Trackdown of Chemical Contaminants to Lake Ontario from New York State Tributaries

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April 11, 1996

Bureau of Watershed Assessment and Research
Division of Water
New York State Department of Environmental Conservation

ACKNOWLEDGEMENTS

This project was not performed single-handedly. Bob Beltran at USEPA -Great Lakes National Program Office suggested visiting the R/V *Lake Guardian* to see the Goulden Large Sample Eextractor (GLSE) in action. GLNPO scientists David Rockwell, David Anderson, and David DeVault assisted us in setting up the GLSE and in making arrangements with the *Guardian*. Jonathan Higgins and his staff from ASCI were also extremely helpful. Captain Ron Ingraham and his crew actually brought the *Guardian* to Oswego and afforded us every courtesy.

Bert Mead, Bruce Butler, Philip Waite, and Bill Moore assisted the project in NYSDEC Region 6. Most of our Region 6 sampling was performed on property owned by Hydro Development Corporation and we were kindly helped by John Bedard and Bob King. Access to and guidance through Fort Drum was given by Jim Hessil.

In Region 7 we were guided by Lee Flocke. Chris Rossi and Scott Cook helped us sampling in Skaneateles Creek and in Onondaga Creek. Bill McCarthy helped at Alcan. David J. Lagoe of Alcan gave us access to the plant's wastewater. David Camp came out from Albany to help at Oswego Castings. Skip Domiek of Niagara Mohawk gave us access to the now extinct High Dam in Oswego. Hal Radiloff showed us around Ley Creek. Brad Bears of the NY Thruway Authority gave us practical assistance and electricity on the Oswego River at Lock 6.

Our work in Monroe County was made possible by Dick Burton and Charlie Knauf of the Monroe County Health Department; and by Michael Kirchgessner of the Monroe County Division of Pure Waters. Robin Woods and her 5th grade class at Harley School helped us sampling Allens Creek.

John McMahon and Rich Swiniuch, were central to our efforts in Region 9. Mike Diehl, Cynthia Tudor-Schultz, and Dennis Brockman of the City of Lockport all were very helpful in sampling in and around Lockport.

Fred Luckey assembled a list of inactive hazardous waste sites in the lake Ontario basin which are associated with Lake Ontario target chemicals. Sal Priore of Hazardous Waste Remediation helped us in Skaneateles Creek. Larry Abele lent us his boat and motor.

Occasional field help was given by Chandler Rowell, Terry Olmstead, Karen Woodfield, Frank Estabrooks, Larry Bailey, Jack Ryan, Sue Wither, Cynthia Leece, and Bill Stoeclin. John Hassett of the SUNY College of Environmental Science and Forestry gave some field assistance and contributed in very significant ways to the project; he invented PISCES. An enormous amount of field assistance was given by Bernadette Anderson and John Donlon.

Chemical analysis was produced in several laboratories. I would like to thank Martha Roy, Gary Stidson, and David Robinson at Inchcape-Aquatec; Dorothy Spurling and Colin Davies at Brooks-Rand; and Ron Pause and Art Richards at the New York State Department of Health.

The author appreciates the comments of Barbara Spinweber, Robert Vaughn, and Randy Braun of USEPA Region II and of Robert Beltran, Great Lakes National Program Office. EPA project officers were Charles Zafonte and Robert Beltran.

This work has been partly funded jointly by the US Environmental Protection Agency, Region II and the USEPA, Great Lakes National Program Office under the assistance of agreement numbers X002715-01-1 and X995237-01-3 to the New York State Department of Environmental Conservation. The contents of this document do not necessairly reflect the views or policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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EXECUTIVE SUMMARY

This project was undertaken to discover sources of toxic substances to Lake Ontario from New York tributaries exclusive of the Niagara River. It is a part of a process of source identification, remediation and reassessment. It is not intended as an overall appraisal of environmental conditions. The project used analytical methods with greater sensitivity than those routinely available to Federal and State regulatory programs and it sampled at locations not routinely monitored as part of those programs. Discovery of chemical contaminants in these sites and by these methods should not be construed as an indication of regulatory failure or environmental harm.

Unconventional sampling methods (passive samplers, pressure filtration, Goulden Large Sample Extractor, and digestion/extraction) were used to trackdown sources of PCBs and pesticides. Mercury was looked for using "clean hands sampling" and gold amalgam laboratory methods. Pesticides were measured from most sites and PAHs and dioxins/furans were measured from a few sites. The most significant tributaries, Black River, Oswego River, Genesee River, and Eighteenmile Creek were monitored extensively for approximately one year beginning in October of 1993 and terminating in November 1994.

Of the four major tributaries, the largest PCB loading was found to be from the Black River but the highest PCB concentrations were seen in Eighteenmile Creek. While the methods used do not provide precise quantitation, it appears that the PCB levels often exceed the ambient water quality criterion of 1 ng/L in all tributaries.

The choice of sites for trackdown sampling was based on data from remedial investigations. This project found high PCB concentrations (arbitrarily defined as greater than 25 ng/L) in the Lake Ontario drainage include Kelsey/Oily Creek in Watertown, a discharge from Alcan Rolled Aluminum Products outside Oswego (but which is within permit limits), Wine Creek outside Oswego, Ley Creek in Syracuse, Skaneateles Creek in Skaneateles Falls, and sites in the Lockport and the upper Eighteenmile Creek area. Many of these sites individually have a negligible impact on Lake Ontario but they may have local effects and the cumulative effect of the myriad small sources is the larger problem.

Mirex was looked for in the Oswego and Genesee Rivers and in Eighteenmile Creek. It was found at very low concentrations in all three rivers. A probable source has been known in the Oswego River and a previously unknown source was identified in upper Eighteenmile Creek. The data for mirex are insufficiently quantitative to compare with criteria.

Mercury was rarely seen at concentrations above the current water quality criterion (200 ng/L) but it usually exceeded the proposed criterion of 1.3 ng/L. The highest mercury concentrations occurred in Eighteenmile Creek, sewers of Lockport and Rochester, and in Skaneateles Creek. Two of the Rochester sources are a former mercury thermometer factory and a dental college where dental amalgams were compounded. Mercury concentrations are increasing in Eighteenmile Creek sediments but are decreasing in Oswego River sediments.

PAHs were measured from sediments near the mouths of the Black River, Irondequoit Creek, the Genesee River, Oak Orchard Creek, Beals Creek, and Eighteenmile Creek. The highest PAH levels occurred in the lower Genesee River and some exceeded dredge disposal guidelines. Suspended solids were sampled for PAHs in Irondequoit Creek and in Eighteenmile Creek. Concentrations were low relative to ambient water quality criteria.

Dioxins and furans were also measured from the sediments but were more intensively sought in upper Eighteenmile Creek. An island in Eighteenmile Mile Creek called the old

Flintkote dump had dioxins/furans in excess of wildlife and human health protection guidelines. The site also had soils with elevated concentrations of PCBs, mercury, and mirex.

Pesticides were frequently sought but the methods used are not reliably quantitative. Pesticides were seen in Wine, Ox, Irondequoit, Johnson Creek, and Eighteenmile Creeks. They were also found in the Genesee River, and Rochester sewer samples.

Of the methods used, passive samplers were found to be efficient trackdown tools but they provide only semi-quantitative data. Their use should be complemented with more quantitative procedures. Pressure filtration may not have been successful and exploration of other means for capturing suspended solids is urged. The digestion/extraction procedure was insufficiently investigated but it may prove useful. The Goulden Large Sample Extractor was also investigated and found too difficult to clean and to operate in the environment of a truck.

INTRODUCTION

Contaminant source investigations were carried out in each of the primary Lake Ontario watersheds in support of the U.S./Canadian Toxics Management Plan and Lakewide Management Plan activities. These were done in close cooperation with NYSDEC regional offices working on problems of local interest.

The principal targets of sampling were polychlorinated biphenyls (PCBs), chlorinated pesticides including mirex, and mercury. A minority of samples were taken for dioxins and polynuclear aromatic hydrocarbons. Most of the samples were from the water column but a few were sediments.

Both load and trackdown sampling present challenges. Many of the substances of interest are extremely dilute and require field concentration or unconventional processing. Several methods were explored during the course of the project. Some of the laboratory methods were also unusual. High quality mercury analysis is available from few vendors and the analytical methods for congener PCBs are still undergoing evolution and require significant review by users. These unconventional procedures were deemed necessary in order to obtain consistent detections of trace contaminants. Most of the samples for PCBs and pesticides were collected by passive samplers. Passive samplers collect dissolved hydrophobic chemicals over the course of several weeks. The effective size of the water sample taken by passive samplers achieves the necessary detection levels and the duration of exposure usually permits observation of both wet and dry periods.

The purposes of this work were two-fold. The initial intention was to produce loading data that would help validate models of toxic chemicals in Lake Ontario. Since our effort would only be looking at New York State tributary surface waters, data generated would have to be compatible with those being produced by other players in Canada and the United States. It quickly became apparent that the level of overall coordination was insufficient to ensure data comparability between two national agencies and two state or provincial agencies. Therefore quantitative load data were de-emphasized and more effort was put into identification of contaminant sources. While the production of load data has a great deal of appeal in terms of understanding the movement of toxic substances in the ecosystem, source trackdown studies have a greater likelihood of leading to immediate practical remediation actions.

Despite their de-emphasis, monitoring efforts were continued at four primary sites. Eighteenmile Creek and three of the largest New York State tributaries to Lake Ontario, the Oswego, Black, and Genesee Rivers, were monitored with about the same intensity. Four other New York streams have discharges greater than Eighteenmile Creek but its history of industry and chemical contamination places it before them in order of potential for causing mischief. Eighteenmile Creek, the Rochester Embayment (Genesee River), and Oswego Harbor are also International Joint Commission (IJC) Areas of Concern. Other tributaries were sampled occasionally.

METHODS

Three different methods were used in this project to sample dissolved hydrophobic organics, that is, PCBs, chlorinated pesticides, and mirex. These were the Goulden Large Sample Extractor (GLSE), passive in-situ chemical extraction samplers (PISCES), and the "digestigator".

GLSE

The GLSE technique was developed at Environment Canada under the direction of Peter Goulden and is used by the Four Parties for long term-chemical monitoring on the Niagara and St. Lawrence Rivers. The US EPA uses GLSE on board the *R/V Lake Guardian* for open lake chemical extraction. The GLSE system has three subsystems; a method for collecting water, a method for water clarification, and the GLSE itself. The water collection system includes a submersible pump and polyethylene tubing. Clarification is accomplished by centrifugation in the Niagara and the St. Lawrence Rivers land-based monitoring stations . On board the *R/V Lake Guardian* large area pressure filtration was used. The same pressure filtration apparatus that EPA selected, Pentaplate, was used in this project. Pentaplate is a stack of from one to five stainless steel filter holders that contain 293 mm glass fiber filters (GFF grade). Filtration is in parallel so that increasing the number of filter holders simply increases the filtration area. GLSE is a continuous liquid/liquid extractor where clarified water is thoroughly mixed with methylene chloride. The denser and immiscible[1] methylene chloride settles out and the extracted water is collected for disposal. Hydrophobic organic chemicals are concentrated in the methylene chloride which may then be further concentrated under nitrogen. **Figure 1** illustrates the set-up.

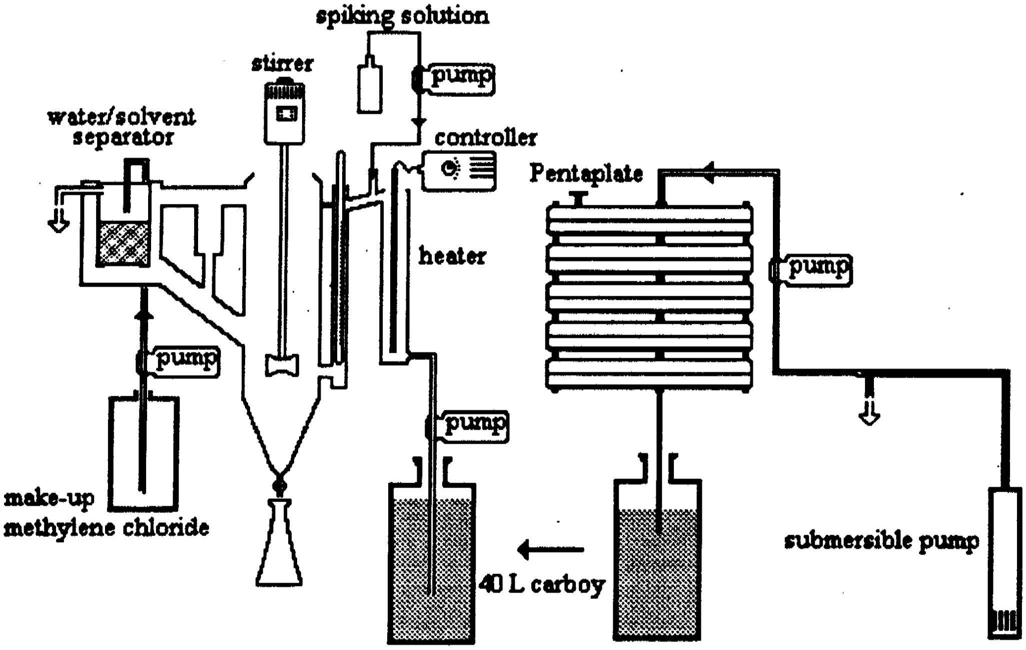

Figure 1. Schematic of GLSE.

Due to its employment elsewhere in the basin, GLSE was initially chosen. The Principal Investigator accompanied the *R/V Lake Guardian* on a cruise around Lake Ontario in March of 1993 to observe the GLSE in operation. At that time it was decided to perform an experiment to test the comparability of recovery by identical GLSEs run on the ship and in a NYSDEC mobile sampling laboratory. The reasoning behind adopting the GLSE technology, which is slow and cumbersome, was that comparability of extraction methods between the several parties performing Lake Ontario area load monitoring is highly desirable. However, it was not known if adoption of the GLSE method would produce comparable data in our hands.

DEC set up a mobile laboratory in a ten foot cargo van equipped with work benches, a portable 5,000 watt generator (which was only used at the end of a 100 ft power cable to reduce contamination by exhaust fumes) and fume hood large enough to hold the GLSE.

In September 1993 a duplicate of the ship's submersible pump, water clarification system, and GLSE was installed in the DEC mobile lab by David DeVault of the Great Lakes National Program Office while the *R/V Lake Guardian* moored at Oswego, NY. Twelve pairs of samples were taken by a submersible pump placed in the Oswego River from the Minetto bridge in Minetto, NY (Map F#7).[2] EPA extracted 12 samples on the ship and DEC extracted 12 samples in the mobile lab. After extractions were completed, EPA gave six to DEC for chemical analysis and DEC gave EPA six for their lab to process. Results of the experiment allow observation of the differences between operation of the extraction system in the two environments.

All samples were taken through a single submersible pump. Subsamples from two ports at the top of the intake were directed toward two Pentaplates by peristaltic pumps. The two subsample tubes entered identical Pentaplate pressure filtration units each of which was loaded with three pre-fired 293 mm glass fiber filters which were supplied by the *R/V Lake Guardian*. After filtration the clarified water entered five 20 L glass carboys (90 L). Five carboys from the *Guardian's* Pentaplate were driven to the ship, some seven miles distant, for GLSE processing and the five carboys from the DEC Pentaplate were extracted in the mobile lab. The results are summarized in **Figure 2**. The figure shows the larger scatter in results from NYSDEC and the great difference between extractions done in the two settings.

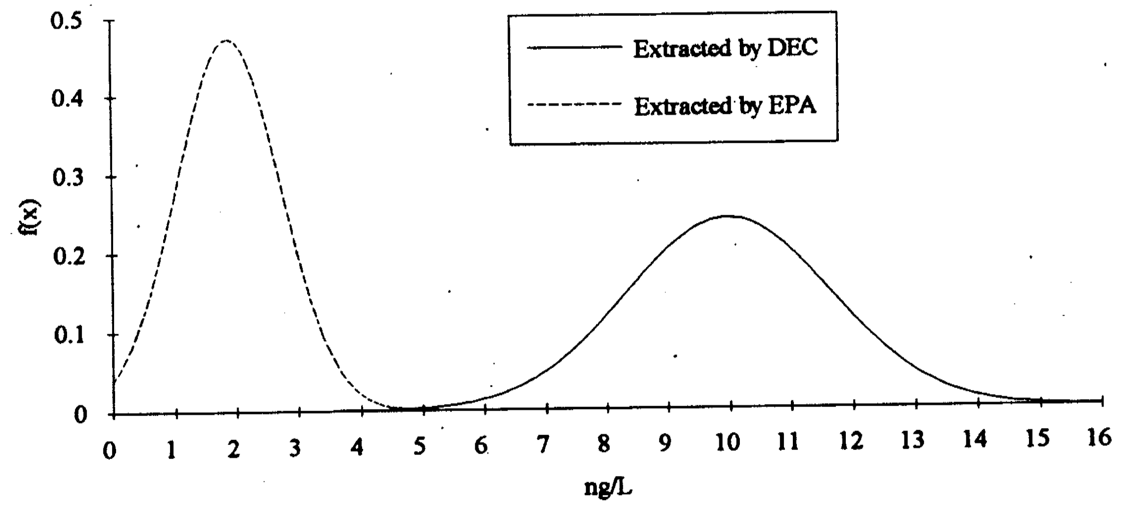

Figure 2. Comparison of GLSE PCB extractions done by EPA and NYSDEC. All chemical analyses were performed by the NYS Department of Health. Means and variances from the two field teams are expressed as normal probability distribution curves.

Subsequent experiments were done with supposedly blank water from the Orenda spring in Saratoga Spa, NY. Orenda Spring is a high volume briney spring whose waters have been deep underground for a long time. It is suggested that the brine may be as old as the Paleozoic (230 million years BP) but diluted with younger waters.[3,4] The dilutant waters are geologically young but their source of entrance was far to the east and is probably sufficiently distant in time to exclude man-made chlorinated chemicals. It rises under pressure and was sampled directly from the spring. This water was run through the Pentaplate and GLSE. Significant levels of PCB were found. In all likelihood, the submersible pump and polyethylene lines were contaminated. Orenda Spring water was later used for checking the Pentaplate without also testing the GLSE.

In our judgment, the GLSE system was too complicated to operate and to clean, too delicate, and too slow to be successfully operated in a truck. There were persistent problems in disposing large quantities of methylene chloride saturated water and methylene chloride fumes were giving field staff severe headaches.

PISCES

Passive In-Situ Chemical Extraction Samplers (PISCES) provide a temporally integrated sample for a period of about two weeks. The apparatus is cheap (costing about $20) so it can be deployed in risky situations where loss of more valuable equipment would be intolerable. No electrical power is required in the field. In conjunction with a strong laboratory PISCES will always collect enough PCB to produce a "fingerprint", and dozens can be deployed in a day. The disadvantages of PISCES are that a return trip is necessary for retrieval, they only sample the dissolved phase and miss PCBs attached to solids or to colloids, and they are only semiquantitative. Uptake of PISCES is a function of water temperature and turbulence at the water/membrane interface. Water temperature was usually measured only at the outset and cessation of sampling. There is no practical way to measure turbulence in the field or in the lab.

PISCES consists of a solvent reservoir and a membrane. PISCES is suspended in water with the membrane submerged and down. The inner surface of the membrane is covered by 200 mL of hexane. **Figure 3** is a schematic illustration of PISCES. Dissolved hydrophobic molecules like PCBs and DDTs dissolve through the membrane and accumulate in the non-polar hexane.

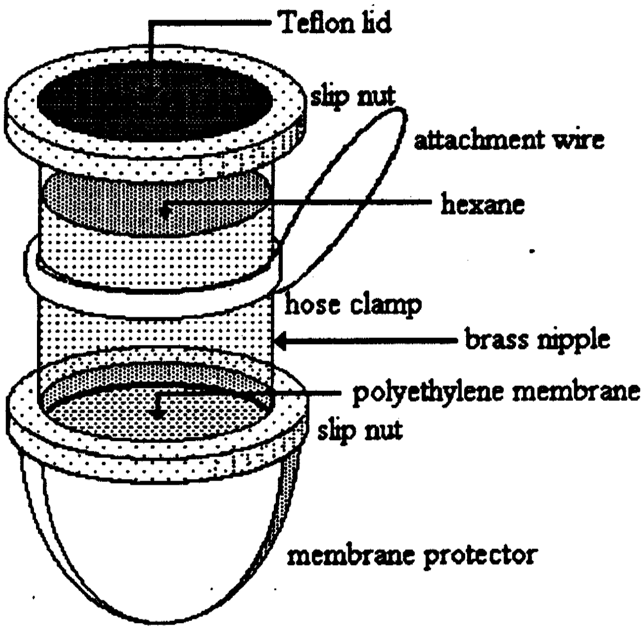

Figure 3. PISCES.

PCB concentrations from PISCES are estimated as the total ng recovered divided by the sampling rate times the number of days of exposure. The sampling rate is:

sampling rate, S (L/cm^2/day) = exp((-6591/absolute temp.) + 19.269)

The effective sample volume (V) is:

V = S x membrane area in cm^2 x days of exposure

Prior to going into the field PISCES bodies, Teflon disks, slip nuts, and "O" rings were cleaned in hot soapy water, rinsed, and washed with distilled and deionized water. After cleaning, the plastic parts were stored under hexane. The metal parts were baked for 4 hours in a furnace at 450^{O}C. Soxhlet extracted polyethylene was fitted onto the bodies and pressure tested. Passed units were then rinsed with a small quantity of hexane to test for leakage. The units were emptied of hexane and allowed to air-dry. They were then wrapped in clean aluminum foil for transportation to the field. Immediately prior to deployment each unit was rinsed twice with hexane. Lastly, they were filled with hexane and deployed.

In most cases the PISCES was attached to a float and the float was moored to a cinder block anchor. Usually, the anchor, float, and PISCES were set out and retrieved with a grapple. In sewers, the PISCES was suspended from a polypropylene rope and tied off to a ladder or to the manhole lid.

Deployment of PISCES required carrying high purity hexane into the field. Under less than ideal conditions the gallon nanograde hexane jugs were opened and exposed to atmospheric contaminants. To test for cleanliness of the PISCES interior and contamination of the solvent, the last 200 mL of hexane from the field jugs were poured into a rinsed PISCES and saved for analysis. Records were maintained of which jug was used to fill which PISCES. The retained 200 mL were analyzed in the same analytical batch as were the extracts from the jug.

In this project 19 field blanks were submitted. The median amount of PCB from the field blanks was 2.1 ng. Eighty-two PISCES samples yielded a calculated concentration of less than 10 ng/L. The median amount of PCB from these low concentration samples was 27 ng showing that the level of field blank contamination was low in relation to the amounts collected by sampling. One of the field blanks, FB-26 collected on 10/22/93, contained 63 ng of PCB. Contamination may have affected three samples: Black Creek at Volney (Map D #1); Wine Creek at Mitchell (Map E #4) begun 10/21/93; and Black River at Dexter (Map A #1) begun 10/22/93. The single sample was taken at Map D #1 had a relatively high concentration (10 ng/L). Potentially affected samples from Wine Creek at Mitchell and Black River at Dexter both showed the greatest PCB concentrations from those sites respectively. The Wine Creek sample from FB-26 hexane had 42 ng/L and the next greatest Wine Creek sample showed 36 ng/L. In the case of the Black River at Dexter, the potentially contaminated sample had 28 ng/L and the next greatest concentration was 26 ng/L.

Suspended Solids

Suspended solids provide sorption sites for hydrophobic molecules. This medium is not efficiently extracted by GLSE and not at all extracted by PISCES. Two related methods were employed for concentrating suspended solids from whole water, a small gas powered unit and a Pentaplate powered by an electric pump. The small set-up is a pressure filtration holder and reservoir (**Figure 4**).[5] This device held a 142 mm glass fiber

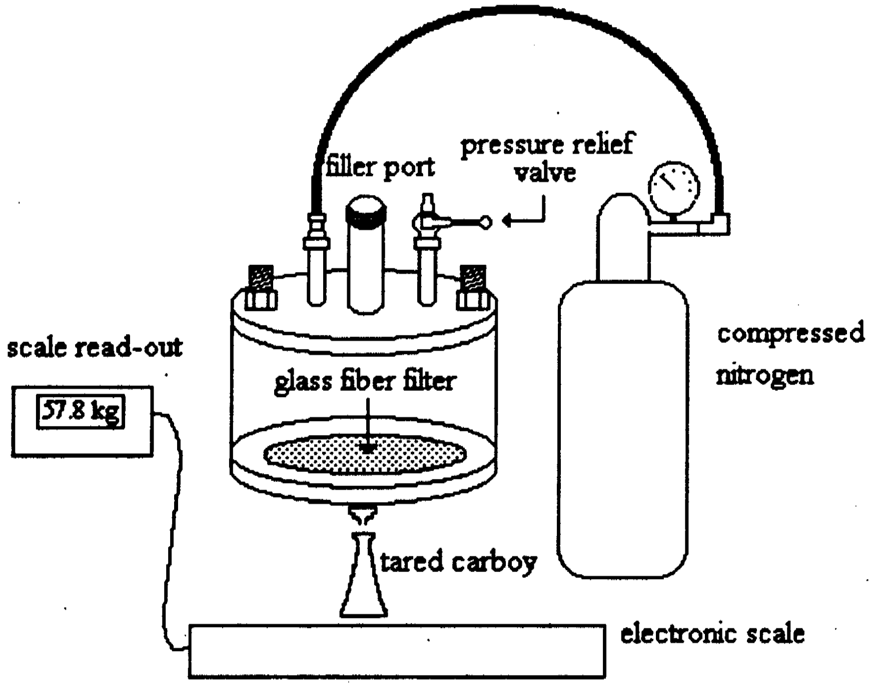

Figure 4. Schematic diagram of small pressure filtration device.

filter. A cylinder of high purity nitrogen gas supplied the pressure. The reservoir held about 1.5 L and must be opened and closed each time more water is added. Filtered water was collected into a tared carboy and weighed to determine its mass. The amount of water filtered was whatever was required to produce a 7 psi back-pressure. Therefore, the amount of water filtered varied greatly from site to site and from time to time but the absolute amount of solids collected was roughly equal. Water was also collected for determination of total suspended solids and total organic carbon. Loaded filters were folded in half and sealed in Ziploc bags. They were kept cool in the field with ice and frozen while waiting for analysis. Prior to going into the field the Whatman GFF filters (nominal pore diameter of 0.7µ) were partially enclosed in aluminum foil and baked in a furnace at 450°C for four hours.

Typically, 142 mm filters filtered less than 10 L from turbid streams and as much as 60 L from clear ones. The relationship between total suspended solids and the amount of water filtered is moderately strong ($r = 0.83$). By setting filtration to a set back-pressure relatively consistent loading, about 0.2 g on the 142 mm filter and 0.8 g on a 293 mm filter, were obtained.

Most of the suspended solids samples were taken with the Pentaplate filtration unit which usually held two 293 mm filters.[6] Operation of the Pentaplate requires a power source and a heavy duty peristaltic pump. The gas filtration equipment holds one filter and usually was used to produce one filter sample with it. The Pentaplate usually held filters. One filter was used for congener PCB determination and the second was used for pesticides/Aroclors.

Flow-Through Digestion/Extraction Sampler

The preceding discussion of separate extraction methods for the dissolved and the particle bound phases stems from the necessity to have medium specific methods. Optimal methods for extraction of aqueous phase organics are different from those designed to extract organic chemicals from the surfaces of particles. Of course, the requirement for separate extractions and then analyses significantly increases the costs of measuring contaminant loads.

Furthermore, there is a third phase, that of dissolved naturally-produced macromolecules, such as humic and fulvic acids, which provide binding sites for the more highly hydrophobic molecules. This third phase is incompletely recovered by either aqueous liquid/liquid extraction or by solid phase extraction. An efficient method for extraction of macromolecular bound organics was developed for batch processing.[7] A universal extractor was designed to be operated in a flow-through mode such that large volumes could be processed. To this end, the "digestigator" (digestor and extractor) was constructed by Dr. John Hassett and his students at SUNY-College of Environmental Science and Forestry in Syracuse, NY (**Figure 5**).

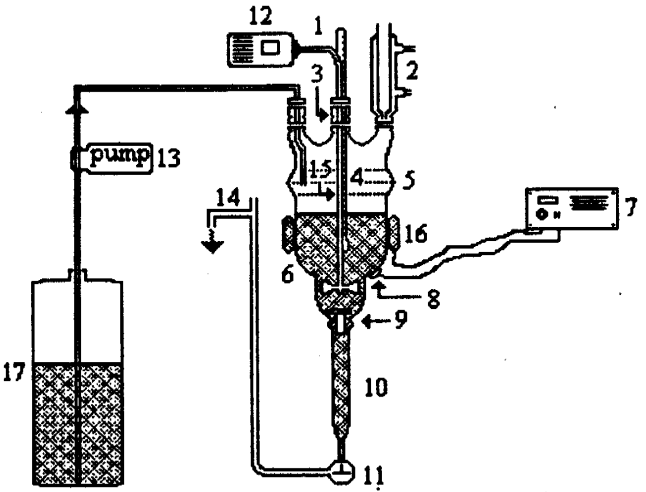

Figure 5. Prototype "digestigator". 1 - flexible drive shaft; 2 - condenser; 3 - stirring shaft adapter and bearing; 4 - thermometer; 5 - reaction flask head with Teflon gasket; 6 - two liter reaction flask; 7 - temperature controller; 8 - thermocouple; 9 - turbulence damper; 10 - outlet tube; 11 - three way stopcock; 12 - stirrer motor; 13 - sampling pump; 14 - discharge tube; 15 - stainless steel stirring shaft with Teflon paddle; 16 - heating tape; 20 L carboy.

The principle behind the digestigator is simultaneous hot chromic acid digestion and extraction into isooctane. Isooctane was chosen as the solvent because of its relatively high boiling temperature (79°). To treat large volumes of water a flow through rate of 1 L/hr was selected. To prevent violent boiling while working near the azetropic boiling point, accurate and automatic temperature control is necessary. Vigorous stirring is also needed to ensure good contact between the water and solvent in a 2 L reaction vessel. All materials used were stock except the bottom outlet tube and the turbulence damper. The outlet tube is a 11 x 1.8 (o.d.) cm glass tube with a 28/15 female ball joint at one end and a 3 cm x 1/4 in (o.d). glass tube at the other end. The turbulence damper is a 3 cm glass disk with a 1 x 6 cm glass rod attached. The disk has four slots cut into it to allow passage of water and solvent.

