PHOS-PHORUS, TOTAL (mg/L AS P)	PHOS-PHORUS ORTHO, DIS-SOLVED (mg/L AS P)	CARBON, ORGANIC TOTAL (mg/L AS C)	CHLO-RIDE, DIS-SOLVED (mg/L AS Cl)	SULFATE, DIS-SOLVED (mg/L AS SO_4)	CADMIUM, TOTAL RECOV-ERABLE (µg/L AS Cd)	COPPER, TOTAL RECOV-ERABLE (µg/L AS Cu)	LEAD, TOTAL RECOV-ERABLE (µg/L AS Pb)	ZINC, TOTAL RECOV-ERABLE (µg/L AS Zn)
1993											
MAR 29-31	1.1	1.00	0.340	0.014	--	67	37	--	120	--	80
APR 01...	0.75	1.00	0.160	0.027	--	55	33	1	20	8	70
APR 05-08	0.61	1.20	0.070	0.004	4.6	72	58	<1	40	12	60
JUN 05-05	3.5	1.00	0.770	0.011	6.6	92	120	<1	110	80	370
JUN 05-06	2.4	1.00	0.560	0.011	5.9	86	100	2	90	18	180
SEP 03-04	3.0	0.860	1.30	0.053	6.1	65	110	<1	100	48	270
NOV 27-28	1.9	0.860	0.440	0.014	4.9	100	120	<1	--	20	180
NOV 28-29	1.9	1.10	0.450	0.022	6.7	73	84	<1	--	16	110
NOV 29-DEC 2	1.1	1.40	0.150	0.016	6.6	95	130	<1	--	<5	--
1994											
FEB 18-21	0.82	1.20	0.430	0.023	--	350	100	<1	--	11	--
FEB 21-22	1.1	1.20	0.490	0.020	--	130	56	<1	--	7	--
FEB 22-24	0.84	1.40	0.200	0.015	--	140	75	<1	--	6	--
MAR 21-23	1.2	1.20	0.380	0.013	--	130	68	1	50	15	--
MAR 23-24	0.92	1.20	0.320	0.012	--	77	47	2	40	9	--
MAR 24-24	0.67	1.20	0.200	0.011	--	75	53	1	30	5	--
APR 12-14	1.8	0.930	0.310	0.007	--	93	69	--	30	12	--
APR 14-18	1.1	1.00	0.190	0.010	--	100	74	2	20	11	--
AUG 13-14	0.78	0.750	0.370	0.022	--	97	170	<1	40	10	--
AUG 14-15	0.56	0.550	0.740	0.046	--	78	100	<1	50	13	--
DEC 05-06	0.42	0.650	0.290	0.012	--	93	100	2	28	--	--
DEC 06-07	0.47	0.750	0.160	0.012	--	130	110	2	27	--	--
DEC 08-09	0.76	0.860	0.085	0.012	--	190	120	<1	30	5	40

Table A-1. Selected analyses of surface-water samples from Irondequoit Creek at upstream and downstream ends of Ellison Park wetland, Monroe County, N.Y., for flows above median daily discharge (90 cubic feet per second), March 1991 through December 1994--continued

Part B. Irondequoit Creek at Empire Boulevard, Rochester, N.Y. (station 0423205025)

BEGIN DATE	BEGIN TIME	END DATE	END TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (µS/cm)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (mg/L)	ALKA-LINITY, FIELD (mg/L AS $CaCO_3$)	RESIDUE TOTAL AT 105 DEG. C, SUS-PENDED (mg/L)	RESIDUE VOLA-TILE, SUS-PENDED (mg/L)	NITRO-GEN, AMMONIA DIS-SOLVED (mg/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (mg/L AS N)
1991											
MAR 02	1825	910304	0925	438	832	--	--	488	46	0.020	--
MAR 06	1110	910308	1010	659	610	--	--	157	17	0.040	--
MAR 08	1015	910311	0915	291	772	--	--	--	--	0.020	--
MAR 12	0955	--	--	175	--	--	--	--	--	0.040	--
1992											
FEB 15	1815	920216	1715	136	1,800	--	--	28	<21	0.090	--
FEB 16	1815	920217	1915	143	1,400	--	--	33	<21	0.080	--
FEB 18	1130	920219	1430	136	1,310	--	--	--	--	0.050	--
FEB 19	1530	920220	0930	160	1,320	--	--	--	--	0.050	--
FEB 20	1015	920222	2115	148	1,200	--	--	--	--	0.040	--
FEB 22	2215	920224	0915	176	1,230	--	--	--	--	0.040	--
MAR 26	1000	920328	0400	714	--	--	--	367	37	0.040	--
MAR 28	0500	920330	0900	1,010	--	--	--	125	16	0.040	--
OCT 09	0945	921010	0845	256	880	--	--	104	19	0.030	--
OCT 10	0945	921013	0845	167	785	--	--	105	19	0.020	--
NOV 02	1010	921103	2110	316	816	--	--	135	15	<0.010	--
NOV 03	2210	921105	0910	336	694	--	--	105	14	<0.010	--
DEC 10	1025	921214	0925	134	1,460	--	--	<10	<10	0.020	--
DEC 14	1125	921216	0725	147	1,300	--	--	11	<8	0.020	--
DEC 16	0825	921217	0925	276	1,210	--	--	34	8	0.020	--
DEC 17	1025	921218	0125	437	1,020	--	--	--	--	0.020	--
DEC 18	0225	921221	0925	461	809	--	--	--	--	0.020	--
1993											
FEB 01	1100	930204	1000	162	--	--	--	10	<7	0.020	--
MAR 22	0950	930325	0850	325	--	--	--	22	4	0.040	--
MAR 25	0950	930329	0850	668	--	--	--	77	7	0.040	--
MAR 29	1005	930331	0405	1,260	594	<2.0	160	--	--	0.050	<0.050
MAR 29	1005	930331	0605	1,250	597	<2.0	159	90	8	0.050	<0.050

DATE	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (mg/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (mg/L AS N)	PHOS-PHORUS TOTAL (mg/L AS P)	PHOS-PHORUS ORTHO, DIS-SOLVED (mg/L AS P)	CARBON, ORGANIC TOTAL (mg/L AS C)	CHLO-RIDE, DIS-SOLVED (mg/L AS Cl)	SULFATE DIS-SOLVED (mg/L AS SO_4)	CADMIUM TOTAL RECOV-ERABLE (µg/L AS Cd)	COPPER, TOTAL RECOV-ERABLE (µg/L AS Cu)	LEAD, TOTAL RECOV-ERABLE (µg/L AS Pb)	ZINC, TOTAL RECOV-ERABLE (µg/L AS Zn)
1991											
MAR 02-04	1.7	1.00	0.490	0.014	--	130	66	1	80	39	150
MAR 06-08	0.87	1.10	0.240	0.015	--	71	49	<1	70	13	90
MAR 08-11	0.79	1.50	0.110	0.013	--	93	71	<1	50	8	60
MAR 12	0.61	1.40	0.030	0.009	--	100	100	<1	<10	<5	<40
1992											
FEB 15-16	0.70	1.30	0.075	0.008	--	390	240	<1	70	6	--
FEB 16-17	0.77	1.30	0.085	0.009	--	280	130	<1	70	<5	--
FEB 18-19	0.77	1.50	0.085	0.008	--	240	120	<1	70	7	--
FEB 19-20	0.86	1.50	0.095	0.009	--	230	120	<1	70	7	--
FEB 20-22	0.64	1.70	0.060	0.009	--	190	140	<1	60	5	<40
FEB 22-24	0.73	1.70	0.065	0.009	--	200	140	<1	50	<5	<40
MAR 26-28	1.8	1.30	0.460	0.008	--	140	66	1	90	37	120
MAR 28-30	1.2	1.60	0.200	0.016	--	120	56	1	<50	14	90
OCT 09-10	0.94	1.00	0.190	0.024	--	87	130	<1	40	8	70
OCT 10-13	0.94	0.670	0.200	0.027	--	74	100	<1	40	6	60
NOV 02-03	1.1	0.870	0.310	0.026	--	79	110	1	40	9	70
NOV 03-05	1.0	0.570	0.190	0.026	--	61	73	1	40	7	70
DEC 10-14	0.56	1.40	0.050	0.014	--	250	130	<1	60	<5	40
DEC 14-16	0.60	1.30	0.050	0.014	--	200	120	<1	80	<5	30
DEC 16-17	0.69	1.20	0.085	0.014	--	200	96	<1	90	<5	50
DEC 17-18	0.81	1.00	0.120	0.019	--	160	61	<1	70	--	110
DEC 18-21	0.69	1.00	0.120	0.021	--	100	55	<1	70	--	80
1993											
FEB 01-04	0.66	1.50	0.045	0.009	--	230	120	<1	<50	8	<40
MAR 22-25	0.60	1.20	0.055	0.011	--	230	84	<1	70	<5	40
MAR 25-29	0.77	1.20	0.120	0.016	--	130	50	<1	90	<5	110
MAR 29-31	0.76	1.00	0.170	0.021	--	72	37	<1	100	6	70
MAR 29-31	0.76	1.00	0.160	0.021	--	73	37	<1	80	7	50