Water was collected directly into 20 L glass carboys which had been washed with tap water and laboratory detergent; rinsed with distilled water, rinsed with three aliquots of acetone; and finally rinsed with two aliquots of hexane. After cleaning the carboys were sealed with rubber bungs covered with solvent rinsed aluminum foil. The filled carboys were returned to the laboratory and 50 mL of isooctane were poured over the water to trap contaminants and to extract the sides of the carboy as water was withdrawn.

The digestigator was initially loaded with 200 mL of chromic acid, 100 mL of isooctane, and 1 L of sample water. The mixture was heated to 60°C and stirred for 20 min. Then the sample pump was started and water was brought in at a rate of 4 L/hr. At the conclusion of extraction, the contents of the reaction flask were drained into a round bottom flask along with isooctane rinses of the reaction flask. Another 20 mL of chromic acid were added to the round bottom flask and vigorously shaken.

The isooctane was then reduced to 1 mL by vacuum and analyzed by the congener methods used for PCBs.

Sediments and Soils

Sediments and soils were collected at a few sites using either a Petite-Ponar dredge or a stainless steel spoon. The samples were deposited into a stainless steel pail, mixed with a stainless steel spoon, and funneled into glass sampling jars. The sampling equipment (Ponar, spoon, pail, and funnel) was rinsed with distilled water and acetone prior to deployment.

Collected sample was kept cold in the field and refrigerated in the laboratory. Samples were not kept more than 20 days before being sent out for analysis.

Laboratory Analysis

PCBs

PCBs are a family of chlorinated biphenyls. Two hundred and nine different isomers or congeners are theoretically possible. The overwhelmingly greatest sources of PCBs were a line of industrial chemicals manufactured by the Monsanto Corporation under the trademark "Aroclor." Monsanto produced Aroclors with different properties for different applications. The Aroclors differed in the percentage chlorine by weight. For example Aroclor 1242 was 42% chlorine by weight and Aroclor 1260 was 60% chlorine. The different Aroclors have different patterns of relative congener abundance. In distinguishing different sources it is helpful to look at relative homolog abundance.

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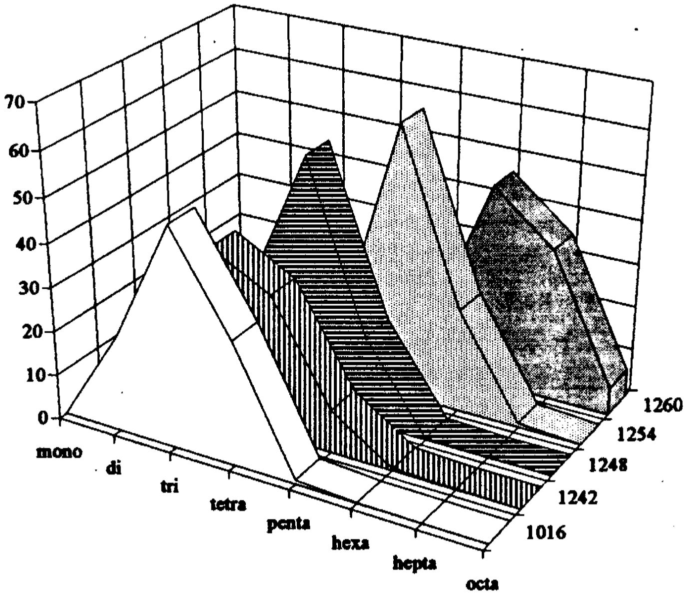


Figure 6. Homolog composition of Aroclors 1016, 1242, 1248, 1254, and 1260. Taken from Webb and McCall.[8] The vertical axis is percent abundance.

Each PCB molecule has between one and ten chlorines. EPA has determined that a monochlorobiphenyl (one chlorine) can be considered to be a polychlorinated biphenyl for regulatory purposes but were ignored here because of analytical problems. Congeners having the same number of chlorines belong to the same homolog group. A sample homolog pattern may be compared with homolog patterns from pure Aroclors to determine which Aroclor was originally present. In actuality, patterns from samples may greatly differ from known Aroclors. The source may have contained more than one Aroclor. Some congeners are more volatile or more soluble, or more likely to be bacterially degraded than others.

Environmentally distributed Aroclors will become increasingly different over time from their original composition. Chemicals that are not PCBs may be wrongly identified as PCB congeners. This can seriously distort the pattern of relative homolog abundance.

Analyses were performed by the New York State Department of Health Wadsworth Laboratory for TSS, TOC, dioxins/furans, and PCBs in GLSE extract and from sediments. All PISCES, pressure filtration, and isooctane samples were performed by a private contract laboratory, Inchcape/Aquatec out of Colchester, VT. Inchcape/Aquatec developed a proprietary GC/EC duel column (RTX-5 and Apiezon) procedure with run times on both columns of about 70 minutes. Hexane samples from PISCES were dried with sodium sulfate and cleaned up with Fluorosil. Glass fiber filters and sediments were Soxhlet extracted. Samples were spiked with tetrachloro-m-xylene (TCX), 2,3,3',4,5,5',6-heptachlorobiphenyl (BZ 192), and octachloronaphthalene (OCN). Acceptable recoveries occur when recoveries are greater than 60% and less than 150%. Out of 161 hexane samples taken in this project, 15 had one or more unacceptable surrogate spike recoveries. Trackdown samples with poor surrogate recoveries are noted in the text. Only those from Monroe County sewers were discounted.

Pesticide/Aroclor data were produced under either EPA Method 608 (for hexane samples) or by EPA Method 8080 (filters and sediments). The 608 method was modified by elimination of the water/solvent extraction step (already accomplished by PISCES) and the final solvent volume was reduced to 1 mL rather than to 10 mL as is standard.

Electron capture PCB congener data are not routinely available, few labs can provide it, or usable, data frequently show congener amounts at levels that are too large to be believable, that is false-positives. The Inchcape/Aquatec data required extensive editing due to false-positives. Concentrations for each PCB congener can be calculated by at least two methods because each congener was independently measured on two chromatographic columns. Inchcape/Aquatec employed RTX-5 and Apiezon columns. In many cases, a target PCB congener co-elutes with another PCB congener. For example, on the Apiezon column, congeners BZ 16 and BZ 32 co-elute. BZ 16 appears as a single peak on the RTX-5 column. BZ 16 can be quantitated from the RTX-5 column or it can be quantitated as the Apiezon multiple peak with the amount of BZ 32 subtracted. The best rule is to use the simplest method for each congener; in this example, the RTX-5 quantitation. However, it can happen that a non-PCB chemical may elute in the RTX-5 BZ 16 retention time window. This sort of thing is not infrequent, especially in very contaminated situations. Co-elution of non-PCB chemicals makes the congener method prone to false positives.

The following rules were applied to the 1993/1994 Inchcape/Aquatec PCB congener data:

1) When a congener is detected as a single chromatographic peak on both columns, use the lower concentration. This occurs for 44 congeners in the 1994 Inchcape/Aquatec output.

2) When a congener is reported by the literature[9] as absent in Aroclors and it was reported as a multiple peak in at least one column, recalculate the concentration from the multiple peak assigning all value to the more probable congener. Compare that value with the value of the congener as determined by using the shortest route to getting the concentration. Select the lower of the two values. This situation occurs for nine congeners in the Inchcape/Aquatec data set. Do not change values for "absent" congeners that appear as single peaks on both columns.

3) Twenty-three congeners in the Inchcape/Aquatec data set were found to often have reported concentrations much greater than what would be expected from any Aroclor mixture. Recalculate each of them and compare the new value with the original value. Use

the lowest. All concentrations were calculated from the data. On occasion, other congeners appeared suspicious and these were also tested by computing their concentration by an alternative method.

Given the differences in laboratory procedures, numerical comparisons (always weak with PISCES) should only be considered within an analytical group. An analytical group consists of samples processed by the same lab using the same method.

Dioxin/Furans

Dioxins and furans were analyzed by a high resolution GC/mass spectrometer method developed at and performed by the New York State Department of Health.[10] Samples were dried with anhydrous sodium sulfate and added to a Soxhlet thimble containing silica gel. It was covered with glass wool and Soxhlet extracted for 16 hours with benzene. The benzene extract was then cleaned on a preliminary silica gel, acid-treated silica gel, and base-treated silica gel and finally eluted with hexane. Preliminary clean-up was followed by an automated system using a sequence of acid alumina, carbon, and neutral alumina columns in series. These columns were eluted with a series of solvent mixtures using dichloromethane, hexane, and xylene. Concentrated extract from the automated cleanup was applied to a micro column containing a layer of silica gel and a layer of Bondesil 20H and eluted with hexane. This elutant was reduced under nitrogen and made up to a volume of 4 µL with benzene and xylene. Chromatography was performed on a HP 5890 A GC equipped with a fused silica column coated with cross-linked 5% phenyl methyl silicone (50 m x 0.2 mm, DB-5). The mass spectrometer was a VG Autospec Q operated in the selected ion recording mode. Only tetra- through octachloro-DD and DFs were collected.

The most potent of dioxins is the 2,3,7,8-tetrachlorinated isomer (2,3,7,8-TCDD). As with the PCBs, dioxins and furans are families of chemicals with similar chemistries and with similar toxicities. 2,3,7,8-TCDD, while highly toxic, is usually scarce. Analytical findings of no or minute 2,3,7,8-TCDD do not rule out the possibility of dioxin toxicity owing the possibility that other less potent but still toxic members of the family may be present. To overcome this problem a number of dioxin and furan isomers were analyzed. Toxicologists have devised toxic equivalency factors (TEF) whereby the 2,3,7,8-TCDD toxicities of other dioxins and furans (and some PCBs) may be determined and summed.[11] The result is a toxicologically effective "concentration" of 2,3,7,8-TCDD which may be determined even if no 2,3,7,8-TCDD is actually found. The summations of the products of TCDD-type chemical concentrations and their TEFs are toxic equivalents (TEQs).

Mercury

Recent advances in the collection and analysis of mercury samples have resulted in its ubiquitous detection but at concentrations very much less than had been previously reported.[12] Whole water samples were collected directly into rigorously pre-cleaned Teflon 125 mL bottles. The bottles were taped to a weighted rope and lowered into the sewer or stream. Filled bottles were kept cold, kept dark, and delivered to a dedicated mercury laboratory within two days of sampling. Care was taken to avoid breathing on the bottle (to reduce contamination from dental work) and to minimize water handling. When possible the bottles were filled to overflowing to eliminate head-space. Sampling procedures used for mercury did not produce temporally integrated data.

Grab samples were sent to Brooks Rand Ltd. of Seattle, WA. In the lab, all samples were acidified and photo oxidized with 1 mL BrCl. An appropriate volume was analyzed using $SnCl_2$ reduction, gold amalgamation, and cold vapor atomic fluorescence spectrometry. In every batch, one sample was analyzed in triplicate. The gold amalgam method is sufficiently sensitive that mercury is always detected. Relative standard deviation was calculated on triplicate analysis for one sample from every batch. The overall RSD was 9.17%. The median MDL was 0.05 ng/L and the median relative percent difference (RPD) was 7%.

Most of the analyses were for total mercury but in a minority methyl mercury were also determined.

SAMPLING SITES

This project visited primary sampling sites at or near the mouths of the Black, Oswego, Genesee Rivers, and Eighteenmile Creek. The mouths of these streams are, with the exception of the Black River, designated as International Joint Commission (IJC) Areas of Concern (AOCs). They were sampled with the intention of obtaining representative water column concentration data. Secondary sites (Sandy Creek, Salmon River, Wine Creek, Irondequoit Creek, and Oak Orchard Creek) were sampled less intensively for the purpose of making an assessment of importance. If indications of contaminants were found, further sampling was undertaken. This occurred in the cases of Sandy and Wine Creeks. Further sampling was performed in Irondequoit Creek at the request of Monroe County.

Special areas of interest are those sites within the Lake Ontario drainage where there was particular concern that contaminants might be found. These include:

Kelsey Creek,
Indian River,
the outfall of Alcan Rolled Aluminum,
a rivulet behind Oswego Castings,
Ox Creek below the Clothier site,
Ley Creek,
Onondaga Creek,
upstream Irondequoit Creek,
a tributary to Fall Creek below Ithaca fire training,
Monroe County combined sewers,
the Barge Canal in Monroe County,
Oatka Creek,
Van Campen Creek above and below Friendship Foundry,
the Genesee River above and below Sinclair Refinery,
Johnson Creek above and below Lyndonville Landfill,
Beals Creek below the J.I. Case Property, and
The Gulf below the Lockport Landfill.

Trackdown studies were performed in all the primary tributaries but most intensively in Eighteenmile Creek/Lockport where, on the basis of previous information, sampling was conducted for sources of PCBs, mercury, mirex, and dioxin, and the Oswego River/Ley Creek for PCBs, mercury, and mirex. Upstream mercury sampling was performed in the Black and Genesee Rivers.

A large number of sampling sites were visited in this project. To bring order to this multiplicity, 19 maps (Maps A through S) each having numbered sampling sites are attached. For the most part, each numbered site is distinct. However some were so close together that they are not distinguished on the maps but are in the text. The maps also indicate locations of inactive hazardous waste sites. These are symbolized in the text with a divided diamond (❖) and have a two-part number. The first digits designate the county and the second set the site within the county. **Appendix I** lists all the displayed inactive hazardous waste sites along with their names, prominent substances either found or suspected, remedial status, and drainage.

Primary Tributaries

The **Black River** delivers about 12.7% of the total tributary water load (exclusive of the Niagara River) to Lake Ontario. Its watershed of 1,900 square miles includes the western Adirondacks and the northern and eastern sides of the Tug Hill plateau. The land is forested or in dairy production. Numerous pulp and paper mills and hydroelectric plants are in the drainage and some have the potential for contributing PCBs. The only major city is Watertown. A 100,000 acre military reservation, Fort Drum, is partly in the Black River drainage and partly in the Indian River basin. Previous work by Environment Canada and NYSDEC have shown PCBs in the fish and water in the Black River.[13] Several small PCB-contaminated sites have been identified in the city of Watertown and there is also a strong possibility of a PCB source in Carthage.

PISCES samples were routinely taken in the forebay of the Hydro Development dam in Dexter (Map A, # 1). Here, the Black River has numerous islands that divide its flow into many channels. The sampling site is near the center of the maze. Vandalism of PISCES was not a problem and the site is above Lake Ontario backwater. No survey was undertaken to assess cross channel representativeness.

The **Oswego River** drains 5,100 square miles of central New York. It contributes a little more than 20% of the entire tributary (exclusive of the Niagara River) water load to Lake Ontario. The city of Syracuse is the largest urban and industrial community in the New York portion of the Lake Ontario basin. Several PCB sources are known in Syracuse, especially in Ley Creek. Armstrong World Industries, a manufacturing firm in Fulton, NY, used mirex as a flame retardant in the early 1960's. Mirex escaped from the site into the river and into Lake Ontario.

The principal sampling site for the Oswego River was off Lock 6 of the Thruway Authority's Oswego Canal (Map F #3). PISCES were hung off the outer wall of the lock in the free flowing channel 15 feet upstream from the High Dam on the right bank. Security was sufficient and the site is above Lake Ontario backwater. In 1992 samples were collected from the bridge at Minetto (Map F #7) using the Goulden Large Sample Extractor (GLSE). Representativeness of the Lock 6 site was assessed by placing PISCES at several sites along the Oswego River. No significant differences were found. One sample was taken from the opposite side of the channel in the forebay to a Niagara Mohawk hydro plant (Map F #2). Current velocities were greater at that left bank location than they were on the right bank. The right bank was favored because it was on the same side of the river as Armstrong and because it was more easily approached for pressure filtration sampling.

The **Genesee River** rises in Pennsylvania and flows north to Rochester and Lake Ontario. The Genesee drains 2,500 square miles and contributes 8.6% of the total tributary water load to Lake Ontario. The principal urban area in the drainage is Rochester. The river receives treated wastewater from Eastman Kodak Company, a manufacturer of chemicals and photographic equipment, from upstream municipal systems, and from the Gate-Chili-Ogden wastewater treatment plant upstream from Rochester. However, within Rochester very little wastewater reaches the river. Most of Monroe County's treated municipal wastewater is discharged directly to Lake Ontario. Erie Canal waters enter the Genesee and some industries discharge to the canal.

Cross channel homogeneity was of concern in the lower Genesee River. On 6/22/94 conductivity was measured upstream from Rochester at two locations on the centerline; from the left and right banks (facing downstream) on the Broad St. Bridge in Rochester; from the sampling site; and from the left and right banks of the Stutson St. Bridge near the River's mouth (**Table 1**). Cross channel differences were seen in Rochester but were erased by the river's mouth. The river is probably homogeneous with regard to conductivity at the sampling site.

The Genesee River was sampled off a pier located downstream from cement loading docks (Map M #1). This site was on the left bank some 30 feet from the shore. The sampling site in the lower Genesee could have been biased. The river is broad, potential sources exist upstream from the sampling point but below the falls, and the actual sampling point was near the left bank. There were no available alternative sites and heavy use of this stretch of river by recreational and commercial shipping precluded placing PISCES in the center of the channel. As it was, several units were lost here, possibly to vandalism.

Table 1. Genesee River conductivities (µS/cm).

		L bank	center	R bank
Map C #2	Fowlerville		241	
Map M #21	Ballentyne Rd		360	
Map M #22	Broad St. Bridge	141		404
Map M #1	main sampling site	403		
Map M #23	Stutson St. Bridge	389		392

Eighteenmile Creek consists of water bled out of the Barge Canal at Lockport and at Gasport, of effluent from the Lockport and Gasport STPs, of waste water from Harrison Radiator, and of natural drainage from Eighteenmile Creek, East Branch and The Gulf. Eighteenmile Creek is a minor tributary contributing about 0.3% of the non-Niagara tributary water input to Lake Ontario. Despite its small size, Eighteenmile Creek is an International Joint Commission Area of Concern and the magnitude of its chemical impact on Lake Ontario may be out of proportion to its discharge.

Eighteenmile Creek was principally sampled at two sites in Olcott Harbor. The earlier site was off the Route 18 bridge (Map Q #2). PISCES were placed in the center of the channel. Later, samples were taken off one of the municipal docks on the left bank further downstream (Map Q #1). Security was poor and several PISCES units were lost. Heavy use of motor boats in Olcott Harbor may have contaminated PISCES with spilled gasoline and oil. No barrier separates this site from Lake Ontario. Several sets of conductivity measurements were made to describe the magnitude of dilution. Eighteenmile Creek, unlike the other primary tributaries, is not gaged but discharge estimates were compiled from releases from the canal, from the treatment plants, and from correlations based on nearby Tonawanda Creek.

Secondary Sampling Sites

Secondary tributaries sampled include Sandy Creek and Salmon River (Map A), Wine Creek (Map D), Irondequoit Creek (Map L), and Johnson and Oak Orchard Creeks (Map P). These smaller and presumably less contaminated tributaries were visited fewer times than the primary sites.

NYSDEC Regional Water Engineers identified specific areas where they felt sampling would be beneficial. These include Indian River and Kelsey Creek (Region 6 - Maps A and B), Ley Creek and Skaneateles Creek (Region 7 - Maps H and J), Monroe County (Region 8 - Maps L and M), and more intensive work in Eighteenmile Creek (Region 9 - Maps Q, R, and S).

The NYSDEC DOW/Great Lakes Section identified inactive hazardous waste sites in the Lake Ontario drainage containing PCBs, DDT and metabolites, dioxins/furans, dieldrin, and mirex, that is the lakewide critical pollutants.[14] Sites from that list not specifically noted by the Regions were in Ox and Black Creeks (Map D), the Alcan and Oswego Castings sites (Map E), Onondaga Creek (Map I), Ithaca fire training (Map K), Sinclair Refinery site in Wellsville (Map N), Friendship Foundry site in Friendship (Map O), Lyndonville-West Ave. site in Lyndonville (Map P), and the Lockport Landfill (Map R).

Three special projects were performed using grant funds that require explanation. These were a very small cooperative effort with the US Army Corps of Engineers to evaluate the impact of dredging in Oswego Harbor; a comparative methods project conducted in the Oswego River in 1993 with EPA; and lastly, a considerable effort went into looking for mirex. Initially, mirex investigations were limited to the Oswego River but the search was broadened. The mirex project was also used for investigations into equipment design that resulted in the "digestigator" **(Figure 5)**.

Representativeness at the Primary Sites

Sampling representativeness has a spatial component and a discharge component. Spatial questions relate to the vertical and horizontal distributions of chemicals and to the hydraulic relations between the tributary and its receiving body. Spatial representativeness is of particular concern where there is no physical separation between a stream and its receiving body, as for example in Eighteenmile Creek and the Genesee River. Dams prevent lake intrusion at the sampling locations on the Oswego and Black Rivers. Conductivity measurements were undertaken to observe distinctions between water masses at these interfaces.

Water Discharge

Temporal variability in stream discharge is enormous. Short of maintaining a long term surveillance program, there is little that can be done about year to year variability. There are within year variabilities that are somewhat predictable. Higher flows occur in the spring and then in the late fall and early winter. Precipitation is often locked up as snow or ice during the winter. Summer sees dry soils, high rates of evapotranspiration, and extensive foliage cover which reduces the impact of storms on rivers.

It is likely that different flow regimes have different contaminant loading implications. The adequacy of a sampling program can be evaluated by noting the percentage sampling discharge quartiles (PSDQ).

Consider the Black River. Sampling began on 10/7/93 and ended 11/29/94, a period of 419 days. During this time a total of 5015.8×10^9 L of water were discharged. If each day's flow is ranked, the entire period's discharge can be divided into flow quartiles. For example:

Table 2. Example calculation of PSDQ for the Black River

quartile	daily discharge range (in 10^9 L)	days	quartile discharge	sampling days	sampling discharge	PSDQ
first	3.72 - 8.42	211	1250	118	677	54
second	8.49 - 15.12	112	1260	38	436	34
third	15.24 - 24.07	65	1260	44	858	68
fourth	24.47 - 80.49	31	1250	18	757	61

A quarter of the total discharge occurred at daily flows of between 3.72 and 8.42 billion L/day. There were 211 of these lowest flow days and sampling occurred on 118 of these days. During the 211 low flow days, a total of 1250 billion L were discharged. During the 118 days of low flow sampling, 677 billion L were discharged. The first quartile PSDQ is 677/1260 or 54.

PSDQs for Eighteenmile Creek are less satisfactory (**Table 3**). Eighteenmile Creek is not gaged. Stream flow from Northrup Creek (drainage 11.7 square miles) and Tonawanda Creek at Batavia (171 square miles) was divided by their drainage area and multiplied by the drainage area of Eighteenmile Creek (84 square miles). Natural flows in Eighteenmile Creek were estimated as the mean of the converted discharges for the two neighboring gaged streams. Data from Tonawanda Creek were missing after 10/1/94. Additional flow from the Lockport, Harrison Radiator, and Gasport STPs was added as were 45 CFS/day during navigation season from Barge Canal overflows at Lockport and Gasport and 11 CFS during non-navigation season.

PSDQs were not calculated from the Oswego or Genesee Rivers due to lack of complete stream discharge data.

A superior sampling program would have PSDQs that are high and uniform. PSDQs are attractive because discharge statistics are readily available.

Table 3. PSDQs for Eighteenmile Creek

quartile	daily discharge range (in 10^9 L)	days	quartile discharge	sampling days	sampling discharge	PSDQ
first	0.09 - 0.21	202	34.5	98	15.6	45
second	0.21 - 0.38	125	34.6	31	8.6	25
third	0.38 - 0.88	87	34.1	28	11.6	34
fourth	0.92 - 2.62	25	35.3	9	11.8	33

Conductivity

Backwater intrusion, that is, dilution by water from Lake Ontario, will reduce the observed chemical concentrations and result in a low bias. Lake Ontario conductivity is around 280 µS/cm but the conductivities of Eighteenmile Creek and the Genesee River are much higher. **Figure 7** displays conductivity maxima, averages, and minima for Eighteenmile at Olcott Harbor, East Branch at Rt. 78, Eighteenmile Creek at Stone Rd., Eighteenmile Creek at Olcott St. bridge, Genesee River at Turning Point Park, Oswego River at Lock 6, and Black River at Dexter. The range of conductivities at the mouth of Eighteenmile Creek is not less than the conductivities at its upstream sources and much greater than the conductivity of Lake Ontario. Conductivities measured at Stone Rd were a little higher than those from Olcott St. bridge. Two sources lie between the sites, the Lockport STP and The Gulf. The Gulf's drainage includes high conductivity tributaries; as much as 2,300 µS/cm were seen. The big range in conductivities seen in the Genesee River may be due to the flooding and pumping from the Retsof salt mine that occurred during the sampling period. The equally large ranges of conductivities seen in the Oswego River might be due to very high conductivity waters from Onondaga Lake and other saline sources. The Black River had conductivities consistently less than those of Lake Ontario.

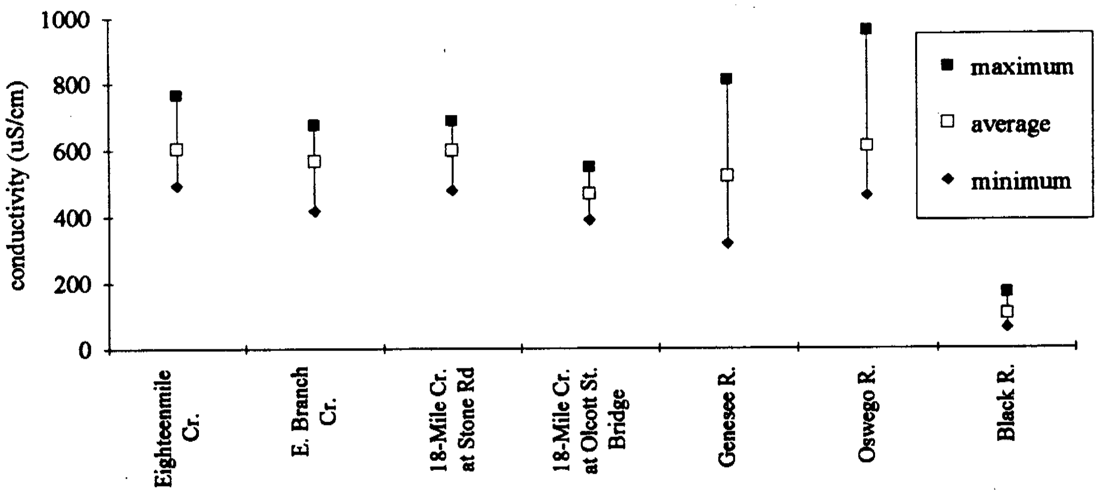


Figure 7. Ranges of conductivities (μS/cm).

Total Suspended Solids

Both the Black and the Oswego Rivers had consistently low TSS concentrations. The Genesee River, Eighteenmile Creek at Stone Rd., and the E. Branch were often turbid. The highest TSS concentration found at Eighteenmile Creek at Stone Rd. (232 mg/L) occurred after a summer storm but corresponding measurements from elsewhere in the system are lacking (**Figure 8**).

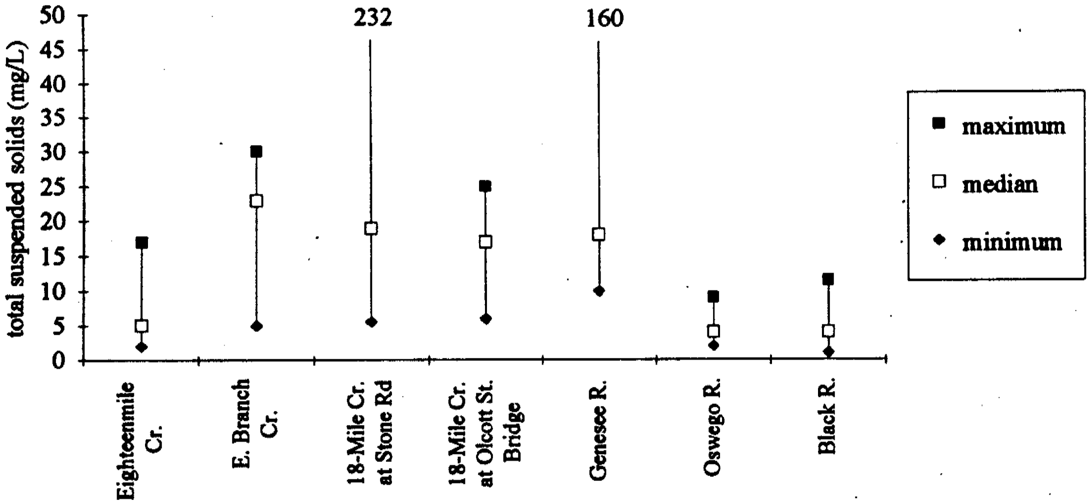


Figure 8. Ranges of total suspended solids concentrations.

CHEMICAL RESULTS

PCB – PISCES

Table 4 summarizes PCB data from all project PISCES samples. Data are arranged by Map and sample number. Concentrations with poor surrogate recoveries are boldfaced. Failure of all three surrogates is superscript "^{s}", when two surrogates failed to be sufficiently recovered the sample is designated "^{m}", and when one surrogate failed, "^{l}". Surrogate recovery failures may occur from general problems affecting all aspects of laboratory processing or they may be artifacts of lab handling and not directly related to the result. Here, all data are given except when there were both surrogate recovery problems and poorly resolved chromatograms. This situation affected some samples taken in Monroe County. PISCES data are semi-quantitative and are best used to provide an indication of the presence and relative abundance of substances; they cannot be used for regulation.

Table 4. Summary of PCB data from PISCES. Five samples designated with an asterisk (*) were analyzed at NYSDOH, all other were analyzed at Inchcape/Aquatec.

Map #	Site Name	Sample type	Date In	Date Out	Rainfall (inches)	Total ng	Liters sampled	ng/L
A 1	Black R. at Dexter	surf.	10/7/93	11/4/93	2.56	193.39	9.24	20.92
A 1	Black R. at Dexter	surf.	10/22/93	11/4/93	0.73	107.72	3.92	27.51
A 1	Black R. at Dexter	surf.	3/22/94	4/5/94	1.15	47.31	2.97	15.91
A 1	Black R. at Dexter	surf.	4/5/94	4/20/94	2.78	89.93	3.66	24.55
A 1	Black R. at Dexter	surf.	5/4/94	5/17/94	1.52	137.2	5.37	25.56
A 1	Black R. at Dexter	surf.	6/1/94	6/16/94	2.36	86.11	6.84	12.59
A 1	Black R. at Dexter	surf.	7/20/94	8/2/94	0.48	131.29	16.48	7.97
A 1	Black R. at Dexter	surf.	8/2/94	8/18/94	1.72	124.79	14.7	8.49
A 1	Black R. at Dexter	surf.	8/18/94	9/1/94	1.59	108.51	12.94	8.38
A 1	Black R. at Dexter	surf.	9/1/94	9/15/94	0.46	87.73	11.49	7.63
A 1	Black R. at Dexter	surf.	9/15/94	10/13/94	4.35	105.03	16.75	6.27
A 1	Black R. at Dexter	surf.	10/13/94	11/2/94	3.36	65.49	8.24	7.95
A 1	Black R. at Dexter	surf.	11/2/94	11/15/94	1.41	98.26	4.93	19.94 s
A 2	Sandy Cr., upstream	surf.	4/20/94	5/4/94	0.98	63.98	6.25	10.24
A 6	Sandy Cr. near mouth	surf.	10/22/93	11/5/93	1.64	40.96	4.09	10.02
A 6	Sandy Cr. near mouth	surf.	4/20/94	5/4/94	0.98	70.27	6.39	10.99
A 7	Salmon R. near mouth	surf.	10/22/93	11/4/93	1.1	20.17	3.94	5.12 s
A 15	Indian R. at Philadelphia	surf.	8/18/94	9/1/94	1.59	5.71	25.98	0.22
B 1	Kelsey Cr. at Rt. 37	surf.	6/1/94	6/16/94	0.9	8	7.5	1.07
B 2	LeRay Sp.	surf.	5/4/94	5/17/94	2.03	84.67	4.63	18.29
B 3	Oily Cr., at Morrison	surf.	5/17/94	6/1/94	1.15	402.87	6.32	63.77
B 3	Oily Cr., at Morrison	surf.	6/1/94	6/16/94	0.9	346.02	7.68	45.04
B 4	Kelsey Cr. at Superior St.	surf.	5/17/94	6/1/94	1.15	177.91	7.66	23.23
B 4	Kelsey Cr. at Superior St.	surf.	6/1/94	6/16/94	0.9	103.44	8.01	12.92
B 5	Kelsey Cr. at Superior St.	surf.	5/4/94	5/17/94	2.03	158.24	5.32	29.74
D 1	Black Cr. at Volney	surf.	10/21/93	11/4/93	1.63	59.14	5.77	10.26
D 2	Ox Creek at S. Granby Rd.	surf.	10/21/93	11/4/93	1.72	14.27	4.18	3.41 l
E 1	Alcan outfall	surf.	10/13/94	10/26/94	0.32	3418.47	11.46	298.4
E 2	Oswego Casting, downstream	surf.	10/5/94	11/2/94	3.88	2.4	10.21	0.24
E 2	Oswego Casting, downstream	surf.	11/2/94	11/15/94	2.11	2.9	4.61	0.63
E 3	Oswego Casting, upstream	surf.	11/2/94	11/15/94	2.11	21.64	4.62	4.68
E 4	Wine Cr., downstream	surf.	10/7/93	10/21/93	1.85	163.08	6.61	24.68
E 4	Wine Cr., downstream	surf.	10/21/93	11/4/93	1.53	206.09	4.87	42.34
E 4	Wine Cr., downstream	surf.	4/28/94	5/12/94	1.48	240.55	6.61	36.37

Map #	Site Name	Sample type	Date In	Date Out	Rainfall (inches)	Total ng	Liters sampled	ng/L
E 4	Wine Cr., downstream	surf.	5/12/94	5/26/94	1.29	204.9	6.29	32.56
E 4	Wine Cr., downstream	surf.	5/26/94	6/9/94	1.2	134.24	7.53	17.83
E 4	Wine Cr., downstream	surf.	6/9/94	6/22/94	0.59	112.45	10.98	10.24
E 5	Wine Cr., upstream	surf.	5/12/94	5/26/94	1.29	20.16	6.29	3.2
E 5	Wine Cr., upstream	surf.	5/26/94	6/9/94	1.2	6.64	5.84	1.14
E 5	Wine Cr., upstream	surf.	6/9/94	6/22/94	0.59	10.96	12.67	0.87
F 2	Oswego R. at High Dam	surf.	10/21/93	11/4/93	1.72	77.57	5.1	15.22
F 3	Oswego R. at Lock 6	surf.	4/14/94	4/28/94	1.92	59.1	4.46	13.26
F 3	Oswego R. at Lock 6	surf.	4/28/94	5/12/94	1.99	56.48	5.81	9.71
F 3	Oswego R. at Lock 6	surf.	5/12/94	5/26/94	0.76	28.27	7.45	3.8 s
F 3	Oswego R. at Lock 6	surf.	5/26/94	6/9/94	1.41	10.5	9	1.17
F 3	Oswego R. at Lock 6	surf.	6/9/94	6/22/94	0.41	14.51	13.48	1.08
F 3	Oswego R. at Lock 6	surf.	7/29/94	8/11/94	1.2	16.3	16.62	0.98
F 3	Oswego R. at Lock 6	surf.	8/11/94	9/1/94	5.47	28.85	22.13	1.3
F 3	Oswego R. at Lock 6	surf.	9/1/94	9/15/94	0.48	18.51	13.65	1.36
F 3	Oswego R. at Lock 6	surf.	9/15/94	9/28/94	1.56	14.22	10.5	1.35
F 3	Oswego R. at Lock 6	surf.	9/28/94	10/13/94	0.47	28.33	9.75	2.91
F 3	Oswego R. at Lock 6	surf.	10/13/94	11/2/94	3.62	12.05	9.69	1.24
F 3	Oswego R. at Lock 6	surf.	11/2/94	11/15/94	2.43	26.05	5.66	4.6
F 4	Oswego R.	surf.	10/4/94	10/20/94	0.29	12.18	9.19	1.32
F 6	Oswego R.	surf.	10/4/94	10/20/94	0.29	21.88	18.4	1.19
F 7	Oswego R.	surf.	10/4/94	10/20/94	0.29	25.12	18.54	1.35
F 8	Oswego R.	surf.	9/9/93	9/23/93	1.59	77.75	12.21	6.37
F 9	Oswego R.	surf.	9/9/93	9/23/93	1.59	28.22	12.16	2.32
F 10	Oswego R.	surf.	10/4/94	10/20/94	0.29	12.91	18.38	0.7
F 11	Oswego R.	surf.	10/4/94	10/20/94	0.29	21.69	18.74	1.16
G 1	Oswego R. below Armstrong	surf.	9/9/93	9/23/93	1.59	58.68	12.22	4.8 m
G 1	Oswego R. below Armstrong	surf.	10/20/94	11/7/94	4.31	43.92	17.57	2.5
G 2	Oswego R. at Armstrong	surf.	10/20/94	11/7/94	4.31	12.47	8.78	1.42
G 3	Oswego R. above Armstrong	surf.	10/20/94	11/7/94	4.31	19.95	8.77	2.27
G 4	Oswego R.	surf.	9/9/93	9/23/93	1.59	76.63	13.1	5.85 s
G 5	Oswego R.	surf.	9/9/93	9/23/93	1.59	78.01	12.37	6.3 m
G 6	Oswego R.	surf.	9/9/93	9/23/93	1.59	86.57	12.24	7.07
H 1	S. Branch Ley Cr. at S. Burnet Ter.	surf.	10/4/94	10/20/94	0.57	8.67	7.96	1.09
H 3	S. Branch Ley Cr. at Rupp Rd.	surf.	10/4/94	10/20/94	0.57	27.85	7.96	3.5
H 4	S. Branch Ley Cr. at Deere Rd.	surf.	10/4/94	10/20/94	0.57	779.2	7.94	98.1
H 5	Sanders Cr. above Carrier	surf.	10/4/94	10/20/94	0.57	55.71	8.08	6.9
H 6	mouth Sanders Cr.	surf.	10/4/94	10/20/94	0.57	11.23	8.62	1.3
H 7	N. Branch Ley Cr.	surf.	10/4/94	10/20/94	0.57	16.76	7.59	2.21
H 8	Ley Cr. at Town Line Rd.	surf.	8/11/94	8/29/94	4.62	222.71	15.01	14.83
H 8	Ley Cr. at Town Line Rd.	surf.	8/29/94	9/12/94	0.32	68	11.27	6.03
H 9	Ley Cr., at Salina Town garage	surf.	8/29/94	9/12/94	0.32	1156.97	11.08	104.42 m
H 11	Ley Cr. at Park St.	surf.	8/11/94	8/29/94	4.62	1569.53	14.84	105.78
H 11	Ley Cr. at Park St.	surf.	8/29/94	9/12/94	0.32	841.75	10.24	82.2
H 12	S. Branch Ley Cr., Rt. 298.	surf.	8/29/94	9/12/94	0.32	38.86	10.04	3.87
I 1	Onondaga Cr.	surf.	7/29/94	8/11/94	0.51	24.5	9.9	2.47
I 2	trib. to Onondaga Cr.	surf.	7/29/94	8/11/94	0.51	19.2	8.1	2.37
I 3	Onondaga Cr.	surf.	7/29/94	8/11/94	0.51	9.67	8.76	1.1
J 7	Stauffer outfall to Skan. Cr.	efflu.	10/7/93	10/21/93	1.48	37.7	6.49	5.81
J 11	Skan. Cr. at Jordan Rd below Stauff.	surf	10/7/93	10/21/93	1.48	171.34	6.22	27.53
J 14	Welsh Allyn, Jordan Rd, outfall	efflu.	10/7/93	10/21/93	1.48	70.22	11.17	6.29
J 15	Skan. Cr. at Rodack Rd.	surf	10/7/93	10/21/93	1.48	171.75	6.38	26.94
J 11*	Skan. Cr. at Jordan Rd below Stauff.	surf.	9/10/93	9/24/93	1.09	154	13.29	12

Map #	Site Name	Sample type	Date In	Date Out	Rainfall (inches)	Total ng	Liters sampled	ng/L
J 13*	Skan. Cr. at Stump Road	surf.	9/10/93	9/24/93	1.09	1959	13.29	150
J 15*	Skan. Cr. at Irish Road	surf.	9/10/93	9/24/93	1.09	549	13.27	41
J 16*	Skan. Cr. at Rodack Rd.	surf.	9/10/93	9/24/93	1.09	1658	13.24	130
J 2*	Skan. Cr. at Long Ridge Sheldon Rd.	surf.	9/10/93	9/24/93	1.09	283	13.31	21
K 1	Ithaca Fire Training	surf.	9/12/94	9/26/94	1.69	29.64	9.28	3.19
L 1	Irondequoit Cr.	surf.	9/27/94	10/12/94	0.64	29.37	8.37	3.51
L 2	Irondequoit Cr.	surf.	10/6/93	10/20/93	1.52	32.42	5.74	5.65
L 5	Allens Cr. at Harley School	surf.	9/27/94	10/12/94	0.64	21.18	8.71	2.43
L 6	Allens Cr. trib at Oak Hill CC	surf.	9/27/94	10/12/94	0.64	17.83	8.73	2.04
L 9	Barge Canal at Brockport	surf.	10/25/94	11/9/94	2.55	76.45	7.08	10.8
M 1	Genesee R. at TP Park	surf.	10/6/93	10/20/93	1.52	115.12	6.24	18.46
M 1	Genesee R. at TP Park	surf.	3/31/94	4/13/94	2.78	36.28	3.54	10.26
M 1	Genesee R. at TP Park	surf.	4/13/94	4/27/94	1.81	44.91	5.53	8.12
M 1	Genesee R. at TP Park	surf.	4/27/94	5/11/94	1.31	108.13	6.86	15.75
M 1	Genesee R. at TP Park	surf.	6/9/94	6/22/94	0.32	27.92	12.75	2.19
M 1	Genesee R. at TP Park	surf.	6/22/94	7/14/94	0.57	40.21	27.23	1.48
M 1	Genesee R. at TP Park	surf.	7/14/94	7/27/94	0.15	71.38	17.86	4
M 1	Genesee R. at TP Park	surf.	7/27/94	8/9/94	1.81	48.59	16.92	2.87
M 1	Genesee R. at TP Park	surf.	9/14/94	9/27/94	1.28	24.15	12.1	2
M 1	Genesee R. at TP Park	surf.	9/27/94	10/12/94	0.64	29.12	13.81	2.11
M 1	Genesee R. at TP Park	surf.	10/28/94	11/9/94	3.23	32.78	5.28	6.21
M 16	Barge Canal at Scottsville Rd.	surf.	10/25/94	11/9/94	3.24	67	6.82	9.82
M 17	Little Black Cr.	surf.	10/25/94	11/9/94	3.24	28.17	5.98	4.71
M 20	Barge Canal at Kendrick Rd.	surf.	10/25/94	11/9/94	3.24	17.44	6.53	2.67
M 21	Genesee R. at Ballentyne Br.	surf.	10/25/94	11/9/94	3.24	31.59	6.09	5.19
N 1	Genesee R. above Sinclair	surf.	8/30/94	9/13/94	0.2	9.84	7.3	1.35
N 2	Genesee R. below Sinclair	surf.	8/30/94	9/13/94	0.2	23.8	7.39	3.22
O 1	Van Campen Cr. below Friendship	surf.	8/30/94	9/13/94	0.2	10.74	7.43	1.45
O 2	Van Campen Cr. above Friendship	surf.	8/30/94	9/13/94	0.2	10.4	7.93	1.31
P 1	Johnson Cr. above Lyndonville	surf.	9/26/94	10/11/94	2.41	47.21	8.68	5.44
P 2	Johnson Cr. below Lyndonville	surf.	9/13/94	9/26/94	0.82	15.07	10.43	1.44
P 4	Oak Orchard Cr.	surf.	10/6/93	10/20/93	1.6	46.5	6.43	7.23
Q 1	18- Mile Cr. at Olcott Harbor	surf.	10/5/93	10/20/93	2.25	968.57	6.55	147.98
Q 1	18- Mile Cr. at Olcott Harbor	surf.	3/31/94	4/13/94	2.35	566.07	4.45	127.29
Q 1	18- Mile Cr. at Olcott Harbor	surf.	4/13/94	4/27/94	1.83	321.64	6.76	47.58
Q 1	18- Mile Cr. at Olcott Harbor	surf.	4/27/94	5/11/94	1.2	428.27	8.55	50.09
Q 1	18- Mile Cr. at Olcott Harbor	surf.	7/28/94	8/10/94	2.99	532.9	14.58	36.55
Q 1	18- Mile Cr. at Olcott Harbor	surf.	8/30/94	9/13/94	1.13	348.91	14.33	24.36
Q 1	18- Mile Cr. at Olcott Harbor	surf.	10/27/94	11/10/94	2.97	415.95	5.86	70.98
Q 1	18- Mile Cr. at Olcott Harbor	surf.	9/13/94	11/21/94	4.44	1222.39	36.91	33.12
Q 1	18- Mile Cr. at Olcott Harbor	surf.	11/10/94	11/21/94	0.5	325.02	4.07	79.83
Q 6	E. Branch 18-Mile Cr.	surf.	10/20/93	11/3/93	1.24	40.29	4.23	9.53
R 1	18-Mile Cr. at Stone Rd.	surf.	10/20/93	11/3/93	1.24	762.56	6.03	126.56
R 4	The Gulf below Niagara St.	surf.	7/6/94	7/28/94	2.13	228.45	27.51	8.3
R 5	The Gulf above Niagara St.	surf.	7/28/94	8/10/94	2.99	82.56	13.91	5.93
R 6	Lockport manhole, Russell St.	sewer	5/25/94	6/8/94	2.06	82.98	7.03	11.81
R 7	Lockport manhole, Prospect St.	sewer	5/25/94	6/8/94	2.06	2283.57	7.16	318.73
S 8	Lockport manhole at Big Br.	sewer	5/25/94	6/8/94	2.06	216.23	7.11	30.4
S 8	Lockport manhole at Big Br.	sewer	6/8/94	6/21/94	0.88	75.88	8.56	8.86
S 9	Barge Canal	surf.	8/10/94	8/31/94	3.15	392.58	21.25	18.48
S 18	Lockport manhole at Market St.	sewer	5/25/94	6/8/94	2.06	326.81	7.38	44.27
S 18	Lockport manhole at Market St.	sewer	6/8/94	6/21/94	0.88	534.72	8.93	59.88
S 19	Barge Canal	surf.	5/25/94	6/8/94	2.06	90.11	6.32	14.25

Map #	Site Name	Sample type	Date In	Date Out	Rainfall (inches)	Total ng	Liters sampled	ng/L
S 21	18-Mile at Clinton St.	surf.	10/20/93	11/3/93	1.24	126.44	5.33	23.71
S 27	Lockport manhole at Mill St.	sewer	5/25/94	6/8/94	2.06	80.44	6.25	12.87
S 28	Lockport manhole at William St.	sewer	5/25/94	6/8/94	2.06	470.67	7.34	64.17
S 29	18-Mile at N. Transit St.	surf.	10/20/93	11/3/93	1.24	1120.85	5.45	205.79

PCB -- Pressure Filtration

Table 5 shows PCB concentration data from suspended solids phase sampling. Results are given in terms of ng/L and µg/g suspended solids. The ng/L value is the total number of nanograms of PCB recovered from the filters divided by the number of liters filtered. On most occasions where pressure filtration was performed, total suspended solids (TSS) was also sampled. When TSS were obtained, the concentration of PCBs on the solids was calculated. Concentrations with poor surrogate recoveries are boldfaced under the heading DQI (data quality impairment). Failure of all three surrogates (9 cases) is designated "**s**" when two surrogates failed (4 cases) to be sufficiently recovered the sample is designated "**m**", and when one surrogate failed (17 cases), "**l**". Out of 75 filtration samples, 30 had some level of surrogate recovery deficiency. Twenty-nine of those 30 had poor octachloronaphthalene recoveries; 12 had BZ#192 problems; and in eight instances, there was poor TCX recovery.

Table 5. PCB concentrations from suspended solids. TOC and TSS in mg/L.

Map #	Site	date	TSS (mg/L)	TOC (mg/L)	L filtered	# filters	PCB (ng/L)	DQI	PCB total ng	PCB ug/g ss
A1	Black R. at Dexter	3/22/94	4	3	28.52	1	0.96	**l**	27.30	0.24
A1	Black R. at Dexter	4/5/94	NA	NA	17.3	1	1.65	**l**	28.50	
A1	Black R. at Dexter	4/20/94	10	1.9	19.14	1	4.00	**l**	76.60	0.40
A1	Black R. at Dexter	5/4/94	4	4.3	20.85	1	1.97	**l**	41.00	0.49
A1	Black R. at Dexter	5/17/94	4	4.1	21.28	1	1.40	**l**	29.80	0.35
A1	Black R. at Dexter	6/1/94	5	14.5	20.82	1	2.24	**l**	46.70	0.45
A1	Black R. at Dexter	6/16/94	1	4.7	12.85	1	2.55	**m**	32.80	2.55
A1	Black R. at Dexter	7/20/94	2	4.9	11.87	1	0.91		10.84	0.46
A1	Black R. at Dexter	8/2/94	2	4.1	117.31	2	1.15		67.38	0.57
A1	Black R. at Dexter	8/18/94	4	6.4	10.32	1	2.81		28.99	0.70
A1	Black R. at Dexter	9/1/94	4	4.1	15.27	1	1.22	**m**	18.58	
A1	Black R. at Dexter	9/15/94	6	5.8	67.44	1	1.96		132.43	0.33
A1	Black R. at Dexter	11/2/94	11.5	5.75	49.09	2	4.09		100.31	0.36
A1	Black R. at Dexter	11/15/94	2	6.4	66.63	2	0.88		29.34	0.44
A5	Sandy Cr.	5/4/94	3	2.35	63.71	1	0.19	**l**	12.23	0.06
B3	Oily Cr.	6/1/94	4	2.1	24.93	1	1.01	**s**	25.20	0.25
F3	Oswego R. at Lock 6	4/14/94	9	3.7	19.7	1	1.06	**l**	20.80	0.12
F3	Oswego R. at Lock 6	4/28/94	9	4.1	23.67	1	2.17		51.40	0.24
F3	Oswego R. at Lock 6	5/12/94	4	4	38.6	1	0.74		28.51	0.18
F3	Oswego R. at Lock 6	7/7/94	2	3.2	348.58	2	13.68	**m**	2384.31	6.84
F3	Oswego R. at Lock 6	7/29/94	4	4.2	254.84	2	0.54	**s**	68.21	0.13
F3	Oswego R. at Lock 6	8/11/94	4	5.35	208.37	2	0.66		68.63	0.16
F3	Oswego R. at Lock 6	9/1/94	3.5	2.35	27.84	1	0.46		12.69	0.13
F3	Oswego R. at Lock 6	9/15/94	6	5.3	21.57	1	0.66	**s**	14.13	0.11
F3	Oswego R. at Lock 6	9/28/94	5	4.1	286.65	2	0.24	**l**	35.04	0.05
F3	Oswego R. at Lock 6	10/13/94	2	4	339.48	2	0.28		47.82	0.14
F3	Oswego R. at Lock 6	11/15/94	4	4	262.83	2	0.30		39.63	0.08

Map #	Site	date	TSS (mg/L)	TOC (mg/L)	L filtered	# filters	PCB (ng/L)	DQI	PCB total ng	PCB ug/g ss
M2	Genesee R. at TP Park	4/27/94	87	2.7	4.96	1	9.78	l	48.50	0.11
M2	Genesee R. at TP Park	6/9/94	NA	NA	8.38	1	3.34		27.97	
M2	Genesee R. at TP Park	6/22/94	48	3.95	5.22	1	1.85		9.65	0.04
M2	Genesee R. at TP Park	7/14/94	14	4.1	6.8	1	7.16		48.72	0.51
M2	Genesee R. at TP Park	7/27/94	10	3.7	76.96	2	2.13		81.85	0.21
M2	Genesee R. at TP Park	8/9/94	10	3.4	81.11	2	1.64		66.31	0.16
M2	Genesee R. at TP Park	8/31/94	33	2.3	5.21	1	3.45		17.98	0.10
M2	Genesee R. at TP Park	9/14/94	12	4.7	10.02	1	1.88		18.81	0.16
M2	Genesee R. at TP Park	9/27/94	11	2.9	100.57	2	1.08	l	54.15	0.10
M2	Genesee R. at TP Park	10/28/94	14	2.6	60.65	2	1.81		54.99	0.13
M2	Genesee R. at TP Park	11/9/94	91	6	13.03	2	1.44		9.40	0.02
M2	Genesee R. at TP Park	11/21/94	18	2.7	56.51	2	0.62		17.44	0.03
Q1	18-Mile Cr. at Olcott	4/13/94	12	7.1	15.83	1	13.34	l	211.15	1.11
Q1	18-Mile Cr. at Olcott	4/27/94	17	6.4	9.53	1	27.72	l	264.22	1.63
Q1	18-Mile Cr. at Olcott	6/21/94	6	4.2	61.98	2	9.48		293.66	1.58
Q1	18-Mile Cr. at Olcott	7/6/94	6	5	96.33	2	7.84		377.55	1.31
Q1	18-Mile Cr. at Olcott	7/28/94	3	3.7	112.53	2	8.89		500.13	2.96
Q1	18-Mile Cr. at Olcott	8/10/94	5	3.7	107.24	2	5.00	s	267.93	1.00
Q1	18-Mile Cr. at Olcott	8/30/94	3	2.9	16.94	1	7.07		119.69	2.36
Q1	18-Mile Cr. at Olcott	9/13/94	4	4.6	127.68	2	6.19		394.98	1.55
Q1	18-Mile Cr. at Olcott	9/26/94	6	3.9	118.59	2	5.70		338.06	0.95
Q1	18-Mile Cr. at Olcott	10/11/94	2	5.3	93.73	2	5.00		234.18	2.50
Q1	18-Mile Cr. at Olcott	10/27/94	5	3.6	117.68	2	7.00		411.95	1.40
Q1	18-Mile Cr. at Olcott	11/10/94	11	9.4	38.54	2	16.25		313.16	1.48
Q1	18-Mile Cr. at Olcott	11/21/94	5	7.3	81.33	2	7.89		320.89	1.58
Q6	E. Branch 18-Mile Cr.	6/21/94	23	4	57.6	2	1.54		44.33	0.07
Q6	E. Branch 18-Mile Cr.	7/6/94	30	4.6	50.4	2	1.47		36.92	0.05
Q6	E. Branch 18-Mile Cr.	7/28/94	26	3.3	38.9	2	1.04		20.29	0.04
Q6	E. Branch 18-Mile Cr.	10/27/94	5	3.7	119.58	2	0.13	s	7.71	0.03
Q6	E. Branch 18-Mile Cr.	11/10/94	13	9.4	37.27	2	1.21		22.59	0.09
R1	18-Mile Cr. at Stone Rd.	6/21/94	20	5.4	58.31	2	15.94	s	464.88	0.80
R1	18-Mile Cr. at Stone Rd.	7/6/94	18	4	46.24	2	28.86		667.34	1.60
R1	18-Mile Cr. at Stone Rd.	7/28/94	97	20	32.31	2	31.19	s	503.85	0.32
R1	18-Mile Cr. at Stone Rd.	9/14/94	232	18.6	10.17	2	107.00	m	544.08	0.46
R1	18-Mile Cr. at Stone Rd.	10/27/94	5.5	3.15	106.23	2	8.56		454.91	1.56
R1	18-Mile Cr. at Stone Rd.	11/10/94	13	8.5	32.8	2	8.61		141.25	0.66
S17	Exchange St., Lockport	6/21/94	92	34	1.69	1	46.21	l	78.10	0.50
S22	18-Mile Cr. at Olcott St. Br.	6/21/94	20	2.8	61.67	2	8.14	s	250.91	0.41
S22	18-Mile Cr. at Olcott St. Br.	7/6/94	25	3.8	59.17	2	11.05		326.78	0.44
S22	18-Mile Cr. at Olcott St. Br.	7/28/94	17	2.6	41.15	2	10.20	l	209.83	0.60
S22	18-Mile Cr. at Olcott St. Br.	10/27/94	6	2.4	108.35	2	3.17		171.72	0.53
S22	18-Mile Cr. at Olcott St. Br.	11/10/94	17	10.5	25.24	2	6.94		87.63	0.41
	filter blank	4/14/94						s	11.50	
	filter blank	11/17/94	12.5	0.65	117.79	2	0.00		7.44	0.01
	filter blank	6/23/94							2.00	

Pesticides – PISCES

Table 6 gives a summary of pesticide observations from PISCES as "ng/L". The quotation marks signify the weakness of PISCES as a sampler for the pesticides. Concentrations from the hexachlorocyclohexanes (α-BHC, β-BHC, δ-BHC, and γ-BHC) are summed (Σ BHC). The cyclodienes are lumped into subsets of Σ heptachlor (heptachlor and heptachlor epoxide); aldrin/dieldrin/endrin (plus endrin ketone and endrin aldehyde); Σ endosulfans (endosulfans I and II and endosulfan sulfate); and Σ chlordane (a-chlordane and b-chlordane). And finally, the DDTs (4,4'-DDT, 4,4'-DDD, and 4,4'-DDE) were lumped as Σ DDT. Methoxychlor and toxaphene were never detected. Table 6 only lists samples where at least one pesticide was detected.

Samples taken between March and mid-July of 1994 were analyzed from extracts reduced to 10 mL (italicized in Table 6). Samples taken in October of 1993 and after mid-July, 1994 were reduced to 1 mL. The smaller extract final volume means that detection limits were an order of magnitude lower. Also, the extractions employed at the lab for EPA Method 608 may have identified some PCB congeners as pesticides. Sometimes high pesticide concentrations appear in samples where PCBs also occur but the presence of pesticides seems unlikely. For example, Σ BHCs at 3.8 ng/L and aldrin/dieldrin/endrin at 2.1 ng/L were reported from the outfall of Alcan (sample Map E #1, site ❖38-15). And finally, quantitations via PISCES are inherently less firm than those for PCBs.

Mirex, another cyclodiene pesticide (and fire retardant), is treated separately from the pesticides altogether (**Table 13**). Mirex is not a USEPA Method 608 analyte and was analyzed as part of the PCB congener scan on a limited number of samples.

Table 6. Summary of pesticides found by PISCES ("ng/L").