Table A-1. Selected analyses of surface-water samples from Irondequoit Creek at upstream and downstream ends of Ellison Park wetland, Monroe County, N.Y., for flows above median daily discharge (90 cubic feet per second), March 1991 through December 1994--continued

Part B. Irondequoit Creek at Empire Boulevard, Rochester, N.Y. (station 0423205025)--continued

BEGIN DATE	BEGIN TIME	ENDING DATE	ENDING TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (µS/cm)	OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (mg/L)	OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (mg/L)	ALKA-LINITY, FIELD (mg/L AS $CaCO_3$)	RESIDUE TOTAL AT 105 DEG. C, SUS-PENDED (mg/L)	RESIDUE VOLA-TILE, SUS-PENDED (mg/L)	NITRO-GEN, AMMONIA DIS-SOLVED (mg/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (mg/L AS N)
1993												
MAR 31	0705	930401	0905	1,360	516	<2.0	--	147	71	7	0.030	<0.050
APR 01	1030	930403	0130	1,760	483	<2.0	--	147	--	--	0.030	<0.050
APR 03	0230	930405	0830	1,150	526	<2.0	--	151	--	--	0.020	<0.050
APR 06	1015	930406	1045	496	698	<2.0	--	197	--	--	0.020	<0.050
APR 06	1045	930408	0945	442	701	<2.0	--	196	--	--	0.020	<0.050
JUN 05	0545	930606	0045	275	939	2.2	--	--	63	<10	--	--
JUN 06	0145	930607	0845	174	764	5.3	--	--	68	<12	--	--
SEP 02	2015	930904	0615	150	735	<2.0	--	140	54	10	0.050	<0.050
SEP 04	0715	930907	0915	106	790	<2.0	--	155	50	28	0.060	<0.050
NOV 27	1330	931128	1330	307	836	<4.0	27	186	209	29	0.060	<0.050
NOV 28	1430	931129	0930	591	589	<4.0	28	144	229	29	0.040	<0.050
NOV 29	1000	931202	0900	244	835	2.3	14	191	50	<14	0.040	<0.050
1994												
FEB 18	1025	940221	1325	362	1,550	4.9	29	186	--	--	0.090	<0.050
FEB 21	1425	940222	0925	976	827	2.9	29	126	117	18	0.090	<0.050
FEB 22	0945	940224	0845	574	871	<2.0	38	162	--	--	0.070	<0.050
MAR 21	0950	940323	0550	582	818	2.6	46	159	263	31	<0.010	<0.050
MAR 23	0650	940324	0850	919	591	2.2	21	131	272	28	0.030	<0.050
MAR 24	1000	940327	0500	580	676	--	20	159	--	--	<0.010	<0.050
APR 12	1555	940414	0855	563	777	2.5	21	178	163	15	0.020	<0.050
APR 14	0930	940418	0830	438	803	2.7	22	191	--	--	0.010	<0.050
AUG 13	0955	940814	1655	133	960	<2.0	10	183	46	5	0.020	<0.050
AUG 14	1755	940815	0855	180	593	<2.0	22	120	86	11	0.030	<0.050
DEC 05	1005	941206	0305	259	832	<2.0	--	182	116	19	0.050	<0.050
DEC 06	0405	941208	0905	192	1,000	<2.0	--	196	40	<16	0.050	<0.050
DEC 08	0945	941209	2045	135	1,250	2.0	--	216	18	<3	0.050	<0.050

DATE	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (mg/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (mg/L AS N)	PHOS-PHORUS TOTAL (mg/L AS P)	PHOS-PHORUS ORTHO, DIS-SOLVED (mg/L AS P)	CARBON, ORGANIC TOTAL (mg/L AS C)	CHLO-RIDE, DIS-SOLVED (mg/L AS Cl)	SULFATE DIS-SOLVED (mg/L AS SO_4)	CADMIUM TOTAL RECOV-ERABLE (µg/L AS Cd)	COPPER, TOTAL RECOV-ERABLE (µg/L AS Cu)	LEAD, TOTAL RECOV-ERABLE (µg/L AS Pb)	ZINC, TOTAL RECOV-ERABLE (µg/L AS Zn)
1993											
MAR 31-APR 01	0.66	1.00	0.120	0.020	--	57	34	<1	70	10	60
APR 01-03	0.68	0.970	0.120	0.023	5.0	55	31	<1	90	10	70
APR 03-05	0.55	1.10	0.085	0.022	4.4	56	37	<1	90	5	60
APR 06-06	0.65	1.30	0.075	0.014	4.4	74	59	<1	70	5	70
APR 06-08	0.56	1.20	0.080	0.014	4.3	73	59	<1	80	8	70
JUN 05-06	1.1	0.870	0.160	0.017	6.5	99	140	--	60	9	110
JUN 06-07	0.91	0.825	0.145	0.020	5.6	89	100	<1	60	12	90
SEP 02-04	0.76	0.860	0.140	0.030	4.3	74	130	<1	30	6	80
SEP 04-07	0.78	0.760	0.060	0.034	4.5	85	120	<1	40	12	60
NOV 27-28	1.6	0.820	0.190	0.016	5.0	100	110	<1	--	13	60
NOV 28-29	1.5	0.940	0.310	0.024	7.4	64	70	<1	--	11	80
NOV 29-DEC 2	0.96	1.10	0.110	0.018	6.7	93	100	<1	--	<5	--
1994											
FEB 18-21	0.84	1.20	0.170	0.024	--	310	110	<1	--	9	--
FEB 21-22	0.69	1.20	0.190	0.020	--	170	66	<1	--	6	--
FEB 22-24	0.68	1.30	0.140	0.019	--	150	74	<1	--	5	--
MAR 21-23	0.99	1.10	0.280	0.016	--	110	65	1	40	12	--
MAR 23-24	0.73	1.10	0.230	0.018	--	72	48	1	30	7	--
MAR 24-27	0.82	1.10	0.130	0.016	--	82	62	1	30	5	--
APR 12-14	0.84	0.860	--	0.011	--	96	71	--	20	8	--
APR 14-18	1.5	0.890	0.170	0.009	--	100	72	<1	30	--	--
AUG 13-14	0.50	0.640	0.100	0.021	--	110	170	<1	30	10	--
AUG 14-15	0.43	0.550	0.180	0.028	--	69	91	<1	40	5	--
DEC 05-06	0.43	0.690	0.210	0.015	--	99	110	1	21	--	--
DEC 06-08	0.50	0.740	0.110	0.015	--	140	110	<1	22	--	--
DEC 08-09	0.80	0.840	0.055	0.012	--	210	120	<1	40	<5	<40

Table A-2. Analyses of ground-water samples from observation wells in vicinity of the Ellison Park wetland, Monroe County, N.Y., December 1989 through April 1994

[Well locations are shown in fig. 2. µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than;--, no data.]

STATION NUMBER AND LOCAL WELL NUMBER	DATE	TURBIDITY (UNITS)	COLOR (PLATINUM-COBALT UNITS)	SPECIFIC CONDUCTANCE (µS/cm)	OXYGEN, DISSOLVED (mg/L)	pH WATER WHOLE LAB (STANDARD UNITS)	ALKALINITY, CARBONATE (mg/L $CaCO_3$)	NITROGEN, AMMONIA DISSOLVED (mg/L AS N)	NITROGEN, AMMONIA + ORGANIC, TOTAL (mg/L AS N)	NITROGEN, NO2+NO3, TOTAL (mg/L AS N)
430854077304601	12-05-89	0.95	5	1,320	1.1	7.6	250	<0.010	0.16	0.460
Mo3	03-20-90	0.70	5	1,300	0.7	7.6	250	<0.010	0.22	0.050
	06-07-90	0.70	5	1,310	2.3	7.6	240	<0.010	0.32	0.520
	09-26-90	1.3	5	1,330	0.6	7.	240	<0.010	<0.10	0.550
	01-09-91	0.95	5	1,300	0.3	7.	250	0.010	0.22	0.300
	04-03-91	0.55	5	1,300	0.3	7	240	<0.010	0.26	0.330
	06-12-91	0.85	5	1,300	1.2	7.6	240	<0.010	0.77	0.590
	09-11-91	0.85	5	1,300	0.9	7.6	240	<0.010	0.30	0.470
	12-18-91	0.80	5	1,290	6.8	7.5	240	<0.010	0.37	0.330
	03-18-92	1.7	5	1,290	1.2	7.6	240	<0.010	0.17	0.260
	06-24-92	0.75	5	1,320	2.2	7.5	240	<0.010	0.45	0.490
	09-10-92	1.0	5	1,320	1.4	7.6	240	<0.010	0.14	0.520
	12-08-92	1.1	5	1,300	0.5	7.4	240	<0.010	0.13	0.450
	03-09-93	1.2	5	1,280	1.2	7.6	240	<0.010	0.16	0.390
	06-22-93	0.60	5	1,270	0.6	7.8	240	<0.010	0.29	0.454
	09-16-93	0.90	5	1,280	0.5	7.7	240	<0.010	0.49	0.510
	04-06-94	0.55	5	1,280	0.5	7.5	240	<0.010	0.46	0.320
430855077304202	12-05-89	5.4	5	916	0.2	7.7	200	0.030	0.24	<0.010
Mo2	03-20-90	16	5	807	0.4	7.8	180	0.030	0.29	<0.010
	06-07-90	21	5	880	0.2	7.7	190	0.015	0.23	0.025
	09-26-90	11	5	916	<0.1	7.8	190	0.030	0.13	0.010
	01-09-91	6.1	5	810	0.6	7.5	180	0.055	0.28	0.015
	04-03-91	5.9	5	807	1	7.6	180	0.030	0.17	--
	06-12-91	3.6	5	897	0.8	7.7	190	<0.010	0.46	0.120
	09-11-91	6.5	5	864	20.4	7.8	180	0.040	0.33	0.055
	12-18-91	4.6	5	1,060	14.4	7.5	180	0.055	0.28	<0.050
	03-18-92	4.9	5	859	2.8	7.8	170	0.030	0.17	<0.050
	06-24-92	7.3	5	933	0.2	7.6	180	0.040	0.54	<0.050
	09-10-92	14	5	898	<0.1	7.6	180	0.040	0.13	<0.050
	12-08-92	5.8	5	875	0.7	7.4	180	0.040	0.17	<0.050
	03-09-93	14	5	897	1.4	7.5	180	0.020	0.20	0.050
	06-22-93	9.4	5	907	0.0	7.8	180	0.030	0.32	<0.050
	09-16-93	7.6	5	887	<0.1	7.8	170	0.040	0.43	<0.050
	04-06-94	1.1	6	888	1.6	7.6	170	<0.010	0.45	0.050
430912077313301 Mo663	04-03-91	190	40	1,600	1.5	6.8	650	0.630	2.0	0.010
	06-12-91	160	80	1,560	--	6.9	620	0.700	2.8	0.100
	09-11-91	60	35	1,660	--	7.1	560	0.960	--	<0.050
	12-18-91	290	35	1,680	--	7.1	470	0.650	1.8	<0.050
	03-18-92	130	40	1,620	0.1	6.9	600	0.670	1.5	<0.050
	06-24-92	150	33	1,600	<0.1	7.0	610	0.800	2.1	<0.050
	09-09-92	130	30	1,610	--	6.9	600	1.00	1.8	<0.050
	12-08-92	120	47	1,680	0.1	7.0	600	0.890	1.6	<0.050
	03-09-93	150	30	1,590	<0.1	7.0	600	0.750	1.7	<0.050
	06-22-93	100	22	1,510	--	7.1	590	0.800	1.9	<0.050
	09-16-93	130	30	1,630	<0.1	7.0	540	0.890	2.1	<0.050
	04-06-94	90	30	1,610	<0.1	6.9	610	0.220	5.2	<0.050
430912077313302	01-09-91	110	23	18,100	<0.1	6.5	160	2.80	3.1	0.020
Mo664	04-03-91	160	38	19,700	<0.1	6.8	160	2.90	3.6	--
	06-12-91	160	110	17,800	0.6	6.6	140	4.10	15	0.100
	09-11-91	180	40	21,400	0.6	6.7	150	2.50	--	0.060
	12-18-91	340	20	19,300	0.1	6.6	150	3.20	6.7	<0.050
	03-18-92	80	50	16,900	<0.1	6.8	170	2.50	5.3	<0.050
	06-24-92	120	10	20,600	<0.1	6.8	160	3.10	9.7	0.560
	09-09-92	55	40	21,200	<0.1	6.7	130	3.50	5.0	<0.050
	12-08-92	36	60	21,200	<0.1	6.8	170	2.90	5.1	<0.050
	03-09-93	60	20	21,600	<0.1	6.9	140	3.30	4.8	<0.050
	06-22-93	35	12	22,000	0.1	6.8	140	3.20	4.0	<0.050
	09-16-93	70	15	23,100	<0.1	6.6	120	3.60	6.4	<0.050
	04-06-94	32	31	19,600	<0.1	6.8	180	2.30	3.1	<0.050

Table A-2. Analyses of ground-water samples from observation wells in vicinity of the Ellison Park wetland, Monroe County, N.Y., December 1989 through April 1994--continued

[Well locations are shown in fig. 2. µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than;--, no data.]

LOCAL WELL NUMBER	DATE	PHOSPHORUS TOTAL (mg/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (mg/L AS P)	HARDNESS, TOTAL (mg/L AS $CaCO_3$)	CALCIUM, TOTAL RECOVERABLE (mg/L AS Ca)	MAGNESIUM, DISSOLVED (mg/L AS Mg)	SODIUM, DISSOLVED (mg/L AS Na)	POTASSIUM, DISSOLVED (mg/L AS K)	CHLORIDE, DISSOLVED (mg/L AS Cl)	SULFATE, DISSOLVED (mg/L AS SO_4)	IRON, TOTAL RECOVERABLE (µg/L AS Fe)	MANGANESE, TOTAL RECOVERABLE (µg/L AS Mn)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (mg/L)
Mo3	12-05-89	0.030	0.003	390	110	27	130	3.0	240	80	150	--	740
	03-20-90	0.005	0.004	380	110	28	130	2.4	240	79	130	--	777
	06-07-90	0.015	0.003	390	110	28	130	2.5	240	75	120	--	790
	09-26-90	0.030	0.003	390	110	26	120	2.5	240	38	360	--	766
	01-09-91	0.005	0.004	380	110	27	120	3.0	230	68	110	--	756
	04-03-91	0.010	0.005	380	110	26	130	3.0	230	85	70	--	737
	06-12-91	0.010	<0.002	390	110	26	120	2.8	230	68	100	--	758
	09-11-91	0.010	0.004	380	110	28	130	2.6	230	15	130	--	748
	12-18-91	0.005	0.005	380	110	26	130	3.2	230	86	70	--	769
	03-18-92	0.010	0.005	380	100	27	130	3.8	230	77	180	--	751
	06-24-92	0.010	0.003	380	100	28	130	2.8	240	80	340	--	757
	09-10-92	0.015	0.005	380	100	26	130	3.0	250	91	290	--	758
	12-08-92	0.010	0.004	370	110	27	130	2.5	240	100	360	--	760
	03-09-93	0.010	0.004	370	100	26	120	2.3	230	87	180	--	--
	06-22-93	0.005	0.003	370	120	33	120	5.2	220	86	140	--	753
	09-16-93	0.010	0.006	370	100	25	130	2.1	230	88	310	--	760
	04-06-94	0.015	0.002	390	130	28	80	2.4	240	91	460	380	764
Mo2	12-05-89	0.040	0.002	310	87	22	74	1.6	140	74	340	--	516
	03-20-90	0.042	0.002	290	80	21	61	1.3	120	71	630	--	488
	06-07-90	0.055	0.002	300	82	20	70	1.5	130	74	820	--	570
	09-26-90	0.028	0.003	290	74	20	80	1.3	140	38	470	--	536
	01-09-91	0.020	0.002	290	76	20	62	1.6	110	68	340	--	500
	04-03-91	0.013	0.004	290	80	20	58	1.5	110	77	330	--	468
	06-12-91	0.025	0.002	290	82	20	78	1.6	150	68	400	--	538
	09-11-91	0.018	0.002	280	78	15	72	1.5	130	74	320	--	516
	12-18-91	0.018	0.004	290	81	20	77	1.7	140	80	290	--	555
	03-18-92	0.025	0.003	300	82	22	66	2.1	130	75	200	--	491
	06-24-92	0.030	0.002	310	88	22	75	1.6	140	72	460	--	544
	09-10-92	0.045	0.006	300	84	21	70	1.6	140	84	1,600	--	544
	12-08-92	0.015	0.003	300	85	22	61	1.4	130	85	400	--	553
	03-09-93	0.025	0.002	310	84	22	61	1.3	140	81	810	--	--
	06-22-93	0.063	0.003	300	90	23	80	1.4	140	81	760	--	580
	09-16-93	0.025	0.037	300	85	20	75	1.2	140	--	480	--	520
	04-06-94	0.010	<0.002	320	79	23	66	1.4	140	88	240	400	513
Mo663	04-03-91	0.480	0.003	860	220	54	58	0.46	230	<10	4,000	--	933
	06-12-91	0.330	<0.002	780	220	51	62	0.48	220	<10	16,000	--	964
	09-11-91	0.140	0.002	760	210	60	67	0.81	250	<10	6,100	--	969
	12-18-91	0.170	0.002	760	220	52	73	1.0	240	<10	12,000	--	932
	03-18-92	0.210	0.003	780	220	56	53	1.2	210	<10	13,000	--	950
	06-24-92	0.300	0.002	770	210	58	63	0.80	220	<10	19,000	--	919
	09-09-92	0.220	<0.002	760	210	55	65	0.78	210	<10	9,600	--	979
	12-08-92	0.240	0.002	800	220	55	68	0.60	240	<5.0	13,000	--	1,000
	03-09-93	0.270	0.002	800	210	54	54	0.32	210	6.0	16,000	--	--
	06-22-93	0.250	0.004	780	220	48	68	<0.50	220	<5.0	4,200	--	1,010
	09-16-93	0.320	0.002	750	210	52	74	<0.50	260	5.0	14,000	--	1,000
	04-06-94	0.350	<0.002	1,300	250	59	57	<0.25	230	7.0	18,000	1,500	958
Mo664	01-09-91	0.170	0.003	5,100	1,300	450	2,300	30	6,700	480	33,000	--	11,100
	04-03-91	0.330	0.003	5,900	1,500	470	2,400	30	7,500	380	36,000	--	12,600
	06-12-91	0.290	<0.002	6,900	1,800	610	2,600	36	8,500	150	56,000	--	14,400
	09-11-91	2.75	0.002	6,200	--	--	3,000	24	8,100	510	25,000	--	13,800
	12-18-91	0.300	0.004	5,600	1,400	480	3,000	31	7,100	550	32,000	--	12,800
	03-18-92	0.290	0.003	4,800	550	450	2,000	37	6,400	310	18,000	--	11,000
	06-24-92	0.250	0.010	5,800	1,400	510	2,700	32	7,400	560	37,000	--	14,000
	09-09-92	--	<0.002	6,000	1,400	520	2,700	34	7,800	590	30,000	--	13,300
	12-08-92	0.260	0.003	5,900	1,400	520	2,500	26	7,700	660	29,000	--	13,900
	03-09-93	0.270	0.002	6,200	1,500	490	2,600	29	7,800	630	34,000	--	--
	06-22-93	0.300	0.036	6,100	--	--	--	--	8,100	660	--	--	14,900
	09-16-93	0.275	0.004	6,600	1,700	550	3,000	24	8,700	--	40,000	--	16,200
	04-06-94	0.300	0.026	5,900	1,300	420	--	24	7,300	690	27,000	4,800	14,600