MAP #	date out	L sampled	rain fall inches	sum BHC	sum heptachlor	aldrin/dieldrin endrin	sum endosulfan	sum DDT	sum chlordane
A 1	8/2/94	16.48	0.48	0.19	ND	0.41	0.61	ND	ND
A 1	8/18/94	14.70	1.72	1.12	ND	0.24	1.21	ND	ND
A 1	9/1/94	12.94	1.59	2.08	ND	ND	0.46	ND	ND
A 1	9/15/94	11.49	0.46	1.57	ND	0.25	ND	ND	ND
A 1	10/13/94	16.75	4.35	1.48	0.40	ND	1.38	0.40	ND
A 1	11/2/94	8.24	3.36	2.00	ND	ND	0.85	ND	ND
A 1	11/15/94	4.93	1.41	2.35	ND	ND	1.83	ND	3.86
D 2	11/4/93	4.18	1.72	ND	ND	ND	31.09	ND	ND
E 1	10/26/94	11.46	0.32	3.84	ND	2.09	ND	ND	ND
E 2	11/2/94	10.21	3.88	0.87	ND	ND	0.50	ND	0.97
E 4	11/4/93	4.87	1.53	ND	ND	14.18	ND	ND	ND
E 4	*5/12/94*	*6.61*	*1.48*	*ND*	*ND*	*ND*	*16.63*	*ND*	*ND*
E 4	*6/9/94*	*7.53*	*1.20*	*4.52*	*ND*	*ND*	*ND*	*ND*	*ND*
E 5	*5/26/94*	*6.29*	*1.29*	*ND*	*ND*	*ND*	*14.78*	*ND*	*ND*
E 5	6/9/94	5.84	1.20	ND	ND	155.74	ND	ND	ND
F 3	8/11/94	16.62	1.20	0.69	0.23	ND	0.49	ND	ND
F 3	9/15/94	13.65	0.48	1.03	0.29	ND	ND	0.46	ND
F 3	9/28/94	10.50	1.56	1.85	0.59	ND	0.95	1.24	ND
F 3	10/13/94	9.75	0.47	2.91	0.66	ND	ND	0.83	ND
F 3	11/2/94	9.69	3.62	2.92	0.31	1.58	1.18	ND	ND
F 3	11/15/94	5.66	2.43	2.99	ND	ND	2.30	ND	2.40
H 8	9/12/94	11.27	0.32	0.28	ND	0.52	3.96	ND	0.43
H 9	9/12/94	11.08	0.32	2.30	ND	ND	1.44	ND	0.30
H 11	9/12/94	10.24	0.32	0.44	ND	ND	1.56	0.84	0.32
H 12	9/12/94	10.04	0.32	1.62	ND	ND	ND	0.65	ND
I 1	8/11/94	9.90	0.51	1.92	ND	ND	ND	ND	ND
I 3	8/11/94	8.76	0.51	ND	ND	ND	0.30	ND	ND
K 1	9/26/94	9.28	1.69	0.33	ND	ND	0.29	ND	ND
L 1	10/12/94	8.37	0.64	1.10	0.51	1.79	5.86	ND	0.59
L 5	10/12/94	8.71	0.64	2.27	0.65	0.98	8.96	1.84	ND

MAP #	date out	L sampled	rain fall inches	sum BHC	sum heptachlor	aldrin/dieldrin endrin	sum endosulfan	sum DDT	sum chlordane
L 6	10/12/94	8.73	0.64	17.54	1.02	6.07	3.55	ND	ND
M 1	7/14/94	27.23	0.57	0.10	ND	0.29	0.64	ND	ND
M 1	7/27/94	17.86	0.15	0.16	0.20	1.56	1.79	ND	ND
M 1	8/9/94	16.92	1.81	0.37	0.16	0.48	1.15	ND	ND
M 1	9/27/94	12.10	1.28	0.45	ND	ND	0.45	ND	0.21
M 1	11/9/94	5.28	3.23	0.44	ND	ND	ND	ND	ND
M 1	10/12/94	13.81	0.64	0.37	0.18	ND	ND	ND	ND
M 6	10/25/94	22.59	0.37	1106.62	23.90	ND	407.24	110.66	194.77
M 7	10/25/94	24.33	0.37	13.97	4.93	18.70	4.93	4.52	4.64
M 16	11/9/94	6.82	3.24	2.18	ND	3.08	0.94	ND	ND
M 17	11/9/94	5.98	3.24	ND	0.67	11.88	9.70	4.77	6.19
M 19	10/25/94	25.04	0.37	22.36	ND	ND	ND	ND	ND
M 20	11/9/94	6.53	3.24	0.49	0.80	ND	ND	ND	0.46
M 21	11/9/94	6.09	3.24	3.10	ND	ND	6.26	ND	3.78
M 2a	10/25/94	24.52	0.37	239.84	11.83	48.13	23.66	20.80	36.30
M 2c	10/25/94	23.56	0.37	89.54	2.50	29.71	54.32	9.34	33.53
N 2	9/13/94	7.30	0.20	1.07	ND	ND	0.38	ND	ND
O 2	9/13/94	7.93	0.20	2.56	ND	ND	ND	ND	ND
P 1	10/11/94	8.68	2.41	0.36	0.39	ND	2.41	ND	ND
P 2	9/26/94	10.43	0.82	3.08	ND	0.60	9.49	1.36	ND
Q 1	10/20/93	6.55	2.25	6.88	ND	ND	ND	ND	ND
Q 1	*4/13/94*	*4.45*	*2.35*	*ND*	*ND*	*ND*	*0.02*	*ND*	*ND*
Q 1	*4/27/94*	*6.76*	*1.83*	*ND*	*ND*	*ND*	*0.01*	*ND*	*ND*
Q 1	*5/11/94*	*8.55*	*1.20*	*ND*	*ND*	*ND*	*0.01*	*ND*	*ND*
Q 1	8/10/94	14.58	2.99	0.18	0.42	1.33	2.96	0.51	ND
Q 1	9/13/94	14.33	1.13	2.14	ND	ND	1.65	ND	ND
Q 1	11/10/94	5.86	2.97	4.04	ND	2.25	2.99	ND	ND
Q 1	11/21/94	36.91	4.44	1.35	0.27	0.84	2.41	ND	ND
R 5	8/10/94	13.91	2.99	8.12	ND	3.09	15.17	ND	ND
S 9	8/31/94	21.25	3.15	3.39	0.65	1.34	1.60	0.84	0.86

Pesticides – Pressure Filtration

Table 7 gives similar pesticide data from filtration samples. Only those samples where a detection has occurred for at least one of the pesticides are listed. Unlike PISCES data, pressure filtration results are less problematic for pesticide concentrations. Detection limits vary with the amount of water filtered.

Table 7. Pesticide concentrations from suspended solids phase sampling (ng/L).

Map #	date	TSS	TOC	L filtered	sum BHC	sum heptachlor	aldrin/dieldrin endrin	sum endosulfans	sum DDT	sum chlordanes
A 1	8/18/94	4	6.4	9.21	ND	ND	0.48	ND	ND	0.80
A 1	9/1/94	4	4.1	15.27	0.48	ND	0.76	ND	ND	0.66
F 3	7/29/94	4	4.2	127.42	0.09	0.03	0.11	0.06	ND	0.13
F 3	9/1/94	3.5	2.35	27.84	ND	ND	0.19	ND	ND	ND
F 3	9/15/94	6	5.3	21.57	0.70	ND	ND	ND	ND	ND
F 3	9/28/94	5	4.1	143.33	ND	ND	ND	ND	ND	0.12
M 1	7/27/94	10	3.7	38.48	0.29	0.08	0.13	ND	ND	0.05

Map #	date	TSS	TOC	L filtered	sum BHC	sum heptachlor	aldrin/dieldrin endrin	sum endosulfans	sum DDT	sum chlordanes
M 1	8/9/94	10	3.4	40.56	0.46	ND	0.15	0.21	0.22	0.68
M 1	8/31/94	33	2.3	5.21	2.88	ND	0.81	ND	ND	1.11
M 1	9/14/94	12	4.7	10.02	2.20	0.96	1.24	ND	ND	4.09
M 1	9/27/94	11	2.9	50.29	0.22	0.09	ND	0.05	ND	0.44
M 1	10/28/94	14	2.6	30.33	ND	0.14	0.04	0.04	ND	0.08
Q 1	7/28/94	3	3.7	56.27	0.24	0.06	0.19	0.05	0.08	0.04
Q 1	8/10/94	5	3.7	53.62	ND	0.07	0.14	ND	ND	0.61
Q 1	9/13/94	4	4.6	63.84	4.67	ND	0.14	ND	0.11	0.27
Q 1	9/26/94	6	3.9	59.30	0.32	0.11	0.20	ND	0.08	0.55
Q 1	10/11/94	2	5.3	46.87	ND	0.10	0.10	ND	0.08	0.53
Q 6	7/28/94	26	3.3	19.45	0.13	0.09	ND	ND	0.70	ND
Q 6	10/27/94	5	3.7	59.79	0.02	0.02	ND	ND	0.22	ND
R 1	7/28/94	97	20	16.16	ND	1.22	ND	ND	ND	0.79
R 1	9/14/94	232	18.6	5.09	3.44	ND	3.34	ND	ND	8.95
R 1	10/27/94	5.5	3.15	53.12	ND	0.17	0.03	0.09	0.14	0.17
S 22	7/28/94	17	2.6	20.58	0.04	0.79	0.45	0.63	0.16	0.52

Tables 4 through 7 are summaries. Raw data, which includes individual PCB congeners and pesticides from PISCES, sediments, pressure filtration and GLSE samples may be obtained on diskette from the author. The raw data also contains results of PISCES and glass fiber filter field blanks. One of the filter blanks was obtained by pumping water presumed to be free from anthropogenic contaminants (Orenda Spring at Saratoga Spa in Saratoga, NY). Blanks were also taken for the GLSE. One of these was taken in the Orenda spring and two were from a fish hatchery believed to be using contaminant-free water. At that time, ice and snow prevented accessing the Orenda Spring. No attempt was made to place PISCES in the Orenda Spring due to inadequate security and because it is used for drinking water.

Mercury

Mercury data appear in **Table 8**. On a few occasions methyl mercury was analyzed. In those cases, either inorganic mercury (Hg II) or total mercury was also measured.

Table 8. Mercury in surface water and wastewaters (ng/L).

Map #	**sample**	**site**	**date**	**Me-Hg**	**Hg(II)**	**total**
A 1	surface	Black R. at Dexter	11/5/93	0.157	0.184	0.341
A 1	surface	Black R. at Dexter	3/22/94			3.5
A 1	surface	Black R. at Dexter	5/4/94			2.7
A 1	surface	Black R. at Dexter	6/1/94			2.4
A 1	surface	Black R. at Dexter	8/2/94			5.35
A 1	surface	Black R. at Dexter	9/15/94			2.92
A 1	surface	Black R. at Dexter	10/13/94			2.48
A 6	surface	Sandy Cr.	11/5/93	0.046	0.305	0.351
A 7	surface	Salmon R.	11/5/93	0.117	0.416	0.533
A 8	surface	Black R. at Forestport	8/2/94			3.92
A 9	surface	Moose R. at Lyons Falls	8/2/94			2.58
A 10	surface	Beaver R. at Naumberg	8/2/94			2.45
A 11	surface	Deer R. at Deer River	8/2/94			1.79
A 12	surface	Indian R., inlet to Indian Lake	8/2/94			1.42
A 13	surface	Indian R., outlet from Indian Lake	8/2/94			2.25

Map #	sample	site	date	Me-Hg	Hg(II)	total
A 14	surface	Indian R. at Antwerp	8/2/94			0.755
B 1	surface	Kelsey Cr. at Rt. 37	6/1/94			1.3
B 2	surface	Oily Cr. at LeRay Sp.	5/4/94			0.1
B 3	surface	Oily Cr. at Morrison	5/17/94			2.1
B 3	surface	Oily Cr. at Morrison	6/1/94			1.3
B 4	surface	Kelsey Cr. at Superior	5/4/94			0.4
B 4	surface	Kelsey Cr. at Superior	5/17/94			1.2
B 4	surface	Kelsey Cr. at Superior	6/1/94			3.1
C 1	surface	Genesee R. at Mt. Morris	6/24/94			6.11
C 2	surface	Genesee R. at Fowlerville	6/24/94			5.59
D 3	surface	Oswego R. at Hinmansville	7/7/94			1.46
D 4	surface	Seneca R. at Baldwinsville	7/7/94			2.19
D 5	surface	Onondaga outlet	7/7/94			3.23
D 6	surface	Oneida R. at Morgan Rd.	7/7/94			0.785
E 4	surface	lower Wine Cr.	10/22/93	0.138	5.54	5.678
E 4	surface	lower Wine Cr.	5/12/94			1.8
E 4	surface	lower Wine Cr., above pipe	5/26/94			3.1
E 4	surface	lower Wine Cr., in pipe	5/26/94			2.3
E 4	surface	lower Wine Cr.	6/9/94			3.43
E 5	surface	upper Wine Cr.	5/26/94			2.7
E 5	surface	upper Wine Cr.	6/9/94			10.7
F 3	surface	Oswego R. at Lock 6	4/1/94			3.7
F 3	surface	Oswego R. at Lock 6	4/14/94			3.68
F 3	surface	Oswego R. at Lock 6	4/28/94			3.1
F 3	surface	Oswego R. at Lock 6	5/11/94			2.1
F 3	surface	Oswego R. at Lock 6	7/7/94			1.4
F 3	surface	Oswego R. at Lock 6	9/15/94			1.44
F 3	surface	Oswego R. at Lock 6	9/28/94	0.157	NA	1.54
F 3	surface	Oswego R. at Lock 6	10/13/94	0.118	NA	0.621
F 7	surface	Oswego R. at Minetto	11/6/92			2.91
G 4	surface	Oswego R. at Fulton	10/22/93	0.125	2.39	2.515
H 2	surface	S. Branch Ley Cr. at Rt. 635	8/11/94			1.4
H 8	surface	Ley Cr. at Townline Rd.	8/11/94			2.47
H 10	surface	Ley Cr. at LeMoyne St.	8/11/94			2.25
H 11	surface	Ley Cr. at Park St.	8/11/94			5.59
J 7	surface	Skan. Cr. Jordan Rd, upstream	3/8/95			5.89
J 8	surface	Skan. Cr. Welsh Allyn outfall	3/8/95			20.6
J 9	surface	Skan. Cr., upstream of Stauffer, L bank	3/8/95			6.98
J 10	surface	Skan. Cr., at seep from Stauffer, R bank	3/8/95			9.44
J 11	surface	Skan. Cr., inlet to culvert at Stauffer , R bank	3/8/95			7.47
J 12	surface	Skan. Cr., outlet from culvert, L bank	3/8/95			549
J 13	surface	Skan. Cr., above trib., L bank	3/8/95			34.7
J 14	surface	Skan. Cr., below island, L bank	3/8/95			9.1
J 15	surface	Skan. Cr., Jordan Rd, downstream	3/8/95			6.12
J 16	surface	Skan. Cr., P&S Filtration, above dam	3/8/95			6.53
L 7	surface	Oatka Cr., bridge at Rt. 36, Mumford	10/25/94			0.408
L 8	surface	Oatka Cr., Circular Hill Rd.	10/25/94			1.79
L 11	sewer	Brockport interceptor to NWQ TP	10/12/94			148
L 12	sewer	grease interceptor, NWQ TP	10/12/94			372
L 10a	sewer	NWQ TP influent	10/12/94			389
L 10b	sewer	NWQ TP effluent	10/12/94			5.31
M 1	surface	Genesee R. at TP Park	10/22/93	0.075	3.05	3.125
M 1	surface	Genesee R. at TP Park	3/31/94			8.6
M 1	surface	Genesee R. at TP Park	4/13/94			8.97

Map #	sample	site	date	Me-Hg	Hg(II)	total
M 1	surface	Genesee R. at TP Park	4/27/94			5.8
M 1	surface	Genesee R. at TP Park	5/11/94			2.4
M 1	surface	Genesee R. at TP Park	6/9/94			2.8
M 1	surface	Genesee R. at TP Park	6/24/94			4.63
M 1	surface	Genesee R. at T.P. Park	9/14/94			2.6
M 1	surface	Genesee R. at T.P. Park	9/27/94	0.17	NA	2.23
M 3	surface	Genesee R. at Rt. 31, R bank	6/24/94			3.23
M 3	sewer	Irondequoit pump station	10/12/94			280
M 4	surface	Irondequoit Cr.	10/22/93	0.014	2.65	2.664
M 4	sewer	Ferris St. and Cover Lane	10/12/94			133
M 5	sewer	Norton Ave. and Halenbach St.	10/12/94			262
M 6	sewer	Hasting St. pump station	10/12/94			257
M 7	sewer	Cliff St. pump station	10/12/94			427
M 8	sewer	Dix St. near #104	10/12/94			87.5
M 9	sewer	Taylor Instrument site, downstream	10/12/94			16,469
M 10	sewer	Taylor Instrument site, upstream	10/12/94			53.4
M 11	sewer	Hutchinson Hall, U of R River Campus	10/12/94	0.667	NA	134
M 12	sewer	Central utilities, U of R	10/12/94	1.03	NA	352
M 13	sewer	S. wing Med Center, U of R	10/12/94	1.04	NA	149
M 14	sewer	Eastman Dental School	10/12/94	3.28	NA	7,451
M 15	sewer	Strong Mem. Hosp	10/12/94			831
M 19	sewer	John St. pump station	10/12/94			168
M 21	surface	Genesee R. at Rt. 252	6/24/94			5.36
M 18a	sewer	GCO preinfluent manhole	10/12/94			173
M 18b	sewer	GCO preinfluent, "the pit"	10/12/94			76.4
M 18c	sewer	GCO influent	10/12/94			50.5
M 18d	sewer	GCO effluent	10/12/94			2.93
M 2a	sewer	F. E. Van Lare influent	10/12/94	3.5	NA	660
M 2b	sewer	F. E. Van Lare TP recirculation line	10/12/94			81.6
M 2c	sewer	F. E. Van Lare effluent	10/12/94			8.22
N 1	surface	Genesee R. above Wellsville (Weidrick Rd)	8/30/94			1.98
N 3	surface	Genesee R. at Scio	8/30/94			1.94
O 2	surface	Van Campen Cr. below Friendship, Rt 31	8/30/94			1.43
P 5	surface	Oak Orchard Cr.	10/22/93	0.033	1.72	1.753
Q 1	surface	18-Mile Cr. at Olcott Harbor	10/22/93	0.017	2.25	2.267
Q 1	surface	18-Mile Cr. at Olcott Harbor	3/31/94			6.4
Q 1	surface	18-Mile Cr. at Olcott Harbor	4/13/94			6.93
Q 1	surface	18-Mile Cr. at Olcott Harbor	4/27/94			7.5
Q 1	surface	18-Mile Cr. at Olcott Harbor	5/11/94			6.4
Q 1	surface	18-Mile Cr. at Olcott Harbor	9/26/94	0.007	NA	2.63
Q 3	surface	18-Mile Cr. below Burt dam	9/23/93			1.3
Q 5	surface	18-Mile Cr. at Jaques Rd	9/14/94			20.6
Q 6	surface	East Branch at Transit Rd.	9/23/93			1.31
Q 7	surface	Barge Canal at Pendleton	9/23/93			0.9
R 1	surface	18-Mile Cr. at Stone Rd.	1/7/93			20.52
R 1	surface	18-Mile Cr. at Stone Rd.	1/7/93			19.57
R 1	surface	18-Mile Cr. at Stone Rd.	7/22/93			10.67
R 1	surface	18-Mile Cr. at Stone Rd.	9/23/93			5.32
R 1	surface	18-Mile Cr. at Stone Rd.	9/14/94			139
R 2	sewer	Lockport STP, influent	9/23/93			96.1
R 2	sewer	Lockport STP, effluent	9/23/93	0.65	1.23	1.88
R 3	surface	The Gulf at W. Jackson St.	7/22/93			0.62
R 6	sewer	Lockport manhole at Russell St.	6/8/94			17.4
R 7	sewer	Lockport manhole at Prospect St.	6/8/94			18.2

Map #	sample	site	date	Me-Hg	Hg(II)	total
R 8	sewer	Lockport manhole at Big Bridge (#6)	6/8/94			26
R 10	sewer	Lockport manhole at South and Washburn Sts.	8/31/94			128
R 11	sewer	Lockport manhole at Davison S. of Akron St.	8/31/94			399
R 14	sewer	Lockport manhole at Spring St. S. of tunnel	8/31/94			554
R 16	sewer	Lockport manhole at Washburn and Union Sts.	8/31/94			1,275
R 17	sewer	Lockport manhole off Exchange St. (#19)	6/8/94			327
R 17	sewer	Lockport manhole off Exchange St. (#19)	8/31/94			2,487
R 18	sewer	Lockport manhole at Market St. (#15)	6/8/94			192
R 18	sewer	Lockport manhole at Market St. (#15)	8/31/94			614
R 20	surface	N. side, Barge Canal	9/23/93	0.18	0.87	1.05
R 21	surface	18-Mile Cr. at Clinton	7/22/93			5.1
R 23	sewer	Lockport manhole at Olcott St (#3)	6/8/94			11.8
R 29	surface	S. side, Barge Canal	6/8/94			4.3
R 29	sewer	Lockport manhole at Chestnut and Market Sts.	8/31/94			98.2
R 30	sewer	Lockport manhole at Market St above #15	8/31/94			541

Mercury results from sediments and soils are shown in **Table 9**.

Table 9. Total mercury concentrations in soils and sediments.

Map #	sample	site	date	ng/g
A 1	sediment	Black R. at Dexter	8/19/94	1087
L 2	sediment	Irondequoit Cr.	8/9/94	16.4
M 1	sediment	Genesee R. at TP Park	8/9/94	40.3
P 3	sediment	Oak Orchard Cr. trib at Beal Rd.	7/28/94	126
P 4	sediment	Oak Orchard Cr.	8/30/94	145
Q 2	sediment	18-Mile Cr. at Olcott Beach	8/10/94	655
S 21	sediment	18-Mile Cr. at Clinton St.	10/12/94	1492
S 25	soil	Old Flintkote dump, black soil	11/22/94	2823
S 26	soil	Old Flintkote dump, red soil	11/22/94	3342
S 31	soil	below Dussault foundry	11/22/94	221
S 32a	soil	clayey soil on bank	11/22/94	66.5
S 32b	soil	black soil on bank, below canal	11/22/94	81
S 33	soil	black soil 100 ft downstream, on bank	11/22/94	43.6

Dioxin and Furans in Sediments and Suspended Solids

Dioxin and furan analyses were performed on a limited number of sediment and suspended solids samples. **Table 10** presents sediment observations. The Table provides Toxic Equivalency Factors (TEF) which permit all dioxin and furan congeners to be summed in units that weight them in terms of toxicity of 2,3,7,8-tetrachlorodibenzo dioxin (2,3,7,8-TCDD TEQ). Total organic carbon (TOC) was measured for each sample. The amount of organic material in a sediment affects its affinity with hydrophobic substances like dioxins/furans. TEF derived total 2,3,7,8-TCDD concentrations were calculated on the organic portion of the sediments (2,3,7,8-TCDD TEQ/mg TOC). This permits the sites to be compared irrespective of the affinities of the sediments for dioxins/furans.

Table 10. Dioxins and furans in soils and sediments.

		Black R.	Irondequoit Cr.	Genesee R.	Oak Orchard Cr.	Eighteenmile Cr.	Old Flintkote #6	Old Flintkote #5
		Map A #1	Map L #2	Map M #1	Map P #4	Map Q #2	Map S #25	Map S #26
		8/18/94	8/9/94	8/9/94	8/30/94	8/10/94	11/22/94	11/22/94
total 2,3,7,8 TCDD (TEQ) , pg/g		2.6	0.15	27	6.8	110	570	30
TOC (%)		0.80	0.70	0.50	2.00	1.60	2.10	0.40
total 2,3,7,8-TCDD (pg/g TOC)		330	22	5,300	340	6,900	27,000	7,500
pg/g	TEF							
2,3,7,8-TCDD	1	<1.2	<1	<1.4	<1	<1.3	40	<.99
1,2,3,7,8-PeCDD	0.5	<1.2	<1.2	<1.3	<1.1	<1.4	68	8
1,2,3,4,7,8-HxCDD	0.1	<1.5	<1.4	5.7	<1.4	14	88	25
1,2,3,6,7,8-HxCDD	0.1	3.3	<1.6	<1.9	4.6	70	530	7.8
1,2,3,7,8,9-HxCDD	0.1	<1.4	<1.3	<1.6	<1.3	13	190	2
1,2,3,4,6,7-HpCDD	0.01	87	4.3	730	130	2100	18000	290
OCDD	0.001	1200	59	18000	2200	30000	150000	6000
2,3,7,8-TCDF	0.1	<1	<1.1	<1.2	<1	22	10	16
1,2,3,7,8-PeCDF	0.05	<.77	<.73	<.9	<.69	15	17	7.4
2,3,4,7,8-PeCDF	0.5	<1.1	<1	<1.3	<.98	21	53	13
1,2,3,4,7,8-HxCDD	0.1	<.83	<.77	<.9	10	110	73	8.5
1,2,3,6,7,8-HxCDF	0.1	<.96	<.9	<1	3.3	31	38	6
2,3,4,6,7,8-HxCDF	0.1	<1	<.99	<1.1	2.9	22	64	8.9
1,2,3,7,8,9-HxCDF	0.1	<1	<.96	<1.1	<.93	7.9	<.99	<.68
1,2,3,4,6,7,8-HpCDF	0.01	20	4.3	39	110	1400	3200	240
1,2,3,4,7,8,9-HpCDF	0.01	<1.5	<1.4	<1.8	<1.4	33	120	<1
OCDF	0.001	30	6.6	380	120	2700	8000	250
Tot-TCDD		<1.2	<1	<1.4	3.5	17	120	<.99
Tot-PCDD		<1.2	<1.2	<1.3	<1.1	38	410	74
Tot-HxCDD		21	<1.6	220	38	580	3100	170
Tot-HpCDD		170	7.4	9900	250	4100	34000	670
OCDD		1200	59	18000	2200	30000	150000	6000
Tot-TCDF		<1	6.8	<1.2	6.8	240	96	260
Tot-PCDF		3.2	<.73	<.9	15	150	400	95
Tot-HxCDF		15	2.2	19	44	610	2500	130
Tot-HpCDF		54	4.3	210	160	3000	14000	540
OCDF		30	6.6	380	120	2700	8000	250

Table 11 displays dioxin and furan data from suspended solids collected in Lockport sewers by pressure filtration on 11/22/1994. The NYS guidance value for 2,3,7,8-TDCC TEQ is 35 pg/L. Data from the filters are also shown in terms of 2,3,7,8-TCDD TEQs/mg TOC.

Table 11. Suspended solids dioxin and furan results from Lockport sewers on 11/22/94 (pg/L).

	The Gulf	**Prospect St.**	**Exchange St.**	**Market St.**
	Map R #3	**Map R #15**	**Map S #15**	**Map S #18**
L filtered	17.51	20.15	10.36	8.35
TSS (mg/L)	24	45	49	110
TOC (mg/L)	7.9	34.2	46.7	85.6
pg TEQ/L	0.45	0.60	0.15	0.57
pg TEQ/kg TSS	19	13	3.1	5.2
pg TEQ/kg TOC	56	18	3.3	6.6
pg/L				
2,3,7,8-TCDD	<.12	<.074	<.13	<.25
1,2,3,7,8-PCDD	<.14	<.098	<.15	<.29
1,2,3,6,7,8-HxCDD	<.24	<.18	<.25	<.48
1,2,3,7,8,9-HxCDD	<.24	<.19	<.27	<.48
1,2,3,4,7,8-HxCDD	<.21	<.16	<.23	<.42
1,2,3,4,6,7,8-HpCDD	6.5	12	6.4	8.7
OCDD	78	200	88	160
2,3,7,8-TCDF	<.11	<.066	<.12	<.23
1,2,3,7,8-PCDF	<.097	<.061	<.1	<.2
2,3,4,7,8-PCDF	<.12	<.078	<.13	<.26
1,2,3,4,7,8-HxCDF	<.12	<.094	<.14	<.26
1,2,3,6,7,8-HxCDF	<.13	<.1	<.16	<.28
2,3,4,6,7,8-HxCDF	0.45	<.12	<.18	<.32
1,2,3,7,8,9-HxCDF	<.16	<.11	<.17	<.33
1,2,3,4,6,7,8-HpCDF	2.5	2.7	<.26	3.1
1,2,3,4,7,8,9-HpCDF	<.32	<.25	<.29	<.62
OCDF	7.4	12	<1.1	12
Tot-TCDD	<.12	0.42	<.13	<.25
Tot-PCDD	<.14	<.098	<.15	<.29
Tot-HxCDD	<.24	2.2	<.27	<.48
Tot-HpCDD	13	24	11	18
OCDD	7.4	200	88	160
Tot-TCDF	<.11	<.066	<.12	<.23
Tot-PCDF	<.097	<.061	<.1	<.2
Tot-HxCDF	2.5	1.5	<.14	2.4
Tot-HpCDF	3.7	6.1	<.26	6.4
OCDF	7.4	12	<1.1	12

DISCUSSION

Overview -- Chemical Loads and Concentrations

PCBs

Of the four primary tributaries, Eighteenmile Creek consistently had the largest PCB concentrations in the aqueous (PISCES) and suspended solids phases. The NYS PCB standard for surface waters is 1 ng/L; the guidance value is 0.6 pg/L. Differences between the tributaries and between the media are illustrated in **Figures 9** and **10**.

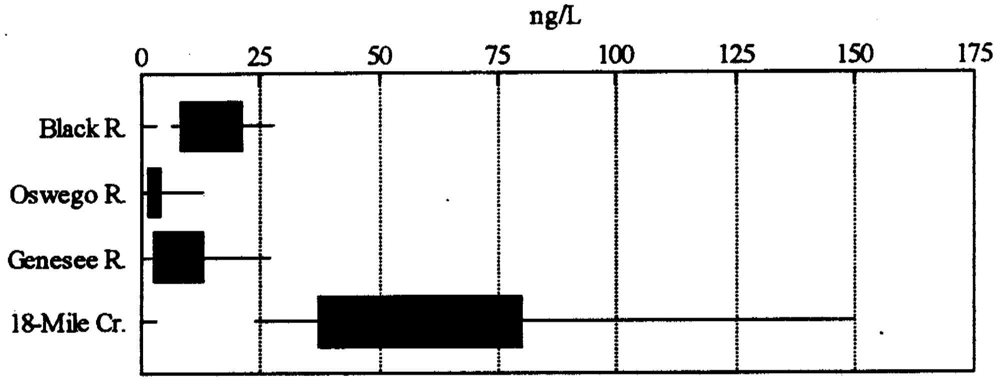


Figure 9. PISCES PCB concentrations, 25th to 75th percentiles and ranges.

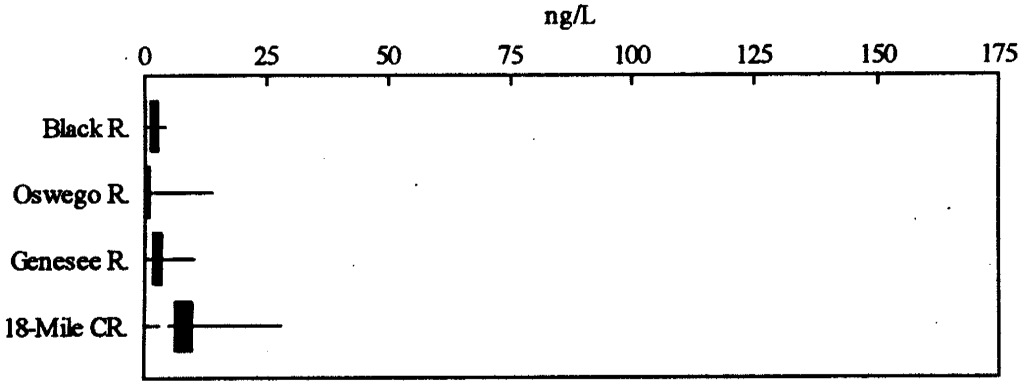


Figure 10. Suspended solids PCB concentrations, 25th to 75th percentiles and ranges.

PCB loading is the sum of PCB concentrations from the two media multiplied by mean stream flow. The four products are displayed in **Figure 11**. While concentrations are greatest in Eighteenmile Creek, the Black River is the largest of the four PCB sources to Lake Ontario.

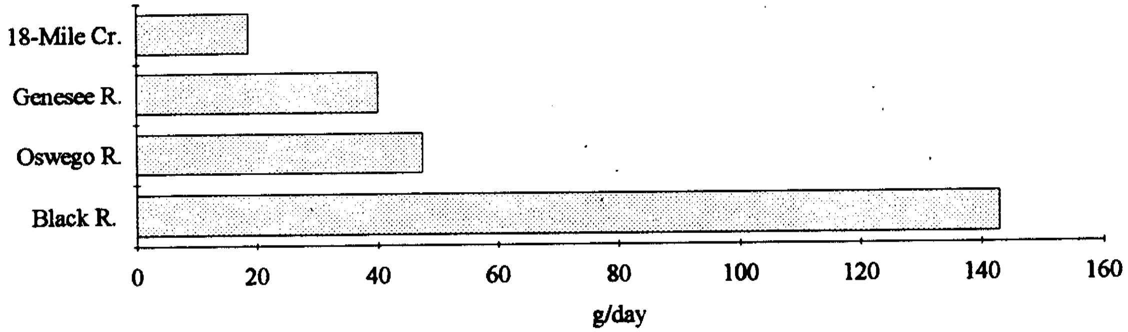


Figure 11. PCB load estimates from the four primary tributaries.