Table A-2. Analyses of ground-water samples from observation wells in vicinity of the Ellison Park wetland, Monroe County, N.Y., December 1989 through April 1994--continued

[Well locations are shown in fig. 2. µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than;--, no data.]

STATION NUMBER AND LOCAL WELL NUMBER	DATE	TUR-BID-ITY (UNITS)	COLOR (PLAT-INUM-COBALT UNITS)	SPE-CIFIC CON-DUCT-ANCE (µS/cm)	OXYGEN, DIS-SOLVED (mg/L)	pH WATER WHOLE LAB (STAND-ARD UNITS)	ALKA-LINITY, CARBON-ATE (mg/L $CaCO_3$)	NITRO-GEN, AMMONIA DIS-SOLVED (mg/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (mg/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (mg/L AS N)
430928077313802	01-09-91	100	42	1,900	--	7.0	760	1.90	3.5	0.030
Mo665	04-04-91	70	45	1,940	<0.1	7.1	760	1.80	1.7	0.00
	06-13-91	50	45	900	<0.1	7.1	770	1.70	3.6	0.140
	09-11-91	80	50	1,970	0.1	7.3	780	2.00	--	<0.050
	12-19-91	75	47	1,970	--	7.1	--	1.90	3.4	<0.050
	03-18-92	60	43	1,910	--	7.1	790	1.90	3.4	<0.050
	06-24-92	75	45	1,990	<0.1	7.2	770	1.90	4.5	<0.050
	09-10-92	75	42	1,980	0.1	7.2	790	2.00	3.1	<0.050
	12-09-92	65	40	1,970	0.1	7.1	790	2.10	3.4	<0.050
	03-10-93	75	40	1,970	0.4	7.1	770	2.00	4.2	<0.050
	07-07-93	75	43	1,930	<0.1	7.2	790	2.00	3.5	<0.050
	09-16-93	55	49	1,970	<0.1	7.1	790	1.90	3.9	<0.050
	04-06-94	60	45	1,960	<0.1	7.1	790	1.80	5.3	<0.050
430928077313803	09-16-93	95	25	1,830	<0.1	7.1	850	7.50	8.3	<0.050
Mo666	04-06-94	130	20	1,900	<0.1	7.2	850	8.40	11	<0.050
430928077314001	01-09-91	160	27	2,080	--	7.1	870	12.0	13	0.030
Mo667										
	04-04-91	220	28	1,720	--	7.3	820	9.80	12	0.00
	06-13-91	100	30	1,370	--	7.3	980	14.5	13	0.100
	09-11-91	170	30	2,480	--	7.3	1,050	22.0	--	0.060
	12-18-91	--	30	2,530	--	7.1	830	16.0	16	<0.050
	03-18-92	220	30	1,880	0.7	7.4	830	12.0	12	<0.050
	06-24-92	100	30	2,440	1.4	7.3	1,060	12.0	16	<0.050
	09-10-92	220	28	2,370	--	7.8	1,050	14.0	14	<0.050
	12-09-92	270	40	2,330	0.2	7.0	1,020	14.0	14	<0.050
	03-10-93	300	30	2,160	<0.1	7.1	930	12.0	12	<0.050
	07-07-93	250	23	2,850	<0.1	7.1	850	15.0	17	<0.050
	09-16-93	510	30	2,970	<0.1	7.2	820	18.0	18	<0.050
	04-06-94	270	35	1,880	1.3	7.2	800	10.0	11	<0.050
430928077314002	01-09-91	160	18	2,880	--	6.8	640	5.90	7.0	0.020
Mo668	04-04-91	200	24	2,860	<0.1	6.9	650	5.90	6.8	0.140
	06-13-91	190	23	2,650	<0.2	6.9	640	4.90	7.3	1.20
	09-11-91	240	25	2,780	8.5	7.0	620	8.40	--	<0.050
	12-18-91	280	20	2,800	9.3	7.0	650	7.10	7.4	<0.050
	03-18-92	220	45	2,860	<0.1	6.9	640	6.00	6.8	<0.050
	06-24-92	150	35	2,800	<0.1	7.0	640	6.40	9.4	<0.050
	09-10-92	160	23	2,830	<0.1	6.9	640	6.00	7.8	<0.050
	12-09-92	75	40	2,800	<0.1	6.9	630	6.00	7.1	<0.050
	03-09-93	230	20	2,820	0.3	7.0	640	5.40	6.4	<0.050
	07-07-93	230	14	2,600	<0.1	7.0	650	6.30	7.0	<0.050
	09-16-93	170	20	2,580	<0.1	6.9	580	6.70	7.6	<0.050
	04-06-94	50	20	2,710	<0.1	6.8	660	5.00	--	<0.050
430932077311501	01-09-91	9.0	6	510	0.4	9.4	35	<0.010	0.24	<0.010
Mo659	04-04-91	9.1	12	522	0.3	9.5	30	<0.010	<0.10	0.00
	06-12-91	13	10	523	<0.1	9.5	32	<0.010	0.86	0.110
	09-11-91	9.0	5	538	12.6	9.2	29	<0.010	0.35	<0.050
	12-18-91	9.2	8	551	11.5	8.4	30	0.020	0.22	<0.050
	03-18-92	15	14	510	0.4	9.3	30	0.010	0.21	<0.050
	06-24-92	12	5	564	0.9	9.0	33	<0.010	0.53	<0.050
	09-09-92	6.6	5	579	0.4	9.0	32	0.010	0.40	<0.050
	12-08-92	12	5	576	1.0	8.3	32	0.010	0.12	<0.050
	03-09-93	6.8	5	1,590	2.4	9.3	51	<0.010	0.15	<0.050
	07-07-93	11	6	866	6.2	8.0	86	<0.010	0.23	<0.050
	04-29-94	7.8	6	863	--	8.2	76	0.020	0.57	<0.050
	04-29-94	80	40	1,230	--	7.5	210	0.080	0.63	<0.050

Table A-2. Analyses of ground-water samples from observation wells in vicinity of the Ellison Park wetland, Monroe County, N.Y., December 1989 through April 1994--continued

[Well locations are shown in fig. 2. µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than;--, no data.]

LOCAL WELL NUMBER	DATE	PHOSPHORUS TOTAL (mg/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (mg/L AS P)	HARDNESS, TOTAL (mg/L AS $CaCO_3$)	CALCIUM, TOTAL RECOVERABLE (mg/L AS Ca)	MAGNESIUM, DISSOLVED (mg/L AS Mg)	SODIUM, DISSOLVED (mg/L AS Na)	POTASSIUM, DISSOLVED (mg/L AS K)	CHLORIDE, DISSOLVED (mg/L AS Cl)	SULFATE, DISSOLVED (mg/L AS SO_4)	IRON, TOTAL RECOVERABLE (µg/L AS Fe)	MANGANESE, TOTAL RECOVERABLE (µg/L AS Mn)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (mg/L)
Mo665	01-09-91	0.300	0.004	580	180	35	230	0.80	240	<10	12,000	--	1,210
	04-04-91	0.240	0.003	580	170	34	240	0.76	230	<10	27,000	--	1,220
	06-13-91	0.160	0.004	590	170	33	260	0.70	240	<10	6,900	--	1,240
	09-11-91	0.260	0.004	570	160	7.0	260	0.88	240	<10	13,000	--	1,240
	12-19-91	0.300	0.004	580	170	34	270	1.0	240	<10	9,700	--	1,220
	03-18-92	0.250	0.004	590	180	37	230	1.2	240	<10	9,900	--	1,240
	06-24-92	0.280	0.002	560	170	39	250	0.70	240	<10	7,600	--	1,230
	09-10-92	0.280	0.003	590	180	38	250	0.99	240	<10	7,300	--	1,260
	12-09-92	0.370	0.006	600	170	34	240	0.60	240	6.0	12,000	--	1,240
	03-10-93	0.290	0.003	610	170	35	220	0.48	240	7.0	12,000	--	--
	07-07-93	0.275	0.004	650	180	36	270	<0.50	230	5.0	8,400	--	1,260
	09-16-93	0.320	0.006	600	270	33	250	<0.50	240	8.0	11,000	--	1,230
	04-06-94	0.430	<0.002	690	180	38	100	0.42	240	<1.0	13,000	1,900	1,230
Mo666	09-16-93	0.290	0.003	730	220	52	160	4.8	160	--	19,000	--	1,070
	04-06-94	0.420	<0.002	1,600	180	55	130	9.3	150	12	24,000	1,000	1,030
Mo667	01-09-91	0.710	0.003	750	200	53	170	23	220	10	18,000	--	1,250
	04-04-91	1.65	0.004	690	200	52	100	21	130	<10	25,000	--	1,000
	06-13-91	3.90	0.003	880	250	62	170	25	250	<10	13,000	--	1,390
	09-11-91	0.990	0.004	910	240	71	230	22	280	<10	18,000	--	1,170
	12-18-91	1.60	0.004	990	290	73	210	31	310	10	53,000	--	1,500
	03-18-92	1.60	0.003	820	220	60	100	23	120	84	19,000	--	1,160
	06-24-92	1.50	0.009	990	270	74	190	26	270	<10	14,000	--	1,490
	09-10-92	1.85	0.004	930	280	37	180	29	240	<10	20,000	--	1,460
	12-09-92	2.80	0.004	910	250	65	170	23	250	<5.0	39,000	--	1,400
	03-10-93	3.60	0.004	910	240	61	130	22	230	7.0	44,000	--	--
	07-07-93	1.75	0.006	1,100	290	71	230	28	530	<5.0	28,000	--	1,730
	09-16-93	11.0	0.007	950	260	62	280	25	550	7.0	55,000	--	1,710
	04-06-94	3.65	<0.002	1,000	210	51	180	13	190	24	33,000	2,000	1,120
Mo668	01-09-91	0.160	0.003	860	220	72	280	6.7	620	<10	27,000	--	1,610
	04-04-91	0.460	0.003	920	210	73	280	6.0	700	<10	31,000	--	1,560
	06-13-91	0.250	0.002	840	220	70	310	6.2	670	<10	23,000	--	1,610
	09-11-91	0.320	0.002	860	220	27	290	5.0	690	<10	24,000	--	1,540
	12-18-91	0.260	0.003	860	220	69	390	6.1	580	<10	33,000	--	1,560
	03-18-92	0.480	0.003	820	220	74	290	7.8	620	<10	18,000	--	1,560
	06-24-92	0.660	0.003	840	220	74	310	5.7	590	<10	40,000	--	1,550
	09-10-92	0.580	0.002	830	230	70	270	8.1	600	<10	23,000	--	1,570
	12-09-92	0.640	0.003	860	220	73	270	5.0	610	<5.0	31,000	--	1,560
	03-09-93	0.620	0.003	860	210	72	260	4.9	600	6.0	34,000	--	--
	07-07-93	0.630	0.004	830	210	69	280	4.9	570	<5.0	26,000	--	1,530
	09-16-93	0.190	0.004	770	210	64	250	4.5	540	6.0	30,000	--	1,420
	04-06-94	0.690	<0.002	1,900	230	76	240	4.8	580	4.0	30,000	1,200	1,540
Mo659	01-09-91	<0.005	0.003	90	11	16	57	8.0	140	<10	3,400	--	248
	04-04-91	0.005	0.003	92	11	17	57	7.9	140	<10	2,200	--	235
	06-12-91	<0.005	<0.002	95	4.0	9.0	60	8.0	140	<10	7,800	--	268
	09-11-91	<0.005	0.002	97	12	18	58	6.4	150	40	2,000	--	252
	12-18-91	<0.005	0.002	100	10	18	66	18	220	<10	3,100	--	262
	03-18-92	0.005	<0.002	110	10	20	57	8.7	210	<10	4,200	--	264
	06-24-92	<0.005	<0.002	100	9.0	20	61	7.3	150	<10	5,000	--	277
	09-09-92	<0.005	<0.002	100	32	28	66	7.3	150	<10	1,400	--	283
	12-08-92	0.005	0.002	120	10	22	58	7.1	160	<5.0	3,100	--	288
	03-09-93	0.005	0.002	210	210	54	62	3.3	220	6.0	16,000	--	--
	07-07-93	0.005	<0.002	280	23	46	72	3.2	230	<5.0	3,200	--	432
	04-29-94	<0.005	<0.002	--	22	51	62	3.0	230	<1.0	2,900	300	378
	04-29-94	<0.005	<0.002	--	88	52	71	3.5	270	20	9,800	200	622

Table A-3. Analyses of atmospheric deposition in northern part of Ellison Park wetland, Monroe County, N.Y., April 1992 through September 1994 (station 431021077315902)

[Sampling location is shown in fig.2. µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than; --, no data.]

Part A. Wetfall analyses

DATE	SPECIFIC CONDUCTANCE (µS/cm)	pH WATER WHOLE LAB (STANDARD UNITS)	ACIDITY (mg/L AS $CACO_3$)	NITROGEN, AMMONIA DISSOLVED (mg/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (mg/L AS N)	NITROGEN, NO2+NO3 TOTAL (mg/L AS N)	PHOSPHORUS TOTAL (mg/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (mg/L AS P)	CALCIUM, DISSOLVED (mg/L AS Ca)
OCT 01-NOV 05 **1992**	730	4.7	3.3	0.550	0.64	0.600	0.075	0.047	--
NOV 05-DEC 02	53	4.2	8.1	0.600	0.64	0.970	0.020	0.011	--
DEC 02 1992-JAN 05 **1993**	17	6.1	0.9	0.280	0.34	0.340	0.025	0.006	--
APR 14-MAY 07	78	3.9	11	0.790	1.2	1.70	0.050	0.015	--
MAY 07-JUN 02	36	4.0	5.8	--	0.93	0.680	0.030	0.003	--
JUN 02-JUL 01	78	3.8	11	0.780	0.96	0.940	0.025	<0.002	--
JUL 01-AUG 05	104	3.8	14	0.670	0.92	0.910	0.015	<0.002	--
AUG 05-SEP 02	113	3.7	15	1.10	1.2	1.40	0.020	0.006	--
SEP 01-OCT 01	38	4.2	5.9	0.390	0.49	0.480	0.010	0.003	0.30
OCT 01-NOV 03	32	4.4	5.1	0.450	0.61	0.550	0.025	0.011	0.73
NOV 03-DEC 02	41	4.4	6.0	0.900	1.0	1.30	0.020	0.006	0.75
DEC 02 1993-JAN 12 **1994**	42	4.9	5.7	0.310	0.36	0.720	0.010	0.009	0.48
JAN 12-31	8	4.9	1.9	0.110	0.14	0.220	0.005	0.004	0.08
JAN 31-MAR 01	13	6.0	1.2	0.050	0.19	0.310	0.005	0.004	0.40
MAR 01-APR 01	11	6.3	1.5	0.070	0.23	0.290	0.010	0.003	0.56
APR 01-MAY 02	89	3.9	10	2.10	3.3	2.30	0.140	0.038	3.3
MAY 02-JUN 01	37	4.2	5.0	0.880	1.3	0.680	0.095	0.013	1.2
JUN 01-30	44	3.6	9.4	0.440	0.50	0.580	0.025	0.002	0.30
JUN 30-JUL 29	97	3.3	16	1.40	1.6	1.40	0.050	0.011	1.3
JUL 29-AUG 31	81	3.5	12	0.710	0.87	0.980	0.040	0.003	0.58
AUG 31-OCT 03	79	3.9	10	1.00	1.1	1.30	0.045	0.002	1.2