The composition of PCBs in the aqueous phase is lighter than the PCBs seen on suspended solids. In the Black, Oswego, and Genesee Rivers, PISCES samples were dominated by dichlorobiphenyls and the most abundant congeners in suspended solids were pentachlorobiphenyls. In Eighteenmile Creek, however, the PISCES samples were heavier (trichlorobiphenyls instead of dichlorobiphenyls) while the suspended solids were lighter (tetrachlorobiphenyls instead of pentachlorobiphenyls). This is illustrated in **Figure 12**.

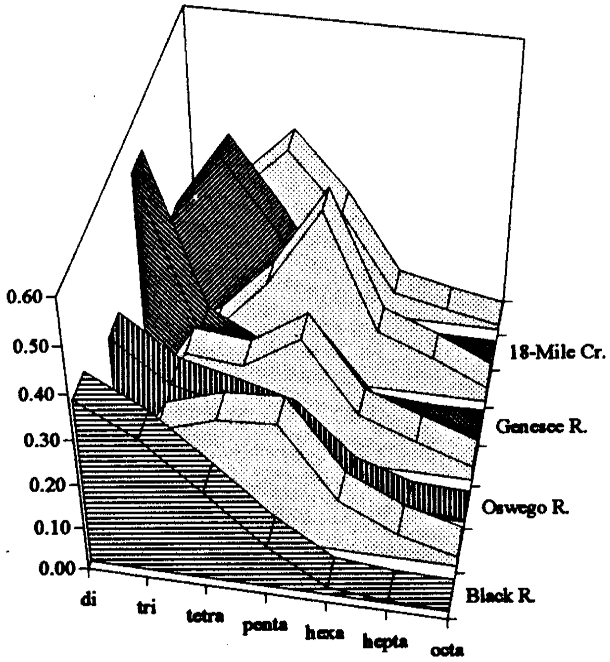


Figure 10. Relative homolog abundances of PCBs in the four primary tributaries from aqueous and suspended phase samples. Mean relative abundances from PISCES from each of the tributaries are shown cross hatched and the corresponding suspended solids phase mean relative homolog abundances are shown dotted.

Relative abundances of PCBs from the dissolved and particulate phases may be calculated from the log octanol/water partition ratios and the assumption that total suspended solids or total organic carbons is functionally equivalent to octanol. The calculations are very sensitive to the choice of which Aroclors are present. If it is assumed that the parent PCB has a log octanol/water partition ratio of Aroclor 1242, the amount of PCB found on suspended solids is too high but if the parent PCB was a mixture of the Aroclors indicated from Figure 10 in the amount indicated on Figure 8, the suspended solids fraction is too low. For example, the median amount of PCB from the Eighteenmile Creek suspended solids samples was 7.8 ng/L, the median concentration of suspended solids was 5 mg/L and if the parent PCB was Aroclor 1242, it would be expected to find 3 ng/L on the suspended solids. Were the PCBs 84% Aroclor 1242 and 16% Aroclor 1248, as suggested by Figure 10, there would be 23 ng/L on the suspended solids.

Pesticides

Table 12 summarizes pesticide results from the primary sites. Mean concentrations, all converted to "ng/L", were calculated by assigning zero to non-detections. Only observations made after 1 mL extracts were used are included. The quotation marks signify the weakness of PISCES derived pesticide quantitations. NYSDEC aquatic and human health standards for the pesticides are shown below:

	ng/L	
	aquatic	human health
a-BHC	10	20
a-endosulfan	9	NA
chlordane	2	20
aldrin+dieldrin	1	0.9
endrin	2	200
g-BHC	10	20
heptachlor + hep. epoxide	1	9
total DDT	1	10

PISCES may provide useful pesticides information in some cases. Elevated pesticides detections were seen below golf courses (Map L #6 - Oak Hill Country Club and below a golf course outside this area of investigation - Town of Tonawanda in Erie County) and in at least one instance, elevated levels below a pesticide-associated inactive hazardous waste site (Map P #2 - downstream Johnson Creek, below ❖32-2 - West Ave. site in Lyndonville). Of the eleven samples with total pesticide concentrations greater than 10 "ng/L", five were samples from Monroe County waste waters. Both influent and effluent concentrations from the Frank E. Van Lare STP in Monroe County (Map M #s 2a and 2c) had high pesticide levels. Means from the four principal tributaries show again that Eighteenmile Creek (Map Q #1) had the greatest overall pesticide concentrations. High pesticide concentrations also appeared in Little Black Creek (Map M #17) and in upper Wine Creek (Map E #5). The high "concentration" of the aldrin/dieldrin/endrin complex in the 6/9/94 Map E #5 sample was not found in an earlier sample from the same location.

Table 12. Mean pesticide concentrations from the primary tributaries ("ng/L").

		Black	Oswego	Genesee	18-Mile
sum BHC	suspended solids	0.068	0.11	0.76	0.58
	PISCES	1.5	1.2	0.32	1.5
heptachlors	suspended solids	ND	0.004	0.16	0.039
	PISCES	0.057	0.21	0.089	0.14
aldrin/dieldrin/endrin	suspended solids	0.18	0.043	0.30	0.086
	PISCES	0.13	0.16	0.39	0.89
endosulfans	suspended solids	ND	0.008	0.037	0.005
	PISCES	0.91	0.49	0.67	2.0
sum DDTs	suspended solids	ND	ND	0.027	0.039
	PISCES	0.057	0.25	ND	0.10
chlordanes	suspended solids	0.21	0.035	0.81	0.22
	PISCES	0.55	0.24	0.034	ND

Mercury

The Great Lakes Initiative water quality standard for whole water mercury (protection of wildlife) is 1.3 ng/L. The current New York State standard is 200 ng/L which is also the detection limit of the present official analytical method. Of 105 surface water samples analyzed for mercury under this project and a companion study in the Niagara River area:

14 observations < 1.3 ng/L
53 observations >1.3 and < 5 ng/L
25 observations >5 and < 10 ng/L
13 observations > 10 ng/L

Of the 13 surface water samples with mercury concentrations greater than 10 ng/L, five were from the Lockport area, four were from the Buffalo area, three were from Skaneateles Creek, and one was from upstream Wine Creek. Lockport is an old industrial city and a dump in the creek (Old Flintkote dump) may be a contributor. The Flintkote building was investigated but the dump was not. Soil samples from this site are rich in mercury, about 3,000 ng/g, and a sediment core from near Eighteenmile Creek's mouth shows that mercury levels are higher near the top (recent) than the bottom.

Some of the large whole water concentrations were associated with run-off events. The Skaneateles Creek samples, also taken during a run-off time, are associated with two industrial sites. A sample from one site had a mercury concentration of 550 ng/L.

Seventy-two waste water samples were taken from Buffalo, Lockport, and Rochester. Of these, only four had mercury concentrations less than 10 ng/L and all of these were treated STP effluents. The four treatment plants achieved an average mercury reduction of 97%. Median mercury concentrations in untreated waste water was 130 ng/L. Five samples had whole water mercury levels greater than 1000 ng/L. Two of these were from Monroe County, 16,500 ng/L in a sewer below a former mercury thermometer factory, and 7,500 ng/L in a sewer below a dental school. Mercury levels in Monroe County waste waters were generally quite high. The influent concentration at the largest Monroe County STP was 660 ng/L. Removal efficiency was greater than 98% but the plant effluent still had a mercury concentration more than six times above the proposed 1.3 ng/L standard. High mercury levels were seen in Lockport sewer wastewaters below a foundry (2,500 ng/L) and below a former radiator factory (1,300 ng/L). In Buffalo sewers a high wastewater mercury concentration occurred downstream from a rail yard (1,600 ng/L) but an upstream sample is lacking.

Methyl mercury was analyzed in 20 samples along with total mercury. The median methyl contribution was 2.4% of the total. Wastewaters tended to have a lower median percent methyl level than surface waters (0.51% versus 6.3%). The only STP effluent (Lockport) analyzed for methyl mercury had a high percentage of organic mercury - 35%.

Of the four primary sites, mercury concentrations were greatest at Eighteenmile Creek.

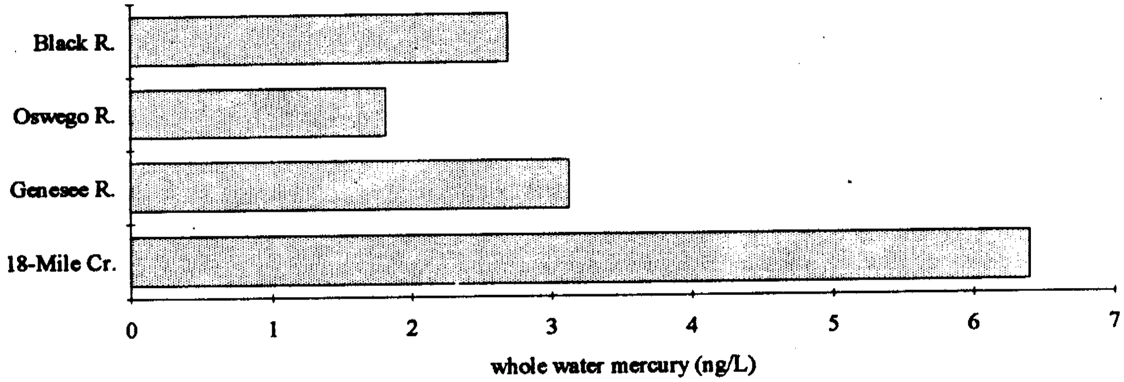


Figure 11. Median concentrations of mercury at the four principal sampling sites.

Mercury loads to Lake Ontario were dominated by water discharge.

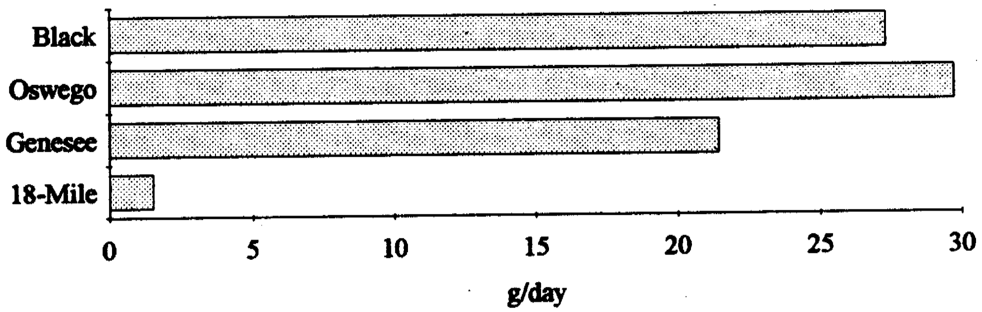


Figure 12. Mercury loads based on median concentrations.

Dioxins/Furans

Dioxins and furans were sampled in sediments but rarely. Results are expressed in 2,3,7,8-TCDD toxic equivalents (2,3,7,8-TCDD TEQ) and normalized for sediment total organic carbon content (**Figure 13**). The NYSDEC guidance value for dioxins/furans is 35 pg/L 2,3,7,8-TCDD TEQ for water and a NYS guidance for the protection of wildlife from bioaccumulation of dioxins is 0.2 ng/g TOC. A possible upstream source for the dioxins in Eighteenmile Creek, the Old Flintkote dump, was sampled at two locations. Old Flintkote dump sample S#25 was the most contaminated. This was the only sample in which actual

2,3,7,8-TCDD was measured. Comparisons between dioxin/furans from sediments and filters are difficult. The total amount of solids collected on the filters was small and the concentrations of TCDD TEQ/mg TOC appear to be smaller than those from sediments. It is possible that this is an artifact of sampling.

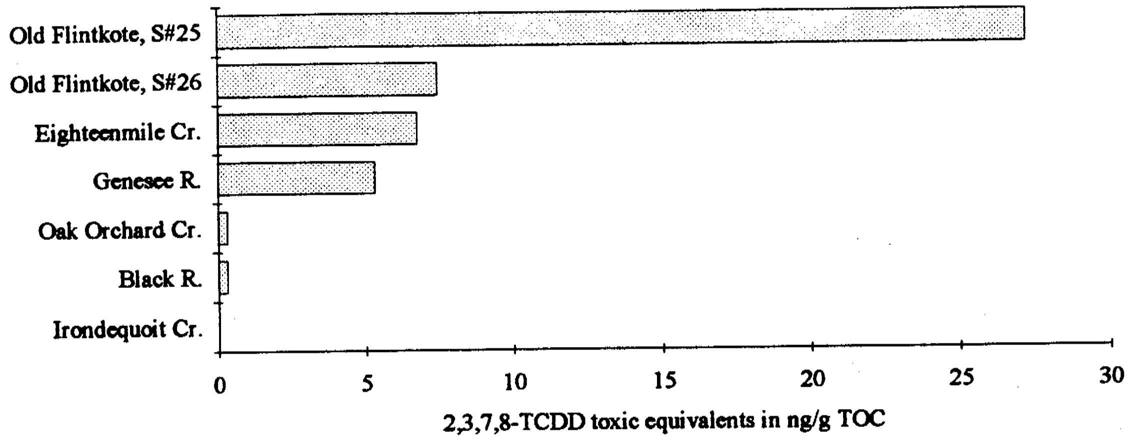


Figure 13. Dioxin and furan concentrations in sediments and soils expressed in TEQs and normalized by TOC.

Mirex

Mirex (or Dechlorane) was used by Armstrong World Industries as a flame retardant in their Fulton plant in the manufacture of paper backing for linoleum tile. Some has escaped to the Oswego River and to Lake Ontario. Sampling was conducted to determine if mirex can be found in the water column and traced back to any current source. PISCES (16 observations), suspended solids (8 observations), and digestigator (3 observations) samples from the Oswego River were analyzed for mirex. As with the other pesticides, PISCES quantitations for mirex should be understood as being semi-quantitative. A separate special study was performed in the spring of 1993 using pressure filtration to collect suspended solids. These later samples were taken and analyzed by Dr. John Hassett at the SUNY-College of Environmental Science and Forestry.

Samples from the Genesee River (9 PISCES and 5 suspended solids) and Eighteenmile Creek (8 PISCES and 14 suspended solids) were also analyzed for mirex. Sediment sampling for mirex was performed in the Oswego River and in Eighteenmile Creek.

On no occasion was mirex found in suspended solids samples. The median detection limit for mirex from Oswego River suspended solids was 0.0019 ng/L; 0.026 ng/L from the Genesee River; and 0.005 ng/L from Eighteenmile Creek at Olcott Harbor. Mirex, a highly hydrophobic chemical, was expected to be found on particles.[15] It was not. Mirex did, however, appear in a few PISCES samples (**Table 14**). The NYS ambient water quality standard for mirex is 1 ng/L.

Mirex occurred, but rarely at measurable concentrations, from Lock 6 and off the lower end of Armstrong property. These observations show that mirex is present but at very low levels. Mirex was seen as frequently in the Genesee River and in Eighteenmile Creek. The Genesee River sources remain unknown but a possible source was found in Eighteenmile Creek. Eighteenmile Creek arises south of the Barge Canal and enters a tunnel for its journey under the City of Lockport. Before tunneling under the Barge Canal, its flow is augmented by spillage from the canal. In 1991 a sediment sample was collected from Eighteenmile Creek just before its submergence (Map R #13) and mirex was found at 7.4 ng/g. Lockport

Cotton Batting, an industry near Eighteenmile Creek upstream (south) of the Barge Canal, began manufacturing cotton insulation and flameproof decorative cotton in 1942. In 1953 the company changed its name to Lockport Mills and ceased operation in the late 1960's. A facility making fireproofed materials would in the course of business be interested in fireproofing agents and could have investigated Dechlorane. There is no evidence of that actually occurring. The plant site, which has been leveled to grade but foundations and sewers are still visible, lies approximately 1000 feet south of Eighteenmile Creek just above the tunnel. The slope of land and the presence of old sewers suggests that wastes from the plant site would have entered Eighteenmile Creek.

Table 14. Mirex observations, PISCES.

site	PISCES exposure dates	amount recovered (ng)	estimated conc. ("ng/L")
Oswego R., Map F #3	10/13 - 11/2	1.5	0.15
Oswego R., Map G #1	10/20 - 11/7	1.7	0.19
Genesee R., Map M #1	6/22 - 7/14	2.6	0.10
Genesee R., Map M #1	7/27 - 8/9	2.2	0.13
18-Mile Cr., Map Q #1	7/28 - 8/10	2.2	0.15
18-Mile Cr., Map Q #1	8/30 - 9/13	4.3	0.30
18-Mile Cr., Map Q #1	9/13 - 11/21	1.6	0.04

Armed with knowledge about Lockport Mills, upper Eighteenmile Creek was resampled in 1994 near the mouth of the tunnel and below old drains still visible in the bank (Map R #13) and upstream where the creek leaves a golf course (Map R #12). **Table 15** shows a marked increase in mirex below the old Lockport Mills outfall. Mirex was not seen in sediments upstream from the Lockport Mills former outfall but was seen below it. Mirex was also found in sediments from Eighteenmile Creek below the Barge Canal (S#22a) and in soils at the Old Flintkote dump (S#25) in the creek below the canal. It is unlikely that mirex could have been deposited at site S #25 by the creek but a hauler may have brought mirex-contaminated waste to the dump.

Table 15. Mirex and PCBs in Eighteenmile Creek sediments and soil.

Map #	mirex ng/g	PCB ng/g	TVS %	TOC %
R#12	<.1	92	12	0.8
R#13	18	95	6	1.1
S#22a	2	3700	11	1.3
S#25	28	850	19	2.1

PAHs

Polynuclear aromatic hydrocarbons (PAHs) were measured in sediments from grab samples from six sites using EPA Method 625. Results appear in **Table 16**. Dredging criteria are available for total PAHs, anthracene, benz(a)anthracene, and chrysene.[16] Exceedences of one or more PAH sediment quality criteria occurred in the Genesee River and in Eighteenmile Creek. However, each site was only sampled once.

Table 16. PAHs in sediments (µg/kg). Highlighted parameters have screening values for dredging, riparian, or in-water disposal. Underlined values belong in class C - "High Contamination".

	A#1 Black R. 8/18/94	L#2 Irond. Cr. 8/9/94	M#1 Gen. R. 8/9/94	P#3 Beals Cr. 7/28/94	P#4 Oak Orch. Cr. 8/30/94	Q#2 18-Mile Cr. 8/10/94
Total PAH	1,600	1,400	43,000	1,722	1,800	8,100
naphthalene	ND	17	1100	ND	ND	49
acenaphthylene	ND	3	78	ND	ND	ND
acenaphthene	ND	27	2500	ND	ND	ND
fluorene	44	48	3700	ND	ND	ND
phenanthrene	150	340	12000	140	110	390
anthracene	82	84	2100	ND	31	100
fluoranthene	250	30	8600	250	200	1100
pyrene	330	310	6500	250	290	1600
benz(a)anthracene	190	100	1700	200	170	610
chrysene	220	120	1500	170	210	960
benzo(b)fluoranthene	ND	92	830	190	200	890
benzo(k)fluoranthene	ND	81	800	130	190	610
benzo(a)pyrene	200	85	830	190	180	660
indeno(1,2,3-cd)pyrene	110	53	350	72	61	430
dibenz(ah)anthracene	ND	ND	150	ND	ND	150
benzo(ghi)perylene	ND	57	310	130	140	510

Black River

PCBs

This project did little to explore the distribution of PCBs in the Black River; some of that has been done already.[17] More work will be needed to identify sources of PCB loading in the Black River. Nevertheless, sampling was performed around the New York Air Brake site in Kelsey Creek, Watertown.

Kelsey Creek was visited several times in 1993 and in early 1994. PISCES samples were taken in Kelsey Creek below the junction with Oily Creek at Superior St. (Map B #4), in Oily Creek at Morrison Ave just before its junction with Kelsey Creek (Map B #3), at the LeRay Spring (Map B #2), and in Kelsey Creek at the Rt. 37 bridge (Map B #1). Pressure filtration samples were taken at Oily Creek and mercury samples were taken at all the sites. Elevated mercury concentrations were seen in biota samples[18]. Macroinvertebrate studies have found PCBs in crayfish in Kelsey Creek at Map B #5 but not in animals taken at Map B #1. The presumptive source is Oily Creek which drains property owned by New York Air Brake. New York Air Brake has been in operation since the early 1900s. High concentrations of PCBs were found in drums excavated from their Purdy Ave. Landfill. Liquid wastes dumped in their Industrial Landfill contained volatile organic compounds (trichloroethylene, tetrachloroethylene, and benzene), metals (chromium, lead, cadmium), and PCBs. New York Air Brake has entered into an agreement with NYSDEC to remove contaminated sediments from Oily and Kelsey Creeks.

Figure 14 gives a summary of PCB data from the Kelsey Creek sites. Data from two Oily Creek (Map B #3) PISCES samples and three Kelsey at Superior St (Map B #4) PISCES samples were averaged. The dominance of pentachlorobiphenyls at Oily Creek and downstream on Kelsey Cr. suggests the presence of Aroclor 1254. The presence of 18 ng/L PCB at LeRay Spring (Map B #2) points to contamination of the groundwater.

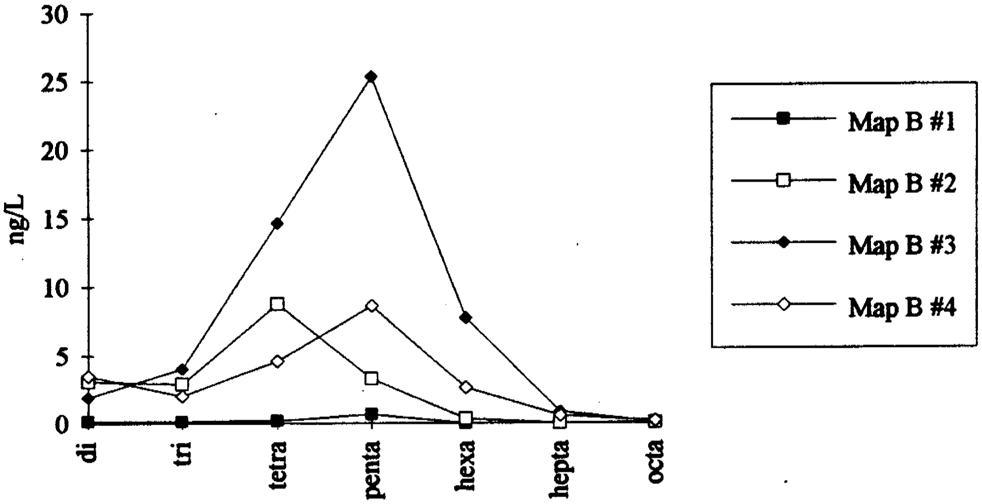


Figure 14. PCBs in Kelsey Creek PISCES samples.

On 6/1/94 a 24.9 L pressure filterer sample was taken from Oily Creek (Map B #3). Total PCBs on suspended solids were sparse (1.01 ng/L -- but this sample showed poor surrogate recovery) and the concentration of PCBs on solids was also low (0.25 μg/g). The Black River at Dexter, in comparison, had a mean suspended solids PCB concentration of 0.51 μg/g.

Oily Creek is a source of PCB to Kelsey Creek and Kelsey Creek is a minor PCB source to the Black River.

Mercury

A low level of effort toward describing mercury in the upstream tributaries found that the mercury seen at Dexter appears to have originated from the Adirondack drainage instead of from the urban area (Watertown) or from Tug Hill. **Figure 15** illustrates mercury concentrations in the major Black River tributaries and the range (and median) of observations from the Black River at Dexter.

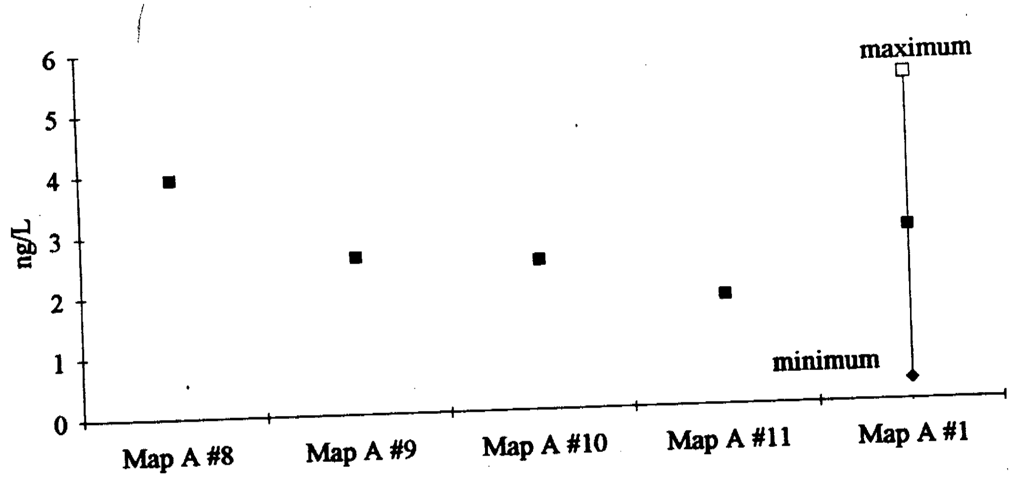


Figure 15. Mercury concentrations in Black River tributaries and Black River at Dexter (Map A #1). The present water quality criterion for mercury is 200 ng/L; the proposed criterion is 1.3 ng/L.

Oswego River

PCBs

PCB sampling from Lock 6 on the Oswego River consistently showed low concentrations from both the aqueous and suspended solids phases. Loadings were also small from the Oswego. Upstream PCB sampling was undertaken in Skaneateles Creek, in Ithaca, Onondaga Creek, Ley Creek, Ox Creek, Black Creek, and in upstream Oswego River. Significant PCB levels were seen in Ley Creek and a modest elevation was found in Skaneateles Creek.

Oswego River work from 1993 suggests that Fulton, NY is a minor PCB source. PCB concentrations were elevated from PISCES placed on the Oswego River along side the city (Map G #6, 7.1 ng/L, and Map G #4, 5.8 ng/L) relative to one sample placed upstream (Map F #9, 2.3 ng/L). **Figure 16** shows that homolog patterns as well as concentrations changed between the upstream and downstream sites. However, the downstream samples were not highly contaminated.

PISCES samples were taken below, at and above the Armstrong site, primarily for mirex but PCBs were also sought. PCB concentrations were low and the homolog patterns were dominated by dichlorobiphenyls.. There is no evidence for a PCB source from Armstrong.

PCBs -- Digestion/Extraction

Digestion/extraction was only performed on three 20 L Oswego River samples taken from Lock 6 in Oswego (Map F #3). One sample was taken on 9/15/94 and two were collected 9/28/94. One of the 9/28/94 digestigator extractions appears to have been contaminated in the lab. The mean of the other two digestigator sample results are compared with the sum of the mean PISCES and mean suspended solids (GFF samples) also taken at Lock 6 on the Oswego over the 1993/1994 sampling season. The total mean digestigator derived PCB was 5.7 ng/L and the sum of the mean PISCES and GFF PCBs was 3.0 ng/L. Much of the difference between the two measurements occurred in the greater amount of penta-, hexa-, and heptachlorobiphenyls recovered by the digestigator (**Figure 17**).

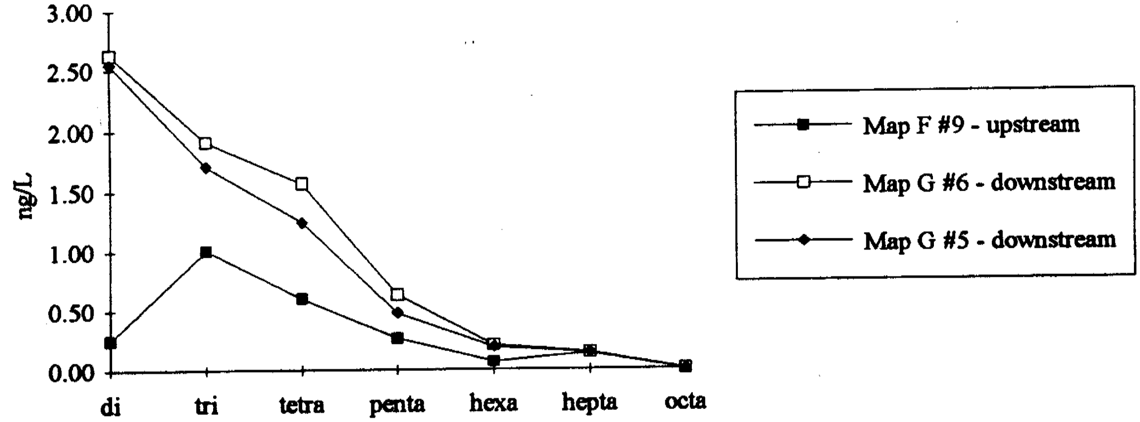


Figure 16. Aqueous PCBs from the Oswego River above and below Fulton, NY.

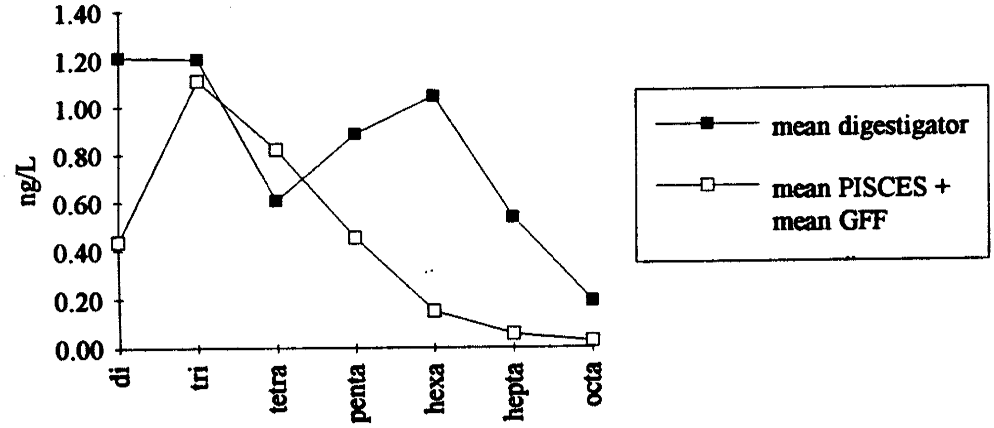


Figure 17. PCBs from the Oswego River at Lock 6 measured by PISCES + suspended solids and by the digestigator.

Mercury

Approximately 44 tons of mercury have been discharged to Onondaga Lake by Allied Chemical and by LCP Chemicals. Evidence for historical mercury contamination of the Oswego River at Oswego is found in sediment cores. **Figure 18** displays a pattern of mercury concentrations increasing with core depth. In the past (how long ago is unknown from this core) mercury levels were high but younger sediments are relatively clean.

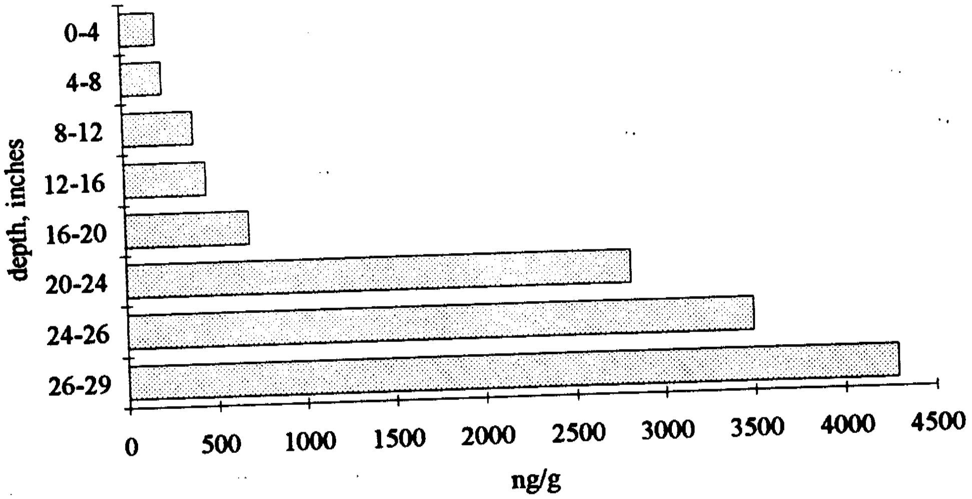


Figure 18. Mercury concentrations from a core in the Oswego River (Map F #8).

Oswego River mercury sampling was routine at Lock 6 but additional sampling was performed in the Seneca River at Baldwinsville (Map D #4), Onondaga Lake outlet (Map D #5), in the Oneida River at Morgan Rd (Map D #6), and at Hinmansville (Map D #3).

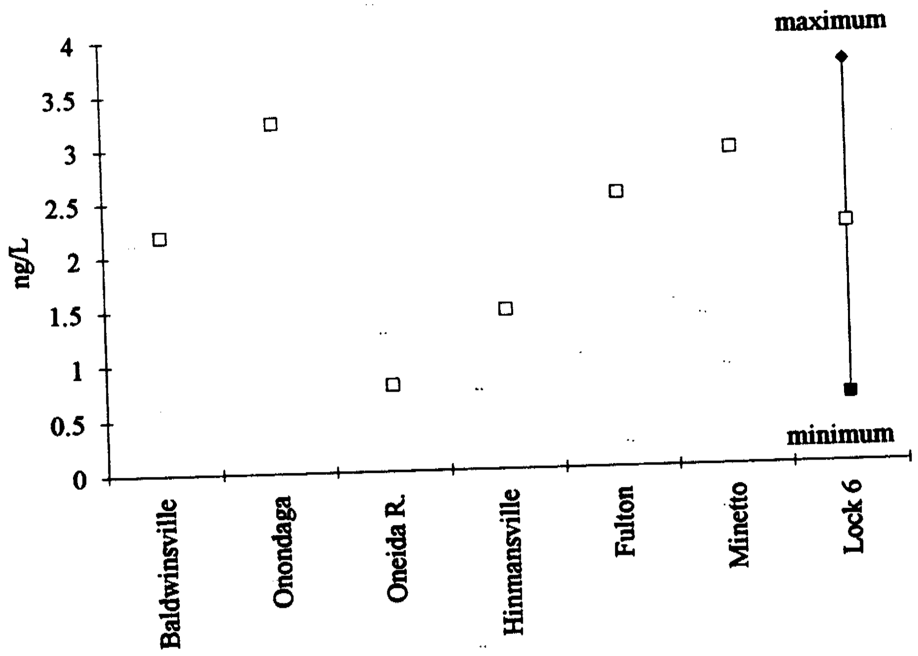


Figure 19. Mercury concentrations in Oswego River area aqueous samples. The maximum, average, and minimum concentrations seen at Lock 6 are also indicated. The present water quality criterion for mercury is 200 ng/L; the proposed criterion is 1.3 ng/L.

Upstream Trackdown Sites

The **Clothier** site (❖38-014) accepted 2200 barrels of wastes from PAS. Contamination of air, soil, groundwater, and surface waters has been noted. Aroclor 1248 was detected in the waste. The site was sampled at Ox Creek (Map D #2) but PCB concentrations here were low (**Figure 20**).

Volney Landfill (❖38-003) received and buried some 8,000 drums of wastes from PAS. Subsequently it was found that the barrels were leaking and affecting both groundwater and Bell and Black Creeks. Bell Creek drains south to the Oneida River while Black Creek drains north and west toward the Oswego River. PCB levels here (Map D #1) exceed 10 ng/L. On the other hand, this sample was potentially taken from contaminated hexane (see the discussion on **page 12**).

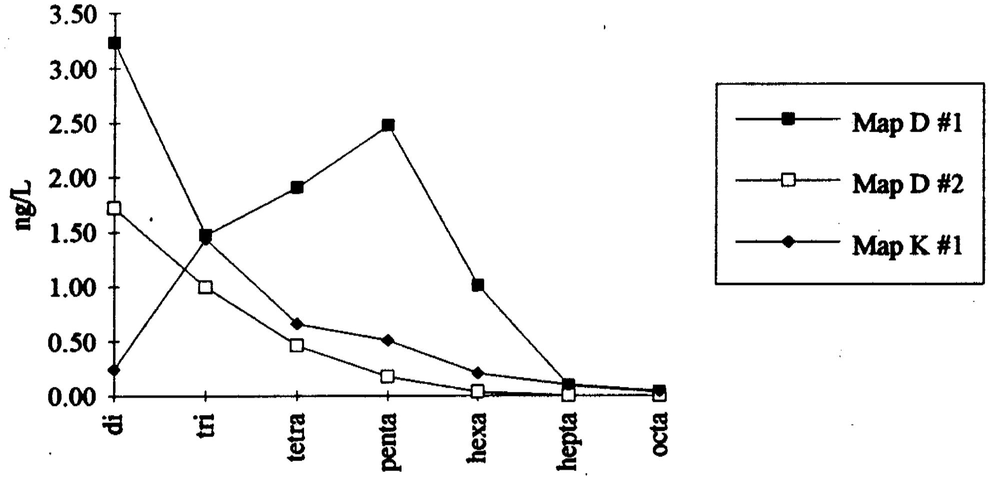


Figure 20. PCB concentrations at three minor sites in the Oswego drainage; Black Creek (Map D #1), Ox Creek (Map D #2), and Ithaca Fire Training (Map K #1).

City of Ithaca Fire Training School (❖55-004) was sampled with PISCES (Map K #1). PCBs (Aroclors 1016/1242) were reported from the site in 1983 sampling but none were detected in more recent sampling. Pesticides (0.47 ppm DDTs) were seen. PISCES samples were taken from a culvert draining the site into Fall Creek. The PISCES PCB concentration was low (3.2 ng/L) and pesticides were also sparse. DDTs were not seen in the PISCES sample.

Tennessee Gas Pipeline Station 241 (❖34-050) had PCBs in gas compressors. Concentrations up to 25,500 ppm were found in soils. This potential source was investigated using PISCES samples taken in Onondaga Creek at Dorwin Rd. (downstream), in Onondaga Creek upstream at Webster Road, and in a tributary to Hemlock Creek (site Map I #s 1, 3, and 2 respectively). Site Map I #2 may have been in the wrong tributary to Hemlock Creek and Sample I #1 had severe surrogate spike recovery problems.

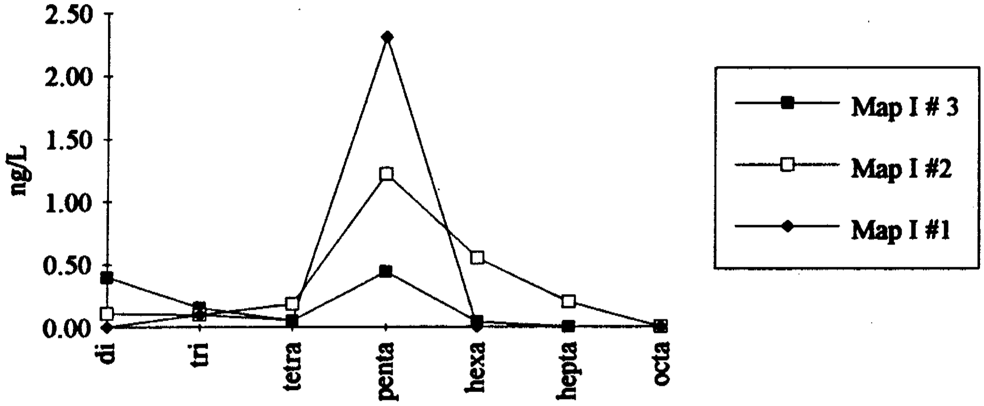


Figure 21. Three PISCES PCB samples from Onondaga Creek at Webster Rd. (Map I #3), an unnamed tributary (Map I #2), and at Dorwin Rd (Map I # 1).

PCBs seen in the three samples were low; 1.1 ng/L at Webster Rd.; 2.4 ng/L in the unnamed tributary; and 2.5 ng/L at Dorwin Rd. PCB concentrations show a marginal increase proceeding down Onondaga Creek with the lowest level at Webster Rd. (Map I #3) and the highest at Dorwin Rd (Map I # 1). The sampled creek is probably not a significant PCB source.

Ley Creek is in the industrial heart of Syracuse. Factories in its drainage include Bristol Meyer Squibb drugs, New Process Gear auto components, Carrier air conditioners, Roth Brothers, Oberdoffer Foundry, General Electric, General Motors, Crouse Hinds traffic lights, Syracuse China, and numerous small machine shops. There are nine inactive hazardous waste sites in the drainage (❖s 34-1, -4, -23, -29, -32, -36, -43, -44, and -53). PCBs (Aroclors 1242, 1248, and 1260) migrated from the GM Fisher Guide plant and are known to have contaminated 4,000 feet of Ley Creek bed to levels as high as 466 ppm. Previous NYSDEC water and kick samples showed two distinct PCBs sources. Heavy Aroclors were found in South Branch Ley Cr. at Deere Rd. Lighter Aroclors were seen at Park St. near the mouth and upstream at LeMoyne Ave (**Table 17**).

Table 17. Previous PCB sampling from Ley Creek.

site	type	ng/L
Park, 5/2/90	water	310
Park, 5/23/90	water	210
Park, 7/24/90	water	340
Deere Rd, 5/7/92	kick sample	220
LeMoyne, 5/7/92	kick sample	870
Park, 5/7/92	kick sample	160
NYS Thruway, 5/7/92	kick sample	0
Schuyler Rd, 5/7/92	kick sample	0
Court, 5/7/92	kick sample	0
Exeter, 5/7/92	kick sample	0

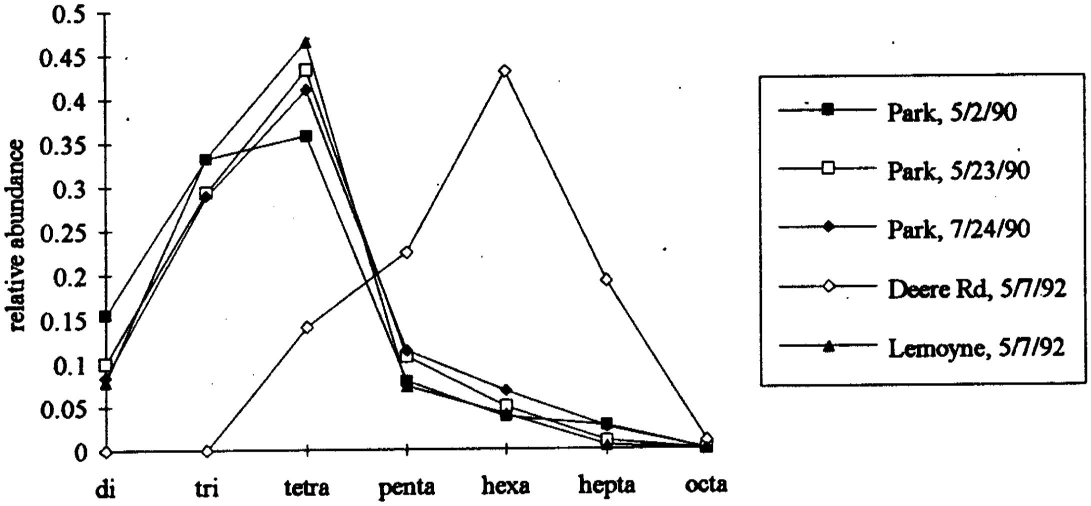


Figure 22. Historical PCB relative homolog abundances, Ley Creek.

PISCES sampling performed in 1994 essentially confirmed these earlier observations. PCB at Deere Ave. Ext. (Map H #4) was like Aroclor 1248; downstream at the Salina town garage (Map H #10) a left homolog shift occurs so that at Park St. the PCB was like Aroclor 1242 (**Figure 23**). There was a medium level of surrogate spike recovery deficiency from the H #4 sample.

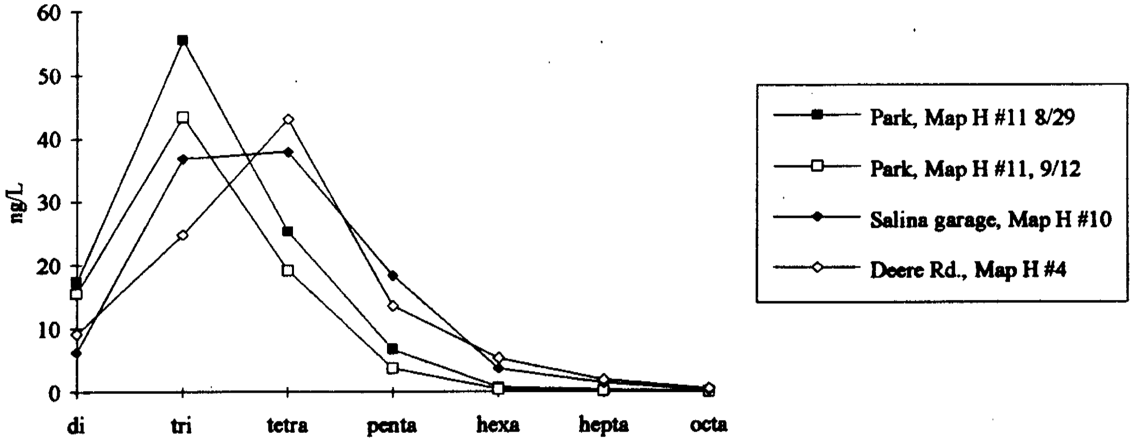


Figure 23. PISCES PCB concentrations, Ley Creek.

Mercury samples were taken in Ley Cr. at sites Map H #s 2, 8,10, and 11. The greatest concentration, 5.6 ng/L, was seen at the downstream site by Park St.

Fish composited from a 14 mile stretch of **Skaneateles Creek** in 1984 and again in 1988 had PCB levels above the FDA limit of 2 mg/kg (2.9 and 2.5 mg/kg respectively).[19] Consequently, there is a consumption advisory on brown trout larger than ten inches from Skaneateles Creek (eat no more than one meal a month).[20] Macroinvertebrates taken in 1992 at seven sites in the creek showed a jump in PCB levels between sites Map J #11 and 16.[21] Macroinvertebrates were collected again on 9/10/93. At that time PISCES were also set out. The macroinvertebrates and the 9/10/93 PISCES extracts were analyzed by the New York State Department of Health laboratory. PISCES were re-deployed on 10/7/93 and the extracts were analyzed by Inchcape/Aquatec. Results are given in **Table 18**. The 1993 macroinvertebrate data show an increase in PCBs between Long Bridge and Jordan Rd. This stretch includes a Welch Allyn plant, Stauffer Chemical, and a swale leading down from a gas transmission pump station. The composition of PCBs at site J #s1 and 2 were a mixture of hexa- and to a lesser extent, tetrachlorinated PCBs. Jordan Rd. and downstream PCBs from macroinvertebrates were lighter, mostly tetrachlorinated. Results from PISCES placed out on 9/10/93 do not indicate an increase in PCB concentrations at Jordan Rd. (Map J #11) but do at Stump Rd (Map J #13). Downstream from site Map J #13 another PCB increase was found at Rodack Rd (Map J #17). Tetrachlorinated PCBs were dominant in the samples from Map J #s 13 and 17.

The 9/10/93 macroinvertebrates and the 10/7/93-10/21/93 PISCES both suggest a PCB source between Map J #3 and Map J #11. Soil samples from the Stauffer site (❖ 34-010) were found to contain relatively low levels of Aroclor 1248 (0.23 mg/kg). Aroclor 1248 is predominately tetrachlorinated biphenyls. However, the soil concentrations are below the threshold for remediation and there are untested potential sources.

On-site borings from the Stauffer plant found high concentrations of mercury (up to 25 ppm)[22]. This project sampled Skaneateles Creek for mercury above, at, and below the Stauffer site on 3/8/95. Sample # 4 was taken from an outfall of Welch Allyn; sample #6 came from a seep of the Stauffer waste beds entering Skaneateles Creek; samples #7 and #8 were from the upstream and downstream ends of a culvert on the Stauffer property.

NYSDEC Region 7 staff (Scott Cook) reports that drainage pipes enter the culvert. Sample #7 was from the right side (facing downstream) and sample #8 came from the left side. Results appear in **Figure 24**.

Table 18. Macroinvertebrate and PISCES PCB sampling in Skaneateles Creek.

Map #	site name	9/10/93 macroinverts. µg/g	9/10/93 9/24/93 PISCES ng/L	10/7/93 10/21/93 PISCES ng/L
J 1	Willow Glen	0.43		
J 2	Long Bridge	0.61	2.2	
J 7	Stauffer outfall			5.8
J 11	Jordan Rd.	2.6	1.7	28
J 13	Stump Rd.	2.3	13	
J 14	Welch Allyn outfall			6.2
J 15	Irish Rd.	3.0	9.2	
J 16	Case Rd.	3.1		
J 17	Rodack Rd.		22	27

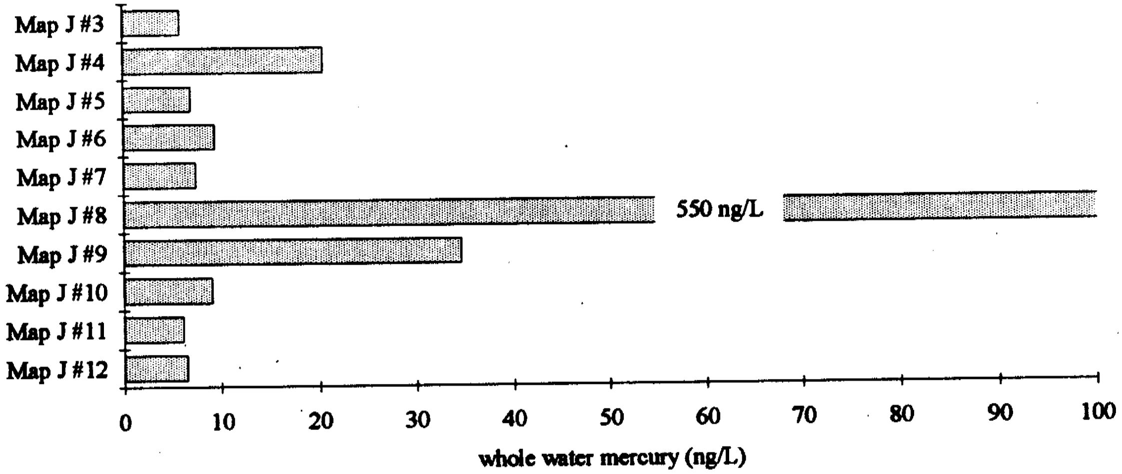


Figure 24. Surface water total mercury concentrations around the Stauffer site, Skaneateles Creek. The present water quality criterion for mercury is 200 ng/L; the proposed criterion is 1.3 ng/L.

Genesee River/ Rochester

PCBs

PCBs in Barge Canal at upstream Brockport (Map L #9) and downstream at Scottsville Rd. (Map M #16) have a similar composition and concentration indicating no important sources between them. Strong similarities are also seen in PCB concentration and composition at Genesee at Ballentyne Rd (Map M #21) and in Little Black Creek (Map M #17) on comparisons by individual congeners as wells as homologs (**Figure 25**).

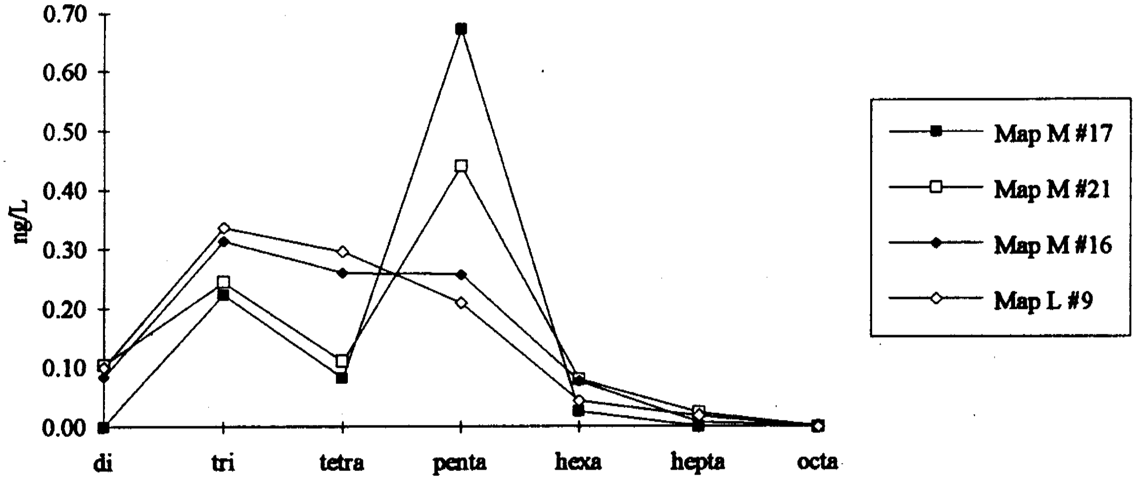


Figure 25. PCBs in the Barge Canal (Brockport, Map L #9 and Scottsville Rd., Map M #16), the Genesee R. at Ballentyne Rd (Map M #21) and Little Black Creek (Map M #17). PISCES data.

PISCES were placed in two influents to the GCO plant (Map M #18 A - the preinfluent pit, and Map M #18B - preinfluent manhole); the influents and effluent from the F. E. Van Lare plant (Map M #s 2A and 2C respectively) and in three pump stations, Hastings St. (M#6), Cliff St. (M#7), and Johns St. (M#19). These data were rejected because of poor surrogate recoveries and the presence of interferences degrading the quality of the chromatograms.

Pesticides

Pesticide concentrations from Monroe County sewer samples (PISCES) were some of the highest values of the project. Particularly high concentrations were seen in both influent (Map M #2a) and effluent samples (Map M #2c) from the F. E. Van Lare plant (**Table 19**). Pesticide data are presented as "ng/L" to indicate the weak quantitation from PISCES. The proper interpretation of Table 19 is that several pesticides may have elevated concentrations in the Hastings St. pump station sample.

Table 19. Pesticide concentrations (PISCES) from Monroe County sewers and sirface waters ("ng/L").

	sum BHC	sum heptachlor	aldrin/dieldrin endrin	sum endosulfan	sum DDT	sum chlordane
Van Lare inf., Map M #2A	240	12	48	24	21	36
Van Lare eff., Map M #2C	90	2.5	30	54	9.3	34
Hastings, PS., Map M #6	1100	24	ND	410	110	190
Cliff PS., Map M #7	14	4.9	19	4.9	4.5	4.6
Scottsville canal, Map M #16	2.2	ND	3.1	0.94	ND	ND
Little Black Cr., Map M #17	ND	0.67	12	9.7	4.8	6.2
Johns PS., Map M #19	22	ND	ND	ND	ND	ND
Kendrick canal, Map M #20	0.49	0.80	ND	ND	ND	0.46
Gen. R. at Ball Br., Map M #21	3.1	ND	ND	6.3	ND	3.8

Mercury

Genesee River mercury samples were collected above Wellsville and at Scio (Map N #s 1 and 3) on 8/30/94; at Mt. Morris (Map C #1), Fowlerville (Map C #2), Rt. 252 (Map C #3), and at Driving Park Ave. bridge in Rochester (Map M #3) on 6/24/94; and on nine occasions at the primary station (Map M #1) (**Figure 26**). There may be a mercury source between Scio and Mt. Morris but the samples were taken on different dates and the increase could be from temporal rather than spatial factors.

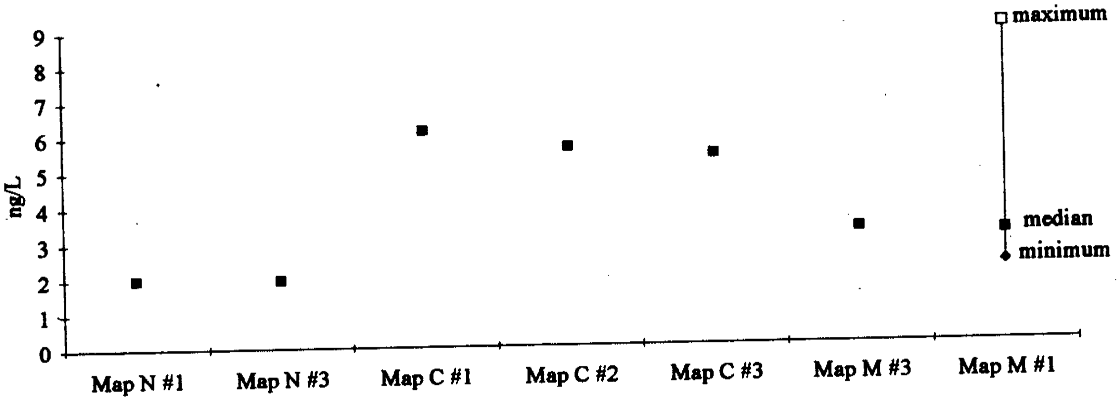


Figure 26. Whole water mercury concentrations at sites in the Genesee River. The present water quality criterion for mercury is 200 ng/L; the proposed criterion is 1.3 ng/L.

Results of wastewater mercury sampling in Rochester (**Figure 27**) show very high levels downstream from two facilities where mercury had been used; Taylor Instruments (mercury thermometers, ❖28-28A), and the Eastman Dental School (mercury amalgam for dental fillings). Mercury levels are relatively high in the influent to the F. E. Van Lare STP. The lowest mercury concentrations were seen in the STP effluents.

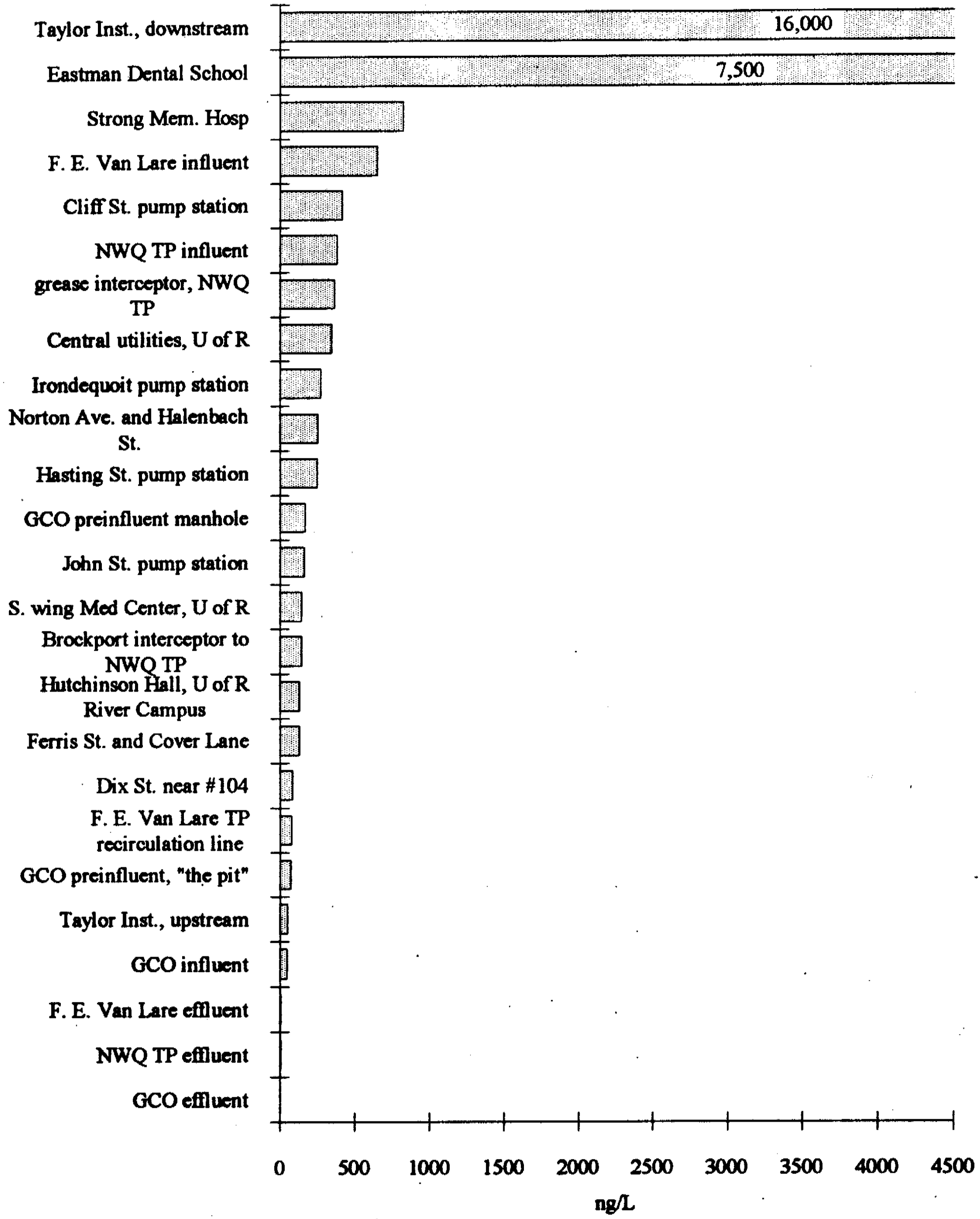


Figure 27. Mercury concentrations in Monroe County sewers and treatment plants.

PAHs

PAHs were sampled in Irondequoit Creek from Eyer Park (upstream from bus barns) and from Linear Park (downstream from the bus barns) using pressure filtration on 9/27/94. There had been a summer storm on the previous day (0.37 inches fell) and also on the 27th (0.19 inches). The stream was fast and turbid at both sampling sites (**Table 20**).

Table 20. PAH concentrations from Irondequoit Creek suspended solids (µg/L).