DATE	CALCIUM, TOTAL RECOVERABLE (mg/L AS Ca)	MAGNESIUM, DISSOLVED (mg/L AS Mg)	SODIUM, DISSOLVED (mg/L AS Na)	POTASSIUM, DISSOLVED (mg/L AS K)	CHLORIDE, DISSOLVED (mg/L AS Cl)	SULFATE, DISSOLVED (mg/L AS SO_4)	LEAD, TOTAL RECOVERABLE (µg/L AS Pb)	ZINC, TOTAL RECOVERABLE (µg/L AS Zn)
OCT 01-NOV 05 **1992**	0.74	0.09	0.07	0.32	0.80	4.0	<5	<40
NOV 05-DEC 02	0.60	0.15	0.20	<0.10	0.30	5.0	<5	30
DEC 02 1992-JAN 05 **1993**	0.63	0.17	1.0	0.09	1.4	2.0	8	<40
APR 14-MAY 07	1.8	0.47	0.38	0.16	0.93	9.0	7	60
MAY 07-JUN 02	0.62	0.13	0.13	0.04	0.40	--	25	<40
JUN 02-JUL 01	0.61	0.15	0.10	0.08	0.40	--	5	90
JUL 01-AUG 05	0.88	0.34	0.22	0.22	0.40	12	<5	<40
AUG 05-SEP 02	0.75	0.18	0.12	0.13	0.51	12	<5	50
SEP 01-OCT 01	--	0.07	0.19	--	0.32	4.3	6	40
OCT 01-NOV 03	--	0.21	<0.02	0.05	0.41	4.0	6	<40
NOV 03-DEC 02	--	0.20	0.31	0.06	0.97	5.0	<5	<40
DEC 02 1993-JAN 12 **1994**	--	0.12	1.5	0.01	2.2	2.0	8	<40
JAN 12-31	--	0.03	0.11	<0.01	0.20	<2.0	<5	--
JAN 31-MAR 01	--	0.05	1.8	0.01	2.6	<2.0	6	40
MAR 01-APR 01	--	0.09	--	<0.01	0.58	<2.0	4	40
APR 01-MAY 02	--	0.80	0.38	0.20	0.99	15	9	40
MAY 02-JUN 01	--	0.33	<0.20	--	0.80	6.5	5	40
JUN 01-30	--	<0.10	0.02	0.06	0.80	5.2	6	<40
JUN 30-JUL 29	--	0.29	0.06	0.18	0.80	13	6	40
JUL 29-AUG 31	--	0.12	0.05	0.08	0.40	9.3	<5	<40
AUG 31-OCT 03	--	0.28	0.08	0.16	0.60	9.7	9	<40

Table A-3. Analyses of atmospheric deposition in northern part of Ellison Park wetland, Monroe County, N.Y., April 1992 through September 1994 (station 431021077315902)--continued

[Sampling location is shown in fig. 2. µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than; --, no data.]

Part B. Dryfall analyses

DATE	SPE- CIFIC CON- DUCT- ANCE (µS/cm)	pH WATER WHOLE LAB (STAND- ARD UNITS)	ACIDITY (mg/L AS $CACO_3$)	NITRO- GEN, AMMONIA DIS- SOLVED (mg/L AS N)	NITRO- GEN,AM- MONIA + ORGANIC TOTAL (mg/L AS N)	NITRO- GEN, NO2+NO3 TOTAL (mg/L AS N)	PHOS- PHORUS TOTAL (mg/L AS P)	PHOS- PHORUS ORTHO, DIS- SOLVED (mg/L AS P)	CALCIUM DIS- SOLVED (mg/L AS Ca)
NOV 05- DEC 02 **1992**	4	6.5	0.9	0.070	0.10	0.160	0.015	0.005	--
DEC 02 1992- JAN 05 **1993**	38	4.3	4.6	0.300	0.28	0.460	0.015	0.008	--
APR 14-MAY 07	42	4.6	5.6	0.700	1.6	1.00	0.300	0.215	--
MAY 07-JUN 02[1]	79	4.9	23	--	24	1.00	0.490	3.40	--
JUN 02-JUL 01	22	6.1	2.2	0.140	0.76	0.450	0.120	0.039	--
JUL 01-AUG 05[1]	45	5.1	9.8	0.180	11	0.510	1.45	0.258	--
AUG 05-SEP 02	23	6.0	2.0	0.240	1.4	0.350	0.250	0.077	--
SEP 01-OCT 01[1]	99	7.0	5.3	3.49	17	0.680	2.05	1.85	2.2
OCT 01-NOV 03	11	5.8	2.2	0.180	0.38	0.330	0.040	0.013	0.76
NOV 03-DEC 02	28	4.6	4.7	0.310	0.31	0.690	0.030	0.013	0.56
DEC 02 1993- JAN 12 **1994**	65	4.4	6.6	0.530	0.53	1.20	0.030	0.022	0
JAN 12-31	57	4.3	4.6	0.680	0.64	1.40	0.020	0.012	0.41
JAN 31-MAR 01	80	4.0	6.9	0.480	0.65	1.80	0.035	0.017	1.3
MAR 01-APR 01	63	4.0	8.7	0.620	0.59	1.40	0.025	0.014	1.4
APR 01-MAY 02	10	6.1	1.5	0.120	0.30	0.370	0.035	0.008	0.87
MAY 02-JUN 01	87	4.0	11	2.10	3.9	1.60	0.353	0.084	2.9
JUN 01-30	39	5.4	3.6	0.330	1.7	1.00	0.460	0.255	0.66
JUN 30-JUL 29	20	5.8	3.6	0.190	0.84	0.450	0.290	0.210	1.4
JUL 29-AUG 31	72	3.9	9.8	1.50	2.5	1.00	0.450	0.305	1.9
AUG 31-OCT 03	41	4.8	5.1	0.790	1.4	1.00	0.140	0.038	2.0

DATE	CALCIUM, TOTAL RECOV- ERABLE (mg/L AS Ca)	MAGNE- SIUM, DIS- SOLVED (mg/L AS Mg)	SODIUM, DIS- SOLVED (mg/L AS Na)	POTAS- SIUM, DIS- SOLVED (mg/L AS K)	CHLO- RIDE, DIS- SOLVED (mg/L AS Cl)	SULFATE, DIS- SOLVED (mg/L AS SO_4)	LEAD, TOTAL RECOV- ERABLE (µg/L AS Pb)	ZINC, TOTAL RECOV- ERABLE (µg/L AS Zn)
NOV 05- DEC 02 **1992**	0.20	0.04	<0.10	0.10	0.20	2.0	<5	20
DEC 02 1992- JAN 05 **1993**	0.46	0.14	0.85	0.07	1.3	5.0	10	<40
APR 14-MAY 07	2.3	0.56	0.21	0.18	0.52	8.0	8	50
MAY 07-JUN 02[1]	3.0	0.81	1.9	20	9.2	--	10	<40
JUN 02-JUL 01	1.8	0.48	0.26	0.30	0.30	--	6	100
JUL 01-AUG 05[1]	3.3	0.76	0.76	0.22	2.8	10	6	90
AUG 05-SEP 02	1.4	0.44	0.12	0.44	0.92	6.0	<5	<40
SEP 01-OCT 01[1]	--	0.68	0.86	2.4	2.1	11	11	50
OCT 01-NOV 03	--	0.21	<0.02	<0.02	0.20	2.0	9	<40
NOV 03-DEC 02	--	0.24	0.46	<0.05	0.94	3.6	5	40
DEC 02 1993- JAN 12 **1994**	--	0.20	2.0	0.03	4.8	4.0	13	<40
JAN 12-31	--	0.13	2.0	0.03	3.1	4.0	8	40
JAN 31-MAR 01	--	0.41	6.0	0.06	8.0	6.0	12	40
MAR 01-APR 01	--	0.46	--	0.04	1.5	8.0	9	40
APR 01-MAY 02	--	0.14	0.09	0.03	0.30	<2.0	<5	40
MAY 02-JUN 01	--	0.90	<0.20	--	0.80	18	19	40
JUN 01-30	--	0.73	1.1	1.1	1.9	8.1	7	60
JUN 30-JUL 29	--	0.29	0.10	0.64	0.50	3.4	7	60
JUL 29-AUG 31	--	0.66	0.25	0.80	0.50	14	6	40
AUG 31-OCT 03	--	0.69	0.30	0.24	0.80	8.1	11	<40

[1] Results affected by contamination; bird droppings, insects, and water noted in bucket.

Table A-3. Analyses of atmospheric deposition in northern part of Ellison Park wetland, Monroe County, N.Y., April 1992 through September 1994 (station 431021077315902)--continued

[Sampling location is shown in fig.2. µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; <, less than; --, no data.]

Part C. Bulk sample analyses[1]

DATE	SPECIFIC CONDUCTANCE (µS/cm)	pH WATER WHOLE LAB (STANDARD UNITS)	ACIDITY (mg/L AS $CACO_3$)	NITROGEN, AMMONIA DISSOLVED (mg/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (mg/L AS N)	NITROGEN, NO2+NO3 TOTAL (mg/L AS N)	PHOSPHORUS TOTAL (mg/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (mg/L AS P)
APR 10-MAY 05 **1992**	68	4.1	8.7	0.960	1.2	1.20	0.028	0.005
APR 10-MAY 05	69	4.1	8.0	1.00	1.1	1.30	0.030	0.005
MAY 05-JUN 04	91	4.0	12	1.60	3.4	1.30	0.280	0.076
MAY 05-JUN 04	90	3.9	12	1.50	3.6	1.30	0.390	0.150
JUN 04-JUL 06[2]	203	7.5	4.6	2.30	6.5	1.60	0.960	0.064
JUN 04-JUL 06[2]	322	7.3	14	11.0	44	3.40	5.60	5.10
JUL 06-27	42	4.3	6.4	0.370	0.50	0.470	0.030	0.008
JUL 06-27	41	4.2	6.3	0.370	0.45	0.460	0.035	0.011
JUL 28-SEP 01	66	4.0	9.2	0.160	0.56	0.710	0.045	0.002
JUL 28-SEP 01	73	3.9	9.5	0.480	0.76	0.760	0.050	0.007
SEP 01-OCT 01	29	6.2	2.6	1.40	2.6	0.530	0.280	0.220
SEP 01-OCT 01	57	7.0	4.4	3.00	5.9	0.560	0.870	0.815

DATE	CALCIUM, TOTAL RECOVERABLE (mg/L AS Ca)	MAGNESIUM, DISSOLVED (mg/L AS Mg)	SODIUM, DISSOLVED (mg/L AS Na)	POTASSIUM, DISSOLVED (mg/L AS K)	CHLORIDE, DISSOLVED (mg/L AS Cl)	SULFATE, DISSOLVED (mg/L AS SO_4)	LEAD, TOTAL RECOVERABLE (µg/L AS Pb)	ZINC, TOTAL RECOVERABLE (µg/L AS Zn)
APR 10-MAY 05 **1992**	0.80	0.18	0.07	0.06	0.20	8.0	7	20
APR 10-MAY 05	0.77	0.16	0.06	0.06	0.20	8.0	5	40
MAY 05-JUN 04	2.1	1.2	0.26	0.49	0.60	14	10	50
MAY 05-JUN 04	2.1	1.1	0.24	0.51	1.2	15	13	30
JUN 04-JUL 06[2]	18	1.6	1.6	0.31	2.4	34	59	260
JUN 04-JUL 06[2]	7.7	2.0	3.3	0.15	4.9	52	23	140
JUL 06-27	0.36	0.10	0.05	0.05	0.60	10	6	<40
JUL 06-27	0.31	0.09	0.04	0.03	0.20	10	<5	<40
JUL 28-SEP 01	0.60	0.64	0.09	0.09	0.60	10	9	<40
JUL 28-SEP 01	0.14	0.15	0.06	0.06	0.30	<10	6	<40
SEP 01-OCT 01	1.1	0.29	0.20	0.87	1.1	6.0	<5	<40
SEP 01-OCT 01	2.0	0.33	0.47	--	1.6	7.0	8	<40

[1] Analytical results for the "wet" and "dry" samples are presented as bulk-sample analyses because both buckets of the atmospheric-deposition collector were exposed to both "wet" and "dry" atmospheric conditions.

[2] Results affected by contamination; bird feathers and mud noted in bucket.

Table A-4. Analyses of sediment samples collected in the Ellison Park wetland, Monroe County, N.Y., October 1994

[Sampling locations are shown in fig. 7. µg/g, microgram per gram; BOT MAT or BM, bottom material; <63U WS, material passing through a 63-micron wet seive; DW REC, dry weight recoverable; < , less than.]

Part A. Major Elements, Trace Elements, and Carbon

STATION NUMBER	LOCAL SITE ID	ALUMINUM BOT MAT <63U WS FIELD PERCENT	ANTIMONY BOT MAT <63U WS FIELD (µg/g)	ARSENIC BOT MAT <63U WS FIELD (µg/g)	BARIUM BOT MAT <63U WS FIELD (µg/g)	BERYLLIUM BOT MAT <63U WS FIELD (µg/g)	BISMUTH BOT MAT <180UWS FIELD (µg/g)	CADMIUM BOT MAT <63U WS FIELD (µg/g)	CALCIUM BOT MAT <63U WS FIELD PERCENT
430951077312801	SQ1	5.0	0.4	4.9	460	1	<10	0.9	6.4
		5.0	.5	5.1	460	1	<10	.7	6.6
430952077314001	SQ2	4.9	.2	5.0	450	1	<10	.9	6.7
431021077315901	SQ3	4.8	.6	3.9	470	1	<10	3.8	4.7

LOCAL SITE ID	CERIUM BOT MAT <63U WS FIELD (µg/g)	CHROMIUM BOT MAT <63U WS FIELD (µg/g)	COBALT BOT MAT <63U WS FIELD (µg/g)	COPPER BOT MAT <63U WS FIELD (µg/g)	EUROPIUM BOT MAT <63U WS FIELD (µg/g)	GALLIUM BOT MAT <63U WS FIELD (µg/g)	GOLD BOT MAT <63U WS FIELD (µg/g)	HOLMIUM BOT MAT <63U WS FIELD (µg/g)	IRON BOT MAT <63U WS FIELD PERCENT	LANTHANUM BOT MAT <63U WS FIELD (µg/g)
SQ1	45	43	11	41	<2	11	<8	<4	2.7	25
	44	43	10	38	<2	12	<8	<4	2.7	25
SQ2	45	46	12	49	<2	12	<8	<4	2.8	25
SQ3	39	59	10	72	<2	11	<8	<4	2.4	23

LOCAL SITE ID	LEAD BOT MAT <63U WS FIELD (µg/g)	LITHIUM BOT MAT <63U WS FIELD (µg/g)	MAGNESIUM BOT MAT <63U WS FIELD PERCENT	MANGANESE BOT MAT <63U WS FIELD (µg/g)	MERCURY BOT MAT <63U WS FIELD (µg/g)	MOLYBDENUM BOT MAT <63U WS FIELD (µg/g)	NEODYMIUM BOT MAT <63U WS FIELD (µg/g)	NICKEL BOT MAT <63U WS FIELD (µg/g)	NIOBIUM BOT MAT <63U WS FIELD (µg/g)	PHOSPHORUS BOT MAT <63U WS FIELD PERCENT
SQ1	44	30	1.4	880	0.11	<2	25	19	12	0.13
	46	30	1.4	890	.10	<2	26	18	12	.13
SQ2	62	30	1.2	720	.14	<2	24	20	11	.15
SQ3	89	20	1.3	530	.33	<2	23	20	11	.12

LOCAL SITE ID	POTASSIUM BOT MAT <63U WS FIELD PERCENT	SCANDIUM BOT MAT <63U WS FIELD (µg/g)	SELENIUM BOT MAT <63U WS FIELD (µg/g)	SILVER BOT MAT <63U WS FIELD (µg/g)	SODIUM BOT MAT <63U WS FIELD PERCENT	STRONTIUM BOT MAT <63U WS FIELD (µg/g)	SULFUR BOT MAT <63U WS FIELD PERCENT	TANTALUM BOT MAT <63U WS FIELD (µg/g)	THORIUM BOT MAT <63U WS FIELD (µg/g)	TIN BOT MAT <63U WS FIELD (µg/g)
SQ1	1.7	8	0.5	0.5	1.2	420	0.34	<40	4.7	<10
	1.7	8	.6	.5	1.2	420	.33	<40	7.8	<10
SQ2	1.6	8	.8	.7	1.1	440	.60	<40	6.5	<10
SQ3	1.6	7	.8	2.3	1.3	340	.35	<40	5.7	<10

LOCAL SITE ID	TITANIUM, BOT MAT <63U WS DW REC (PERCENT)	URANIUM BOT MAT <63U WS FIELD (µg/g)	VANADIUM BOT MAT <63U WS FIELD (µg/g)	YTTRIUM BOT MAT <63U WS FIELD (µg/g)	YTTERBIUM BOT MAT <63U WS FIELD (µg/g)	ZINC BOT MAT <63U WS FIELD (µg/g)	CARBON, ORGANIC BOT MAT <63U WS DW REC (PERCENT)	CARBON, ORG + INORG, BOT MAT <63U WS DW REC (PERCENT)	CARBON, INORGANIC, BOT MAT <63U WS DW REC (PERCENT)
SQ1	0.26	1.6	50	20	2	210	3.4	5.4	1.9
	0.26	1.6	49	20	2	220	3.5	5.4	1.9
SQ2	0.25	1.6	50	19	2	230	5.0	6.9	1.9
SQ3	0.27	1.7	45	19	2	250	3.7	5.1	1.4

Table A-4. Analyses of sediment samples collected in the Ellison Park wetland, Monroe County, N.Y., October 1994--continued

[Sampling locations are shown in fig. 7. µg/g, microgram per gram; BOT MAT or BM, bottom material; <63U WS, material passing through a 63 micron wet seive; DW REC, dry weight recoverable; < , less than.]