	NYS guidance	Eyer Park Map L #4	Linear Park Map L #3
TOC (mg/L)		6.8	8
TSS (mg/L)		113	120
L filtered		3.75	3.51
naphthalene	10	0.15	0.11
acenaphthylene		<0.07	<0.07
acenaphthene	20	<0.07	<0.07
fluorene	50	<0.07	<0.07
phenanthrene	50	0.15	0.16
anthracene	50	0.01	0.02
fluoranthene	50	0.25	0.09
pyrene	50	0.09	0.16
benz(a)anthracene	2	0.11	0.22
chrysene	2	0.13	0.17
benzo(b)fluoranthene	2	0.19	0.34
benzo(k)fluoranthene	2	0.09	0.11
benzo(a)pyrene	2	0.15	0.28
dibenz(ah)anthracene		0.02	0.03
benzo(ghi)perylene		0.08	0.19
indeno(1,2,3-cd)pyrene	2	0.23	0.40

PAH concentrations increased by 38% between the two sites. Concentration of PAHs per mg of suspended solids increased 39%. Remembering that these are only suspended solids data, it appears that while there may be a PAH source between the two sampling sites, it is not having a significant impact on water quality.

Eighteenmile Creek

PCBs

Eighteenmile Creek was the most extensively sampled of the four primary tributaries. NYSDEC Region 9 requested pressure filtration sampling at three additional sites, the **East Branch** (Map Q #6), **Stone Road** (Map R #1), and from the **Olcott St. Bridge** (Map S #22). The East Branch, the major tributary to Eighteenmile Creek, originates south of the Barge Canal, flows under the canal at Gasport and receives additional water from the canal and from the Gasport STP. Its natural drainage is almost entirely agricultural and wooded. The Stone Road site samples the main stem of Eighteenmile Creek above the entrance of East Branch and below the junction of The Gulf and below the outfalls of the Lockport STP.

Olcott St. Bridge samples the main stem above The Gulf and the Lockport STP but below the canal. The Gulf was sampled with pressure filtration at West Jackson Rd (Map R #3), and with PISCES at Map R, #s 4 and 5. The Gulf receives treated waste from **Harrison Radiator** (❖32-17) but there is no evidence for PCBs, pesticides, or mercury originating from this facility. The **Lockport Landfill** (❖32-89) is also in The Gulfs drainage. This site was used for sanitary wastes and industrial wastes generated by Harrison Radiator, Noury Chemical (predecessor of AKZO), and Lockport Felt. PCBs are believed to be in the landfill. It is currently undergoing remediation. PISCES were also deployed at sites Map R #s 6, 7, and Map S #s 8, 9, 18, 19, 21, 27, 28, and 29.

PISCES showed a possible PCB source to Eighteenmile Creek between Clinton St (Map S #21) and a site above the N. Transit bridge (Map S #29)(**Figure 28**). The Old Flintkote dump site lies between these two sites.

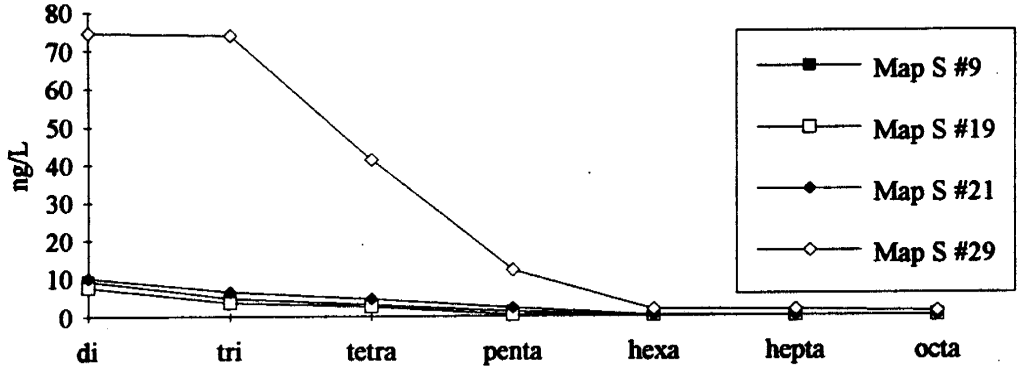


Figure 28. PCBs in Lockport area surface waters.

Trackdown sampling was conducted in Lockport sewers. Site Map R #6, Russel St., is a 54" trunk draining most of southern Lockport. It was selected to represent residential and commercial land use. Site Map R #7, Prospect St. diversion chamber 11, samples an industrial area including the Ohio St. industries (Diversified Manufacturing ❖32-011, Guterl Specialty Steel ❖32-032, and Diamond Shamrock ❖32-071). Diversified Manufacturing has a small hazardous waste site containing waste oil and solvents. Guterl Steel is inactive. Its 8.6 acre hazardous waste site contains slag, baghouse dust, foundry sand, and waste oil. None of these sites are known to contain PCBs. Diversion chamber 6 (Map S #8) receives wastewater from the western half of Lockport except for the extreme west that is carried by The Gulf interceptor. Interceptor 15 (Map S #18) collects wastes originating from the Market St and Chestnut St industrial and commercial area. Infiltration from the back of Dussault Foundry (❖32-012) may also reach this site. Dussault Foundry disposed foundry sand over the side of the escarpment. It contained PAHs, phenol, and phthalates. Diversion chamber 19 (Map S #17) receives water from Washburn trunk. This includes wastes from the Dussault Foundry and the old Harrison Radiator site[23] as well as commercial and residential wastes from South St. Diversion chamber 3 (Map S #27) collects wastewater from the northern part of Lockport including residential streets and the Norton Labs site (❖ 32-029). Norton Labs operated a disposal area that was found to contain waste lubricating oil, polyester based plastics, and phenolic based plastics.

PISCES found one site, at the foot of Prospect St. (Map R #7), to be rich in Aroclor 1248 (**Figure 29**).

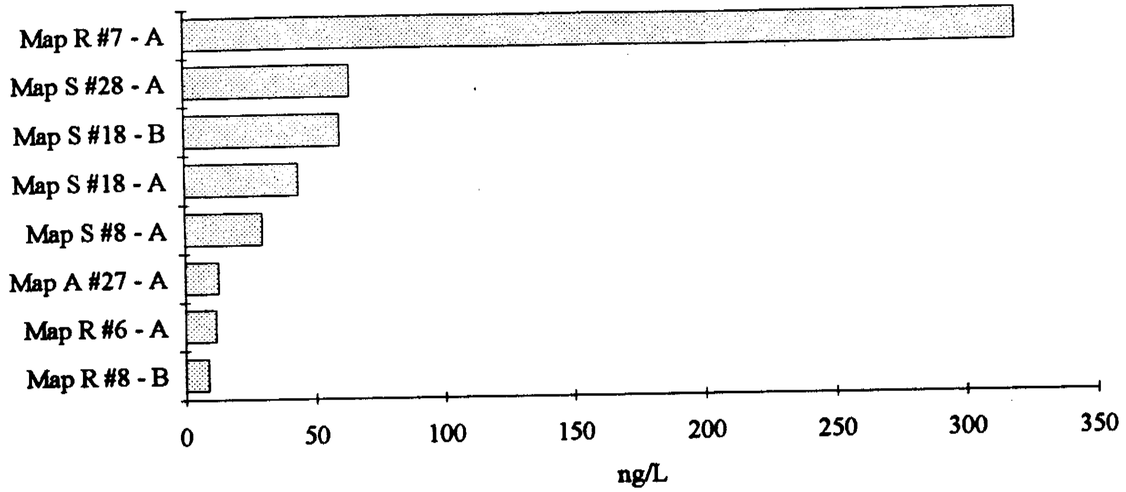


Figure 29. PCBs in Lockport combined sewers. The letter designations, "A" and "B" refer to two periods of PISCES exposure, 5/25/94 to 6/8/94 for A and 6/8/94 to 6/21/94 for B. During the A exposure total precipitation at Lockport was 2.06 inches. During the B exposure it rained 0.88 inches.

Suspended solids collected at Olcott Harbor, East Branch at Transit Rd., Stone Rd., and Olcott St. bridge are shown in **Figure 30**. A significant increase in PCB concentration occurs between the samples from Olcott St. Bridge and Stone Rd. PCBs expressed as µg/g suspended solids show the highest concentration at Olcott Harbor (**Table 21**).

Table 21. PCBs on suspended solids from Eighteenmile Creek sites. Medians.

	Olcott Harbor Map Q #1	E. Branch Map Q #6	Stone Rd. Map R #1	Olcott St. bridge Map S #22
# obs.	13	5	6	5
ng/L	7.8	1.2	22	8.1
µg/g ss	0.39	0.01	0.18	0.11

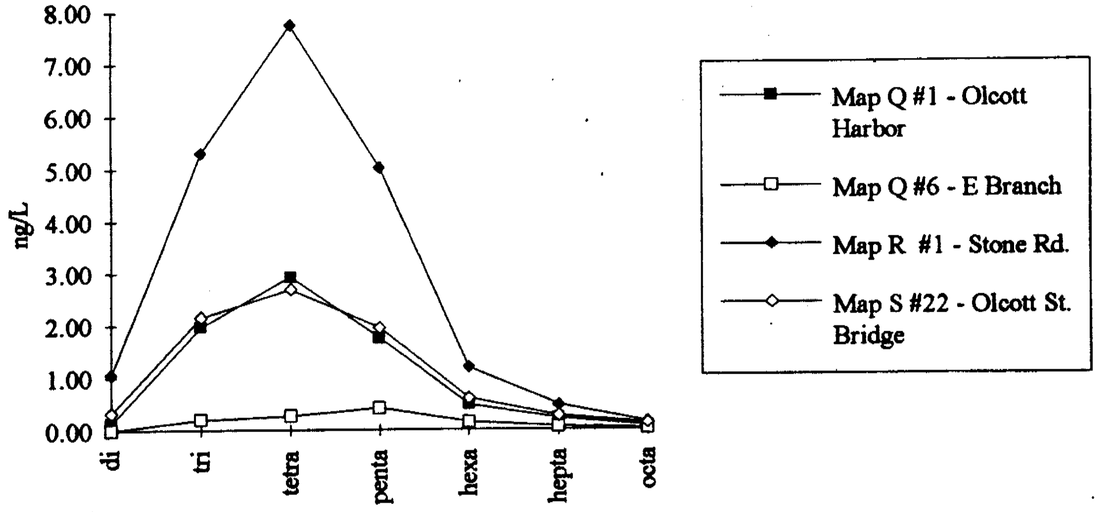


Figure 30. PCBs on suspended solids, medians of Eighteenmile Creek stations.

On two occasions Stone Rd. (Map R #1) suspended solids samples were taken after storms. On the previous comparisons, data from the second Stone Rd. storm event were not included. An event on 7/28/94 was intense but brief (0.26 inches total rainfall); the 9/14/94 sample was taken in the morning after a night of heavy rain (1.36 inches). The samples were taken after the storms had passed and both flow and turbidity were decreasing. **Table 22** compares the wet time samples with the means of three dry time samples.

Table 22. Dry and wet observations from Stone Rd. (Map R #1). Means.

	four	wet samples	
	dry samples	7/28	9/14
TSS, mg/L	14.1	97	230
TOC, %	5.26	20	19
ng/L PCB	16	31	110
µg PCB/g SS	1.2	0.32	0.46

These observations suggest that the high concentrations of PCBs on suspended solids seen after storms (31 and 110 ng/L versus 16 ng/L) were due to more suspended solids rather than to suspended solids that themselves were more contaminated. If anything, the concentration of PCBs per gram of suspended solid was less in the wet weather samples. This may be due to the presence, during high flow times, of larger particles with less surface area per unit of mass. Solids taken at the mouth in Olcott Harbor were richer in PCBs than the upstream solids.

AKZO Chemical (❖32-30B, Map Q) in Newfane manufactures chlorinated benzoyl peroxide. This material can violently decompose and in the process form a single PCB congener, 2,2',4,4'-tetrachlorobiphenyl (BZ 47).[24] There is no evidence that the proportion of congener BZ 47 is greater at the Olcott Harbor site (Map Q #1) than it is elsewhere. The average relative abundance of the congener in PISCES samples from Map Q #1 was 0.013 and the average from all other samples where it was found was 0.020. In the case of suspended solids samples, the mean Map Q #1 relative abundance for BZ 47 was 0.027 and the mean from all other quantitated sites was 0.025. The difference is not significant.

At least two PCB "hot spots" were found in Lockport; the Prospect combined sewer (Map R #7) and a site lying directly in Eighteenmile Creek. This second PCB site lies between the Olcott St. Bridge (Map S #22) and N. Transit Rd (Map S #29).. The actual source may be the Old Flintkote dump. The Old Flintkote dump is a landfill approximately 300 feet long by 100 feet wide situated just downstream from the William St. bridge. It contains incinerated residential and industrial wastes. Numerous holes on site may have been dug by persons looking for antique glass bottles. The Lockport STP operator, Michael Diehl, remembers as a child seeing flames often rising from the dump. The main stem of Eighteenmile Creek flows to the west of the dump and a trickle flows on its eastern side. The abandoned hulk of the Fintkote plant (a delisted hazardous waste site) looms up on the right bank. Two soil samples (Map S #25 and 26) were analyzed for dioxins and PCBs and two sediment samples from the eastern side channel (Map R #s 23 and 24) were analyzed for PCBs.

Sediment samples taken in the rivulet on the east side of the dump showed PCBs; 1.9 mg/kg at Map S #23 and further downstream, 3.3 mg/kg at Map S #24. **Figure 31** shows the relative abundances of PCB homologs in these soil and sediment samples. Suspended solids PCB samples from Olcott St. Bridge and from Stone Rd. were dominated by tetrachlorinated PCBs. Sediments from Eighteenmile Creek upstream from the Old Flintkote site (S#22a) were relatively contaminated (3.7 mg/kg) and were dominated by penta- and tetrachlorinated PCBs. One of the Old Flintkote soils (S#26) was similar to S#22a but the other soil was both more contaminated and it had a smaller abundance of tetrachlorinated PCB. Both of the sediments from the eastern channel had a Aroclor 1242-type pattern.

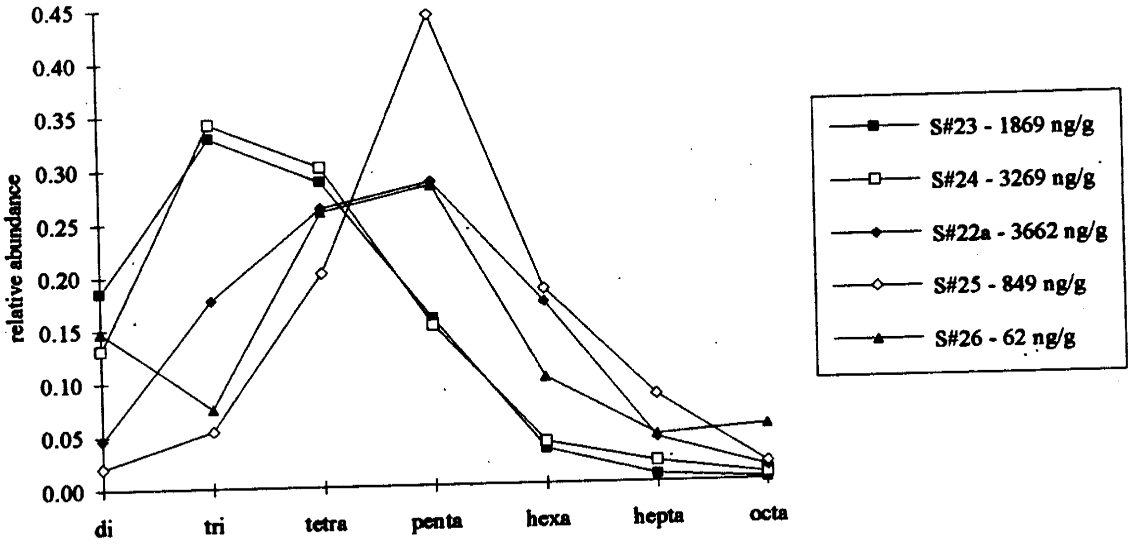


Figure 31. Relative PCB homolog abundances in soils and sediments from the Old Flintkote Dump area in Eighteenmile Creek. Samples S#23 and S#24 were analyzed by Inchcape/Aquatec; the others by NYSDOH.

Mercury

Whole water mercury concentrations from Olcott Harbor (Map Q #1) were somewhat greater than those from the other primary tributaries. **Figure 32** shows the results of analysis of a sediment core taken in Olcott Harbor (Map Q #2) on 5/24/94 by the USEPA *R/V Mudpuppy*. The core was sectioned into eight slices. The core was not dated and times of mercury deposition are unknown. There may be an overlay of contaminated sediment on top of a dredged base or this may be an instance of breakout when contaminated sediments first reached the lower creek. The high concentration sediments could have been released from renovations conducted on the Burt Dam pool in 1987. At any rate, surficial sediments in Olcott Harbor are contaminated with mercury.

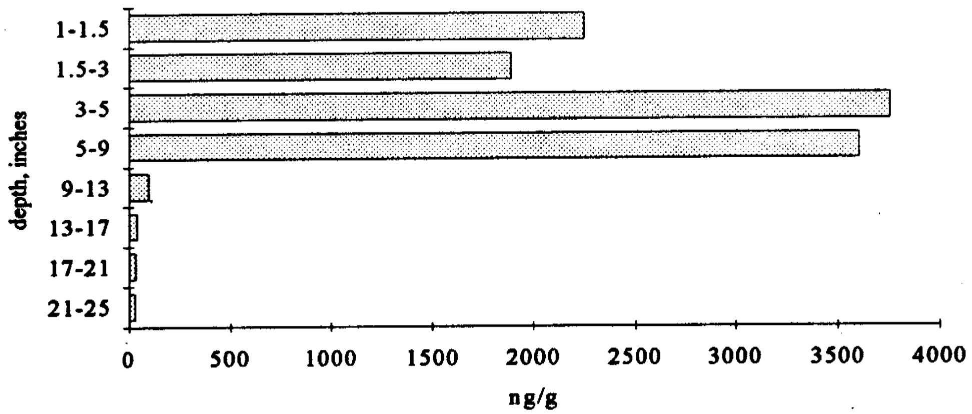


Figure 32. Mercury in Olcott Harbor sediment core sections.

Mercury samples from water taken in the Barge Canal at Pendleton (Map Q #7), the East Branch (Map Q #6), The Gulf (Map R #3), and the outfall of the canal into Eighteenmile Creek (Map S #20) were all low (not greater than 1.3 ng/L) and are significantly less than those seen at Olcott Harbor. High mercury concentrations (up to 20 ng/L) occurred at Jacques Rd (Map Q #5) and Stone Rd (Map R #1), especially after storms. One sample taken at Stone Rd. following a night of heavy rain had 140 ng/L Hg. These observations suggest a source downstream from the canal such as the Lockport STP (Map R #2) or Lockport CSOs.

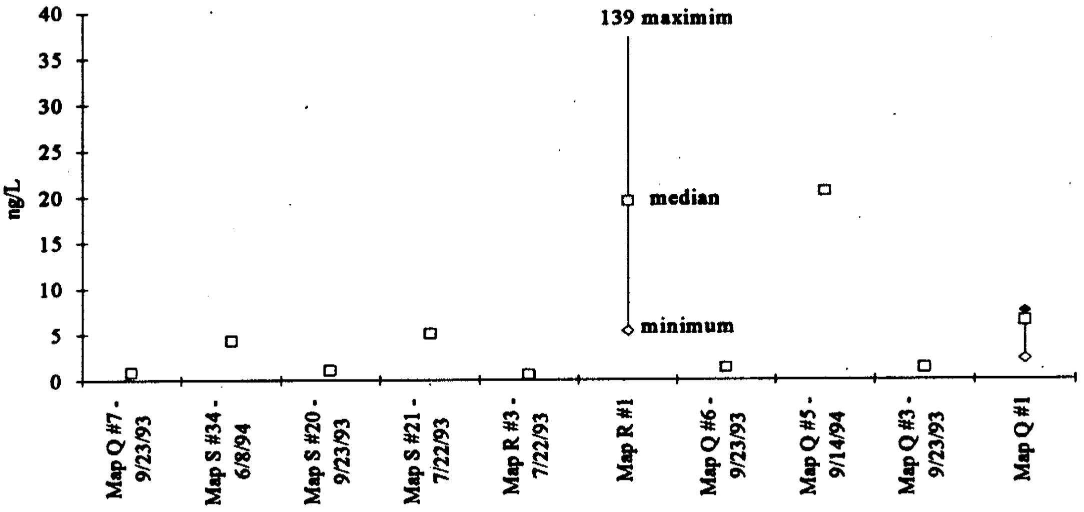


Figure 33. Mercury concentrations in Eighteenmile Creek area surface waters. The present water quality criterion for mercury is 200 ng/L; the proposed criterion is 1.3 ng/L.

A single Lockport STP effluent mercury concentration was relatively low (1.9 ng/L) but the plant influent of 96 ng/L indicated a potential for mercury loading to the creek during overflow conditions. Sampling in Lockport combined sewers pointed to two trunks within the city (diversion chambers 15 - Map S #18, and 19 - Map S #17) where mercury may be found in high concentrations. Diversion chamber 15 (Map S #18) was resampled and so was an upstream site (Map R #29) at the intersection of Market and Chestnut streets. This was intended to focus on the Bewley Building which is the site of several dentists' offices. Dental amalgam may be a significant source of mercury in combined sewers as found in Rochester below the Eastman Dental School. Diversion chamber 19 (Map S #17) was also resampled. Upstream sites were Map R #16 (intersection of Washburn St. and Union St.) which is above Dussault Foundry but below the old Harrison Radiator plant, and Washburn and South St. (Map S #10) which is above the old Harrison Radiator plant site. Additionally, mercury samples were taken from Spring St. before the tunnel (Map R #14) and a site upstream in the southeast part of the city at Map R, #11 (Davidson Rd. S. of Akron St.). This site is below several newer dental establishments.

Results appear in **Figure 34**. Concentrations were high below Dussault foundry - 2,500 ng/L - (Map S #17), below the old Harrison Radiator site - 1,300 ng/L - (Map S #16), and below areas with dentists' offices, 540 ng/L at Map S #30 and 400 ng/L at Map R #11.

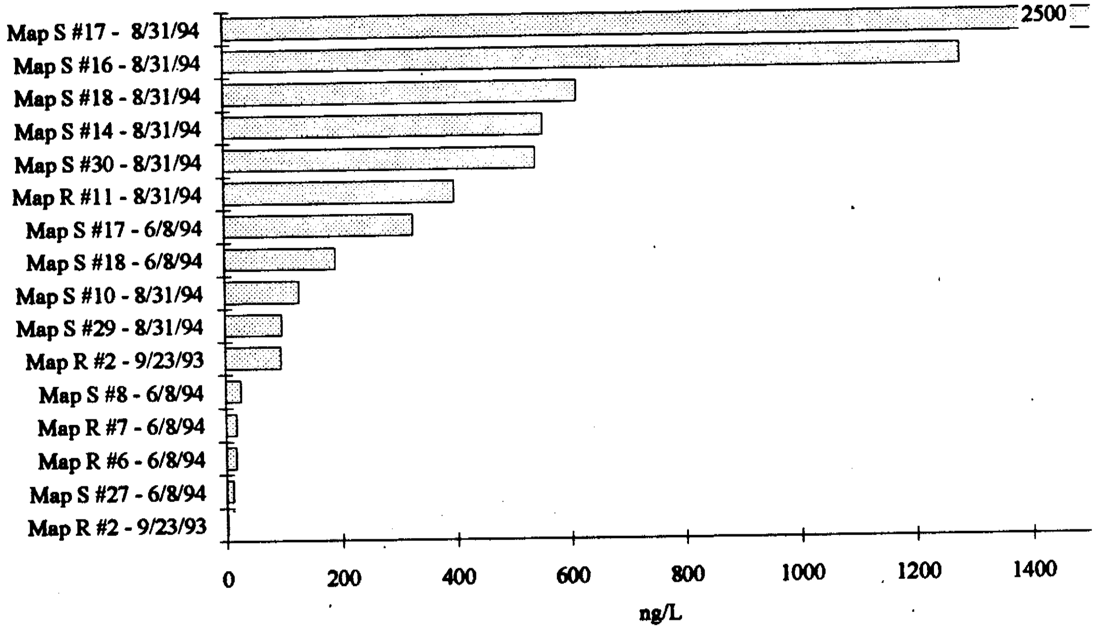


Figure 34. Mercury concentrations in Lockport combined sewers, STP influent, and STP effluent.

Soil and sediment mercury sampling from the Lockport area found high concentrations from two soils on the Old Flintkote dump (Map S #s 25 and 26), in sediments from a pool in Eighteenmile Creek near Map S #21, and from Olcott Harbor (Map Q #2) **(Figure 35)**.

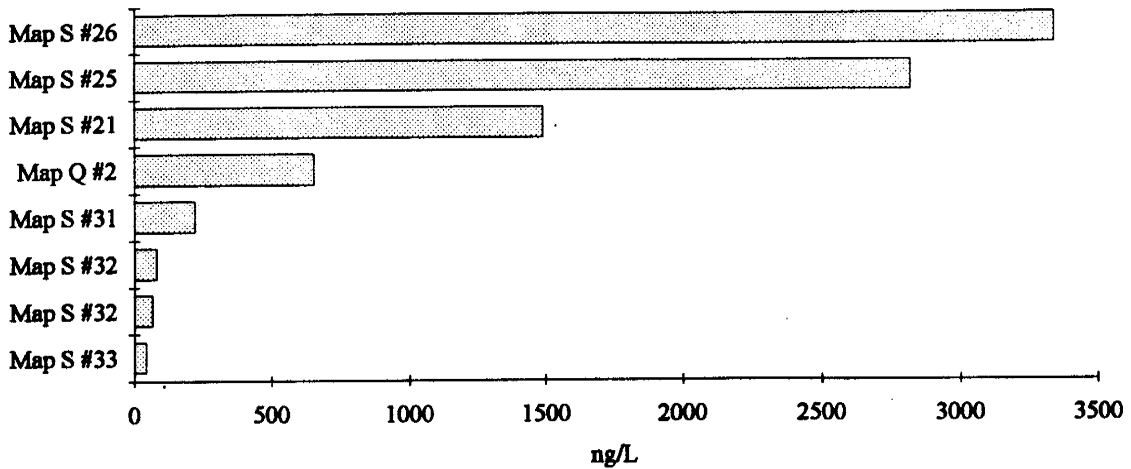


Figure 35. Mercury concentrations in Lockport soils and sediments.

Dioxin

A study performed in 1991 found dioxins and furans in the Barge Canal and in Eighteenmile Creek.[25] **Figure 36** compares some of the 1991 sediments and 1994 Eighteenmile Creek samples by 2,3,7,8-TCDD toxic equivalents (TEQ) on a total organic carbon (TOC) corrected basis. The greatest concentration was from the Old Flintkote dump site (Map S #25) followed by sediment samples taken in the Barge Canal under the Transit Rd. bridge (Map S #34) and under the Exchange St. bridge (Map S #35). A sediment sample from Eighteenmile Creek in Olcott Harbor (Map Q #2) had a much greater concentration than one from Eighteenmile Creek upstream from the Old Flintkote site at the Clinton St. bridge (Map S #21).

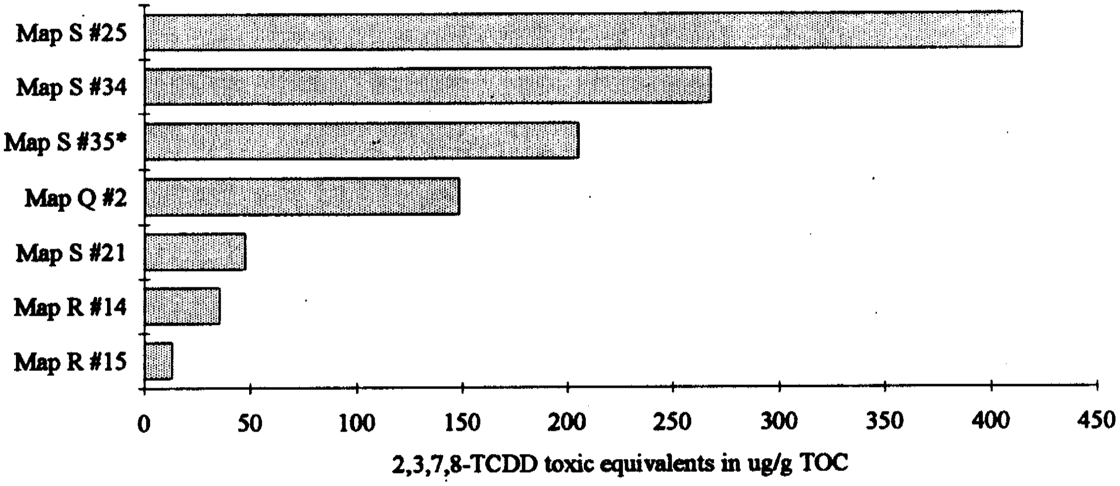


Figure 36. Dioxins and furans from Barge Canal and Eighteenmile Creek sediments. The sample from the Barge Canal at the Exchange St. bridge (Map S #35*) was taken without a subsample for total organic carbon. The calculated value presented was obtained by using the mean of TOCs from the other Eighteenmile Creek locations.

Several dioxin sources are known from the upstream Barge Canal area in North Tonawanda upstream from Lockport. These upstream sources originated from specific manufacturing processes. For example, sediments from the Pettit Flume (now remediated) in North Tonawanda (which discharges to the Niagara River), had a pattern of relative homolog abundances distinct from the pattern originating from incineration. While proceeding north east in the Tonawanda Creek/Barge Canal, sediments show a decreasing level of dioxins and furans until inside the City of Lockport where levels rise again. The pattern of relative abundances of dioxins and furans in Eighteenmile Creek sediments is more like those seen from Lockport Barge Canal sediments than from North Tonawanda sources such as Pettit Flume. These patterns are illustrated in **Figure 37**. Of the combined sewer suspended solids samples analyzed for dioxins, the one from the foot of Prospect St. had the highest total concentration of dioxins and furans but its homolog pattern was dominated by octachlorodibenzo dioxin (OCDD). The pressure filtration sample from The Gulf had the greatest TEQ/mg TOC. This may be an artifict of sampling.