Part B. Polynuclear aromatic hydrocarbons

STATION NUMBER	LOCAL SITE ID	PARA-CHLORO-META CRESOL BOT.MAT (µg/kg)	2-CHLORO-PHENOL BOT.MAT (µg/kg)	2,4-DI-CHLORO-PHENOL BOT.MAT (µg/kg)	2,4-DP, IN BOTTOM MAT. (µg/kg)	4,6-DINITRO -ORTHO-CRESOL BOT.MAT (µg/kg)	2,4-DI-NITRO-PHENOL BOT.MAT (µg/kg)	2-NITRO-PHENOL BOT.MAT (µg/kg)	4-NITRO-PHENOL BOT.MAT (µg/kg)	PENTA-CHLORO-PHENOL BOT.MAT (µg/kg)	PHENOL (C_6H_5 -OH) BOT.MAT (µg/kg)
430951077312801	SQ1	<600	<200	<200	<200	<600	<600	<200	<600	<600	<200
		<600	<200	<200	<200	<600	<600	<200	<600	<600	<200
430952077314001	SQ2	<600	<200	<200	<200	<600	<600	<200	<600	<600	<200
431021077315901	SQ3	<600	<200	<200	<200	<600	<600	<200	<600	<600	<200

LOCAL SITE ID	2,4,6-TRI-CHLORO-PHENOL BOT.MAT (µg/kg)	ACE-NAPHTH-ENE BOT.MAT (µg/kg)	ACE-NAPHTH-YLENE BOT.MAT (µg/kg)	ANTHRA-CENE BOT.MAT (µg/kg)	BENZO A ANTHRA-CENE BOT.MAT (µg/kg)	BENZO B FLUOR-AN-THENE BOT.MAT (µg/kg)	BENZO K FLUOR-AN-THENE BOT.MAT (µg/kg)	BENZO-A-PYRENE BOT.MAT (µg/kg)	BENZO (G,H,I) PERY-LENE BOT.MAT (µg/kg)	N-BUTYL BENZYL PHTHAL-ATE BOT.MAT (µg/kg)	BIS (2-CHLORO-ETHOXY) METHANE BOT.MAT (µg/kg)
SQ1	<600	<200	<200	<200	500	1,100	1,100	640	<400	<200	<200
	<600	<200	<200	<200	500	780	830	590	<400	<200	<200
SQ2	<600	<200	<200	<200	<400	750	740	500	<400	<200	<200
SQ3	<600	<200	<200	<200	1,200	1,300	1,400	1,300	780	<200	<200

LOCAL SITE ID	BIS (2-CHLORO-ETHYL) ETHER BOT.MAT (µg/kg)	BIS (2-CHLORO-ISO-PROPYL) ETHER BOT.MAT (µg/kg)	4-BROMO-PHENYL PHENYL ETHER BOT.MAT (µg/kg)	2-CHLORO-NAPH-THALENE BOT.MAT (µg/kg)	4-CHLORO-PHENYL PHENYL ETHER BOT.MAT (µg/kg)	CHRY-SENE BOT.MAT (µg/kg)	1,2,5,6 -DIBENZ -ANTHRA -CENE BOT.MAT (µg/kg)	DI-N-BUTYL PHTHAL-ATE BOT.MAT (µg/kg)	1,2-DI-CHLORO-BENZENE BOT.MAT (µg/kg)	1,3-DI-CHLORO-BENZENE BOT.MAT (µg/kg)	1,4-DI-CHLORO-BENZENE BOT.MAT (µg/kg)
SQ1	<200	<200	<200	<200	<200	900	<400	<200	<200	<200	<200
	<200	<200	<200	<200	<200	930	<400	<200	<200	<200	<200
SQ2	<200	<200	<200	<200	<200	670	<400	<200	<200	<200	<200
SQ3	<200	<200	<200	<200	<200	1,700	440	<200	<200	<200	<200

LOCAL SITE ID	DIETHYL PHTHAL-ATE BOT.MAT (µg/kg)	DI-METHYL PHTHAL-ATE BOT.MAT (µg/kg)	2,4-DI-NITRO-TOLUENE BOT.MAT (µg/kg)	2,6-DI-NITRO-TOLUENE BOT.MAT (µg/kg)	DI-N-OCTYL PHTHAL-ATE BOT.MAT (µg/kg)	BIS(2-ETHYL HEXYL) PHTHAL-ATE BOT.MAT (µg/kg)	FLUOR-ENE BOT.MAT (µg/kg)	FLUOR-ANTHENE BOT.MAT (µg/kg)	HEXA-CHLORO-BENZENE TOTAL IN BOT MAT (µg/kg)	HEXA-CHLORO-BUT-ADIENCE BOT.MAT (µg/kg)	HEXA-CHLORO-CYCLO-PENT-ADIENE BOT.MAT (µg/kg)
SQ1	<200	<200	<200	<200	<400	750	<200	1,700	<200	<200	<200
	<200	<200	<200	<200	<400	330	<200	2,000	<200	<200	<200
SQ2	<200	<200	<200	<200	<400	510	<200	1,100	<200	<200	<200
SQ3	<200	<200	<200	<200	<400	750	<200	3,300	<200	<200	<200

LOCAL SITE ID	HEXA-CHLORO-ETHANE BOT.MAT (µg/kg)	INDENO (1,2,3-CD) PYRENE BOT.MAT (µg/kg)	ISO-PHORONE BOT.MAT (µg/kg)	NAPHTH-ALENE BOT.MAT (µg/kg)	NITRO-BENZENE BOT.MAT (µg/kg)	N-NITRO -SODI-METHY-LAMINE BOT.MAT (µg/kg)	N-NITRO -SODI-PHENY-LAMINE BOT.MAT (µg/kg)	N-NITRO-SODI-N-PROPYL-AMINE BOT.MAT (µg/kg)	PHENAN-THRENE BOT.MAT (µg/kg)	PYRENE BOT.MAT (µg/kg)	1,2,4-TRI-CHLORO-BENZENE BOT.MAT (µg/kg)
SQ1	<200	<400	<200	<200	<200	<200	<200	<200	580	1,300	<200
	<200	<400	<200	<200	<200	<200	<200	<200	880	1,500	<200
SQ2	<200	<400	<200	<200	<200	<200	<200	<200	320	850	<200
SQ3	<200	720	<200	<200	<200	<200	<200	<200	1,700	2,900	<200

Table A-4. Analyses of sediment samples collected in the Ellison Park wetland, Monroe County, N.Y., October 1994--continued

[Sampling locations are shown in fig. 7. µg/g, microgram per gram; BOT MAT or BM, bottom material; <63U WS, material passing through a 63 micron wet seive; DW REC, dry weight recoverable; < , less than.]

Part C. Organochlorine compounds

STATION NUMBER	LOCAL SITE ID	ALDRIN, TOTAL IN BOTTOM MATERIAL (µg/kg)	CHLORDANE, TOTAL IN BOTTOM MATERIAL (µg/kg)	P,P'-DDD, RECOVER IN BOTTOM MATERIAL (µg/kg)	P,P'-DDE, RECOVER IN BOTTOM MATERIAL (µg/kg)	P,P'-DDT, RECOVER IN BOTTOM MATERIAL (µg/kg)	DIELDRIN, TOTAL IN BOTTOM MATERIAL (µg/kg)	ENDOSULFAN TOTAL IN BOTTOM MATERIAL (µg/kg)	ENDRIN, TOTAL IN BOTTOM MATERIAL (µg/kg)
430951077312801	SQ1	<0.1	22	3.8	7.1	1.0	2.3	<0.1	<0.8
		<0.1	19	3.1	6.2	.9	1.8	<0.1	<0.8
430952077314001	SQ2	<0.2	18	4.5	8.4	.6	1.2	<0.2	<1.6
431021077315901	SQ3	<0.1	26	6.5	7.4	.8	3.5	<0.1	<0.8

LOCAL SITE ID	HEPTACHLOR EPOXIDE TOTAL IN BOTTOM MATERIAL (µg/kg)	HEPTACHLOR, TOTAL IN BOTTOM MATERIAL (µg/kg)	LINDANE TOTAL IN BOTTOM MATERIAL (µg/kg)	METHOXYCHLOR, TOTAL IN BOTTOM MATERIAL (µg/kg)	MIREX, TOTAL IN BOTTOM MATERIAL (µg/kg)	PERTHANE IN BOTTOM MATERIAL (µg/kg)	TOXAPHENE, TOTAL IN BOTTOM MATERIAL (µg/kg)	PCB, TOTAL IN BOTTOM MATERIAL (µg/kg)	PCN, TOTAL IN BOTTOM MATERIAL (µg/kg)
SQ1	<0.8	<0.1	<0.1	<32	<0.1	<1	<10	28	<1.0
	<0.8	<0.1	<0.1	<26	<0.1	<1	<10	25	<1.0
SQ2	<1.6	<0.2	<0.2	<24	<0.2	<2	<20	43	<2.0
SQ3	<0.8	<0.1	<0.1	<38	<0.1	<1	<10	52	<1.0