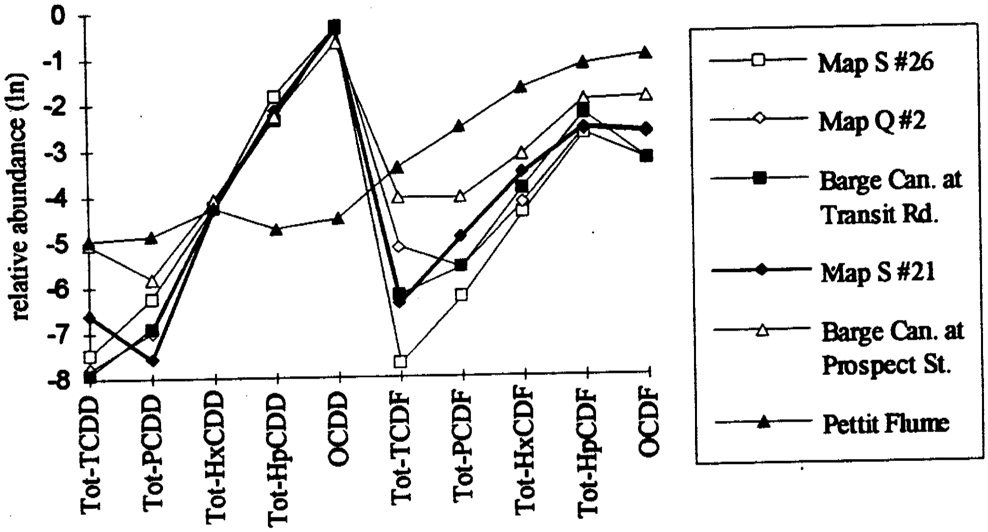


Figure 37. Relative abundances of polychlorinated dioxins and furans from sediments in Pettit Flume, the Barge Canal, and Eighteenmile Creek. Relative abundances (concentration of a particular homolog divided by the sum of all dioxin and furan homologs) is shown in natural log units.

Suspended solids samples from Lockport combined sewers were collected by pressure filtration on 11/22/94 and analyzed for dioxins and furans. **Figure 38** shows results.

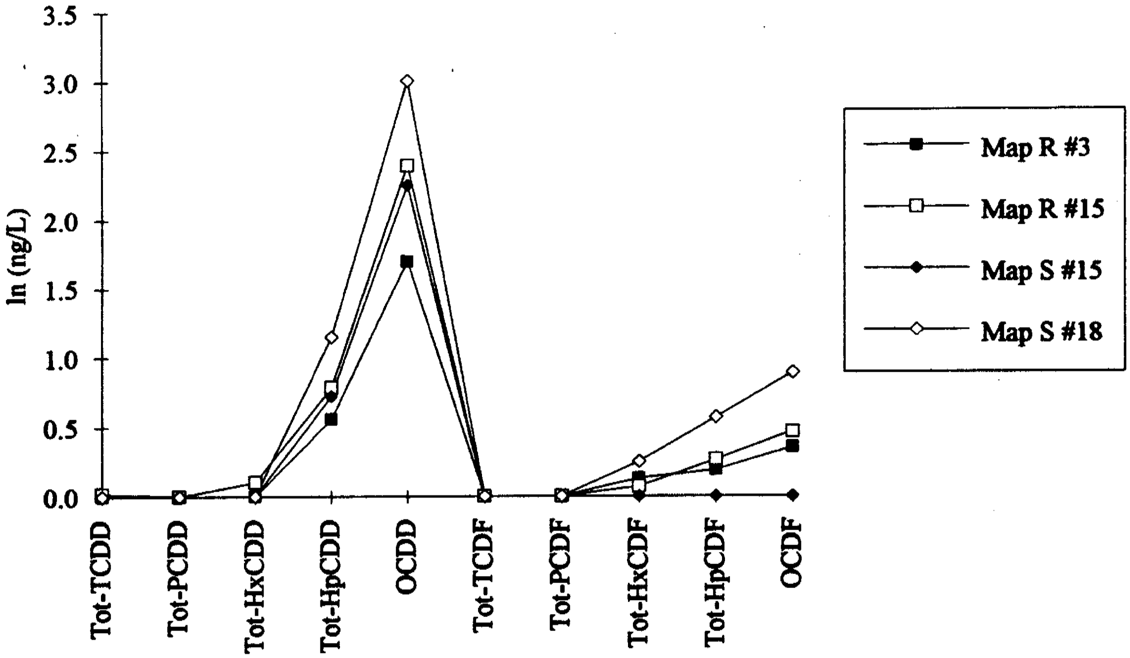


Figure 38. Dioxin and furan homologs from Lockport sewers, suspended solids. Concentrations are log (ng/L +1). Also see Table 10.

All samples show dominance by octachlorodioxins and furans but the Prospect St site (Map R #15) has a small amount of tetra- (0.02 ng/L) and hexachlorinated (0.11 ng/L) dioxins. The Market St. sample (Map S #18) below Dussualt Foundry (❖32-12) has the greatest concentration of octachlorodioxins and furans.

Dioxin and furan contamination in Eighteenmile Creek originated from a variety of sources. These include the Old Flintkote site, Lockport sewer overflows, and, at least historically, sediments from the Barge Canal. Dredging in the Barge Canal has removed some of the former accumulation sites. There is no evidence of on-going sediment contamination. Sewer data are lacking from communities where there is less sediment dioxin accumulation so at this time it is not known if the Lockport concentrations are unusually high.

PAHs

On 6/21/94 pressure filtration samples were taken from four sites on Eighteenmile Creek for PAHs. None were detected (although low levels of phthalates, probably a sampling or lab contaminant, was found) using EPA Method 8270 and the analysis was not repeated (**Table 23**). However, sediment sampling from the Olcott Harbor showed benz(a)anthracene at an elevated concentration (Table 16).

Table 23. PAHs concentrations from Eighteenmile Creek suspended solids (µg/L).

	Map Q #1 Olcott Harbor	Map Q #6 East Branch	Map R #1 Stone Rd.	Map S #22 Olcott St. bridge
TOC (mg/L)	4.2	4	5.4	2.8
TSS (mg/L)	6	23	20	20
L filtered	30.99	28.5	29.16	30.84
acenaphthylene	<0.32	<0.35	<0.34	<0.32
acenaphthene	<0.32	<0.35	<0.34	<0.32
fluorene	<0.32	<0.35	<0.34	<0.32
phenanthrene	<0.32	<0.35	<0.34	<0.32
anthracene	<0.32	<0.35	<0.34	<0.32
fluoranthene	<0.32	<0.35	<0.34	<0.32
pyrene	<0.32	<0.35	<0.34	<0.32
benz (a) anthracene	<0.32	<0.35	<0.34	<0.32
chrysene	<0.32	<0.35	<0.34	<0.32
benzo (b) fluoranthene	<0.32	<0.35	<0.34	<0.32
benzo (k) fluoranthene	<0.32	<0.35	<0.34	<0.32
benzo (a) pyrene	<0.32	<0.35	<0.34	<0.32
indeno (1,2,3-cd) pyrene	<0.32	<0.35	<0.34	<0.32
dibenz (a,h) anthracene	<0.32	<0.35	<0.34	<0.32
benzo (g,h,i) perylene	<0.32	<0.35	<0.34	<0.32

Secondary Sampling Sites

Region 6

Indian River drains into the St. Lawrence River. It was visited due to regional concerns about mercury in Indian River Lake where elevated fish tissue mercury levels had been found. The inlet and outlet to the lake were sampled (Map A #s 12 and 13 respectively). A third mercury sample was taken from the Indian River in Antwerp (Map A #14).

	ng/L mercury
Indian Lake inlet (Map A#12)	1.4
Indian Lake outlet (Map A#13)	2.5
Indian R. at Antwerp (Map A#14)	0.76

PISCES exposed in the Indian River at Philadelphia (Map A #15) found the lowest of all PISCES PCB concentrations (0.44 ng/L).

Sandy Creek was sampled in its south channel below Woodville and below Route 3 shortly before its mouth in Lake Ontario (Map A #6). Lake Ontario waters may penetrate to the site. Sandy Creek is a swift stream that tumbles down a long series of slate ledges. Few sites were suitable for PISCES deployment. Pressure filtration samples were taken below the Village of Adams off County Route 84 (Map A #5) and PISCES were recovered above Adams at County Route 69 (Map A #2). In 1993 pressure filtration samples were taken just below the discharge from the Adams WWTP and above most of the village at the S. Park bridge (Map A #s 4 and 3 respectively).

With the exceptions of Wine, Ley, Skaneateles Creeks and Alcan, the highest PCB concentrations of secondary sites occurred in Sandy Creek. Initial suspicions were directed toward two locations in Adams but the finding from a sample at Map A #2 points to an upstream source. Residents told the sampling crew about a potential contaminant source, the old Rodman dumpsite, which has not yet been explored. PCB concentrations in Sandy Creek have been consistently higher than background and are of borderline significance. A suspended solids sample taken at Map A #5 (5/4/94) was very low (0.06 ng/L). Pressure filtration samples collected on 5/14/93 at sites Map A #3 and 4 showed PCB concentrations of 0.21 and 0.28 ng/L respectively.

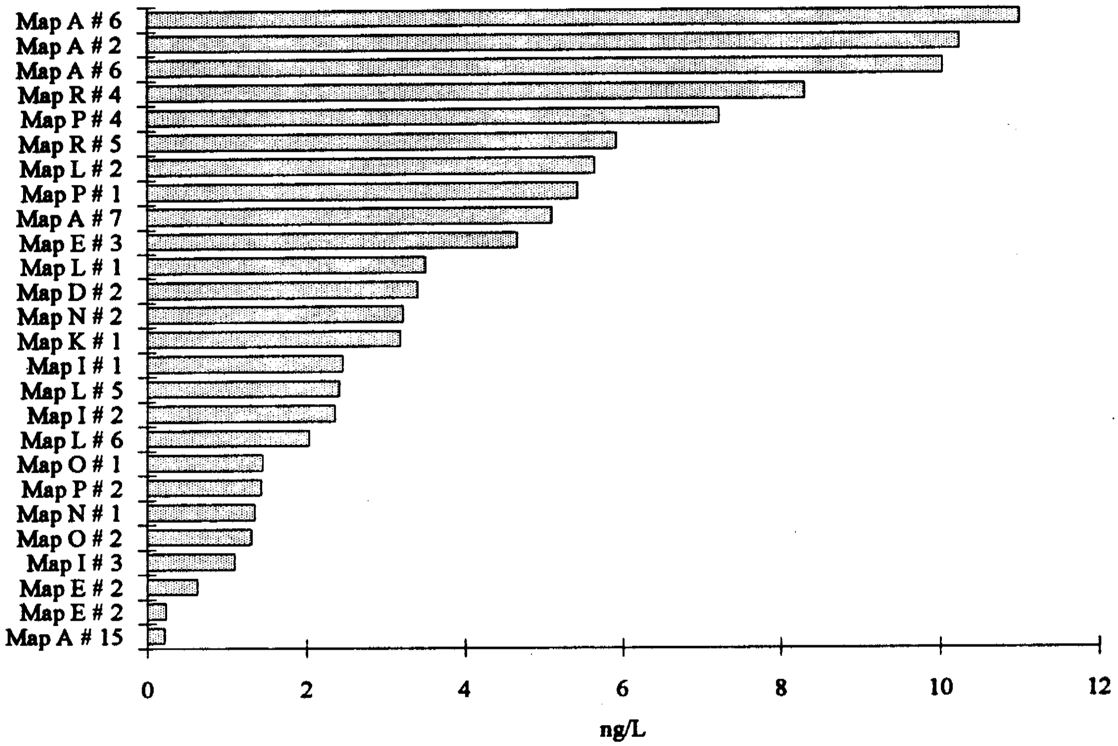


Figure 39. PCB concentrations from three Sandy Creek PISCES exposures (Map A #s 6 and 2) compared with all other secondary tributaries except Wine, Ley, and Skaneateles Creeks, Alcan and Barge Canal sites.

Region 7

Salmon River was sampled off Route 3 at Port Ontario (Map A #7). Backwater effects are possible. PCB concentration was low (5.1 ng/L).

Wine Creek in Oswego County drains three inactive hazardous waste sites; Pollution Abatement Services (❖38-1), Niagara Mohawk Fire Training site (❖38-30), and East Seneca St. dump (now delisted, ❖38-27). Wine Creek was sampled for organics at Mitchell Road below its junction with White Creek (Map E #4) and just above East Seneca St (Map E #5). This sampling does not allow discrimination between sources from the Niagara Mohawk fire training school (on White Creek) and the former Pollution Abatement Services (PAS) site (below E. Seneca St.). Sampling performed in 1978 for Niagara Mohawk showed Aroclor 1016 (up to 3.9 ppm) in sediments at the fire training school. Aroclors 1254 and 1260 were reported but usually at concentrations less than those for Aroclor 1016. Fire training sites have traditionally used waste oils for practice fire situations. In the past waste industrial oils, including PCB contaminated oils, were ignited. The Niagara Mohawk fire training school has been in use since 1957. Sediment samples taken in the facility contained as much as 3.9

mg/kg Aroclor 1016, 0.56 mg/kg Aroclor 1254 and 0.74 mg/kg Aroclor 1260. This site has been remediated.

PAS was originally to be a high-temperature chemical waste incinerator but always had severe operational problems. Area residents complained of noise and smell. The facility continued to accept waste despite its inability to effect thermal destruction. Consequently, large quantities of wastes were stored on site in a lagoon and on satellite sites elsewhere in Oswego County. In 1977 the owners abandoned the site and emergency remedial actions were taken to limit site access and to contain or remove contaminated material. A major surficial clean-up was conducted in 1982. A slurry wall was installed to reduce groundwater movement and a leachate collection system was put in place.

PISCES were deployed in Wine Creek upstream from the PAS site on three occasions at Map E #5 and on six occasions below both the PAS site and the Niagara Mohawk fire training facility at Map E #4. **Figure 40** shows the results. In 1993 samples were taken at Map E #4 before and during construction in the creek bed. Total precipitation in the pre-construction time period was 1.85 inches and 1.53 inches fell in the construction period. Construction may have caused an increase in the level of dissolved PCB.

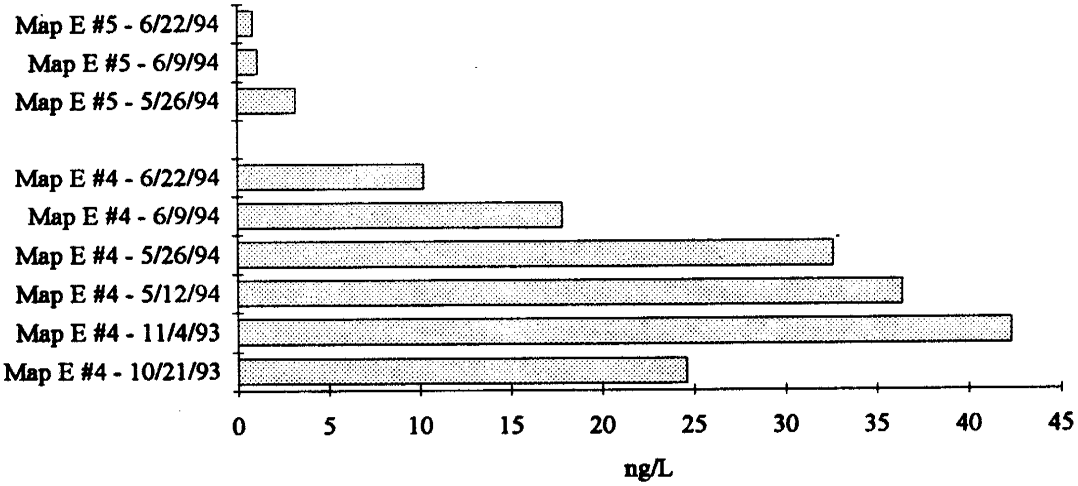


Figure 40. PISCES PCB results from upper Wine Creek (Map E #5) and lower Wine Creek (Map E #4). The sample Map E #4 - 11/4/93 may have been taken with contaminated hexane (see the discussion on page 14).

These results show a high concentration of dissolved PCBs in the downstream site. Large PCB increases were seen on the three occasions when upstream and downstream comparisons could be made. Our data show a preponderance of tri- and dichlorobiphenyls (suggestive of Aroclors 1242/1016) but also with evidence for Aroclors 1254 and 1260.

Mercury samples were also collected in Wine Creek. One sample from the upstream site (Map E # 5) was elevated, 11 ng/L.

PCBs (Aroclors 1248 and 1254) contaminate the **Oswego Casting** facility (❖38-33). They were found in on-site disposed core sands (3,400 ppm), plant site soils (120 ppm), in an on-site pond and its drainage to Lake Ontario. An unnamed tributary was sampled above and below the plant (Map E, #s 2 and 3 respectively). Results showed very low PCB concentrations in the two downstream samples (0.63 and 0.24 ng/L from sampling periods ending 11/2/94 and 11/15/94) but the single upstream sample was marginally contaminated (4.7 ng/L).

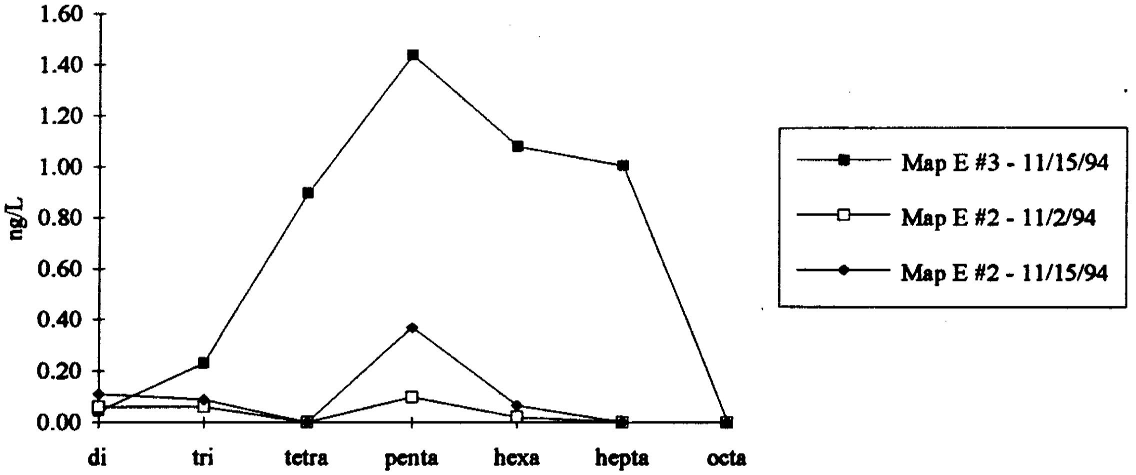


Figure 41. PCB homologs at Oswego Castings sites.

Alcan Sheet and Plate (❖38-015) used Pydraul, a hydraulic fluid that contained 50% (by weight) PCBs. Alcan is a permitted PCB discharger. PCB fluid also leaked from a transformer and found its way to a pond. PCBs have been found in sediments and in water from the North Polishing Pond. In 1980 DEC sampling reported 6.8 ppm PCB from the outfall of the North Polishing Pond but more recent samples indicate PCB concentrations within the SPDES discharge limit of 1,000 ng/L. Recent discharge concentrations average 150 ng/L. PISCES sampling was performed at outfall 002 from the North Polishing Pond (Map E #1). At this location 300 ng/L PCB were found. With a discharge of 7 mgd, this concentration would result in an aqueous phase loading of 7.9 g/day of PCBs, about half that of Eighteenmile Creek. Light homologs dominate the pattern suggesting an Aroclor 1242 or 1016 type source. A wide range of Aroclors were used for hydraulic fluids (Aroclors 1232 to 1260) and a pattern such as was observed is conceivable if the source was hydraulic fluid.

In 1993 NYSDEC cooperated with the US Army Corps of Engineers (COE) in a small project in **Oswego Harbor**. Dredging needed to be done for navigational purposes. Previous sediment quality studies performed by the COE yielded results that were marginally acceptable. However, concerns were raised that New York was the only state still permitting open lake disposal of sediments from an area of concern. NYSDEC decided to gain a better understanding of the consequences of dredging in the Oswego Harbor. The plan agreed to between the Department and the COE was for DEC personnel to collect three suspended solids samples in the vicinity of dredging and three more samples in the vicinity of the open lake disposal site. Samples were to be collected in a Van-Dorn sampler from 60% of the water depth. The dredging contractor was to provide a sampling boat and crew. Funds from this project would have been used for laboratory analyses. Only two samples were collected at the dredging site (Map F #1). Due to unfavorable weather, no samples could be taken around the disposal site.

The first sample, taken during dredging, recovered minimal amount of either suspended solids or PCBs (0.86 ng/L PCB on suspended solids -- before tug). However, a tug moved past the sampling boat and kicked up visible turbidity. This turbidity was sampled (after tug) and found to contain 26 ng/L PCB. Both samples were taken in water about 15 feet deep at a point about 9 feet below the water's surface. Blank contamination occurred (2.4 ng) which would, if present on the test filters, have produced only a small difference (the samples would have had 0.73 and 26 ng/L if blank corrected). Turbulence from the tug could have raised contaminated materials that were suspended in the water column below the sampling depth of 9 feet or mobilized bottom materials. It is possible that normal maritime traffic has a short-term impact on whole water contaminant concentration but the experiment did not confirm such a hypothesis.

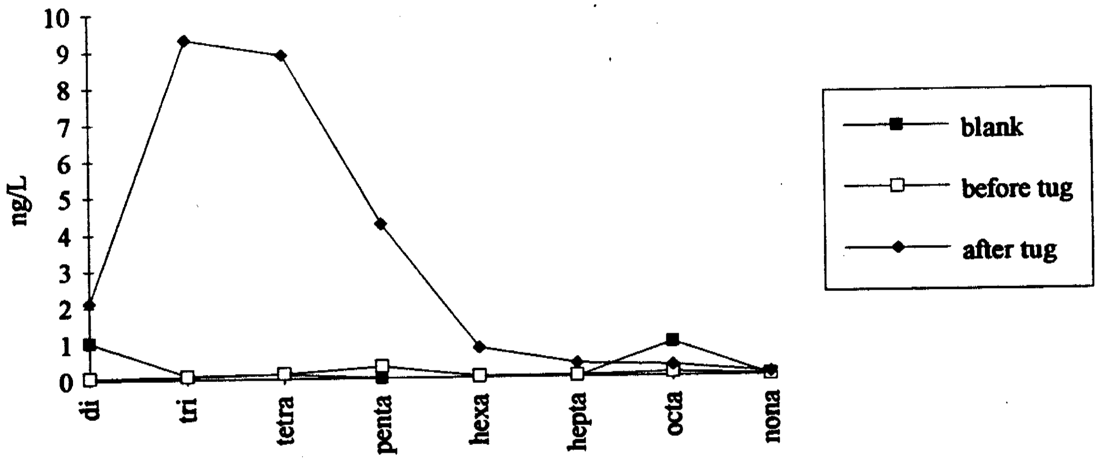


Figure 42. PCBs on suspended solids in Oswego Harbor.

Region 8

Irondequoit Creek was sampled twice (Map L #1 in 1993 and Map L #2, 1994) for PCBs with PISCES. Allens Creek was sampled at Harley School (Map L #5) and a tributary to Allens Creek (Map L #6) was visited at the Oak Hill Country Club. The PCB sample at L#6 had a slight degree of surrogate recovery impairment. Results from Irondequoit Creek show an increase in PCB concentration going downstream (**Figure 43**) but concentrations were low.

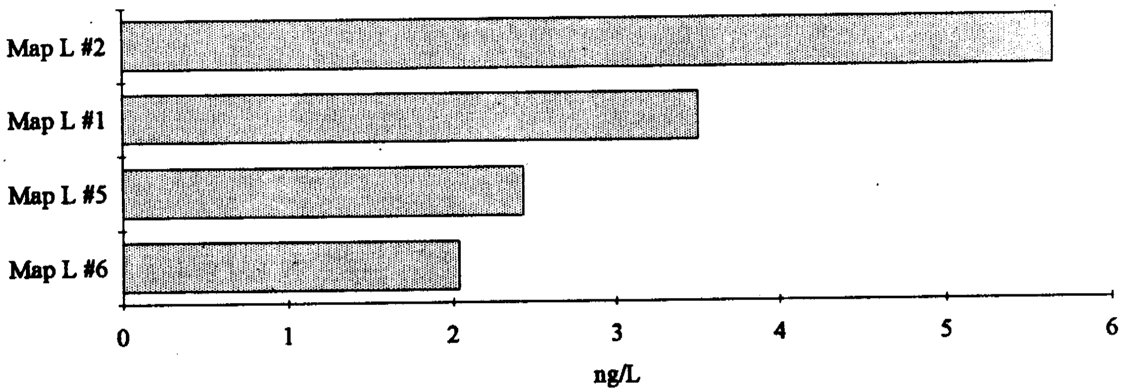


Figure 43. PCBs in Irondequoit Creek sites.

Pesticides were found in the 1994 samples, especially in the Oak Hill Country Club (Map L #6) (**Figure 45**). Allens Creek at the Harley School site (Map L #5) also had detectable pesticides.

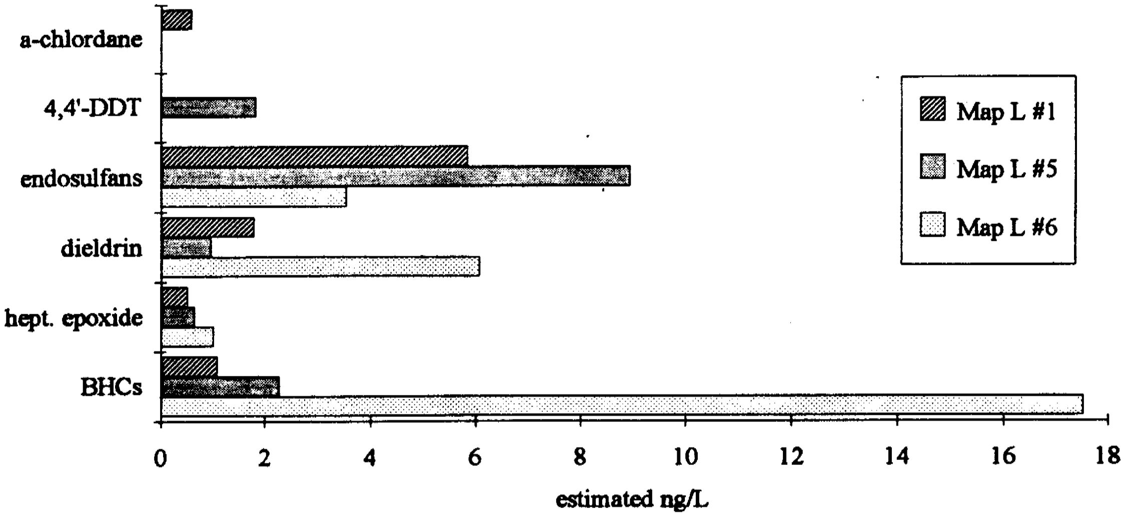


Figure 45. Pesticides in Irondequoit Creek, PISCES. Map L #1 is Irondequoit Creek at Blossom Rd; Map L #5 is Allens Creek at Harley School, and Map L #6 is a tributary to Allens Creek at the Oak Hill County Club.

Oak Orchard Creek is one of the larger minor tributaries to Lake Ontario contributing about one percent of the tributary water load. It is a region of extensive orchards. PISCES (7.2 ng/L PCB) and sediment samples (220 ng/g PCB) were taken from the Eagle Harbor Rd. bridge in Waterport (Map P #4). This part of the stream is backwater from a hydroelectric dam and is deep (16.5 m). On two occasions (10/6/93 and 8/30/94) temperature, dissolved oxygen, and conductivity were measured at one meter intervals from this site. On both occasions near zero concentrations of dissolved oxygen occurred near the bottom of the profiles. There was also a marked increase in conductivity at depth.

The **Lyndonville, West Ave site** (❖ 37-2) is a former agricultural dust/spray formulating facility. Soils from the site were contaminated with DDTs, PAHs, arsenic, methoxychlor, carbon tetrachloride, PCBs, dinitro-o-cresol, and 1,1,1-trichloroethane. PISCES were deployed in Johnson Creek in Lyndonville off Rt. 63 and below the site off Blood Rd (Map P # 2). The initial upstream PISCES were vandalized so a second deployment was made in a more secluded area, off Angling Rd. (Map P #1).

PCB concentrations were a little greater at the upstream station (5.4 versus 1.4 ng/L) but pesticide levels were much higher at the downstream site. This is an intensively farmed region where agricultural pesticides in Johnson Creek might have originated from sources other than the West Ave. site.

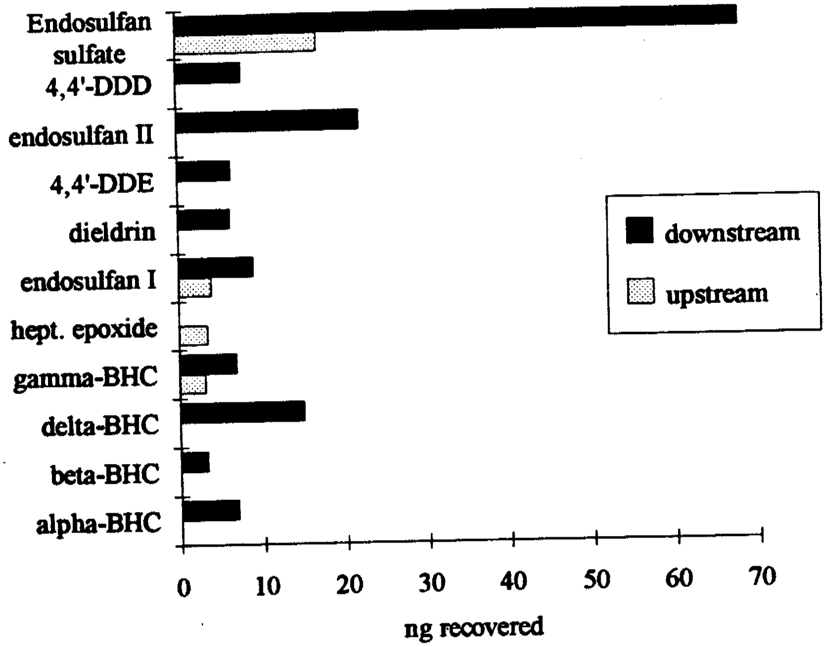


Figure 46. Pesticides above and below Lyndonville, Johnson Creek, PISCES.

Region 9

Sinclair Refinery (❖2-003) was located on a 12 acre parcel next to the Genesee River immediately upstream from Wellsville, NY. It closed in 1958. In October 1981 the Genesee River eroded a portion of the site. Samples from the soil showed metals, PCBs, oil products, and pesticides. The PCBs, while detected, were at background levels. PISCES samples were taken above and below the site at Map N #s 1 and 2 respectively.

PISCES PCB concentrations were low but the downstream station was greater than the upstream site (1.4 ng/L upstream and 3.2 ng/L downstream). **Figure 47** displays the homolog abundances from the two sites as ng/L. Other industries and activities may be PCB sources. Pesticides concentrations were low.

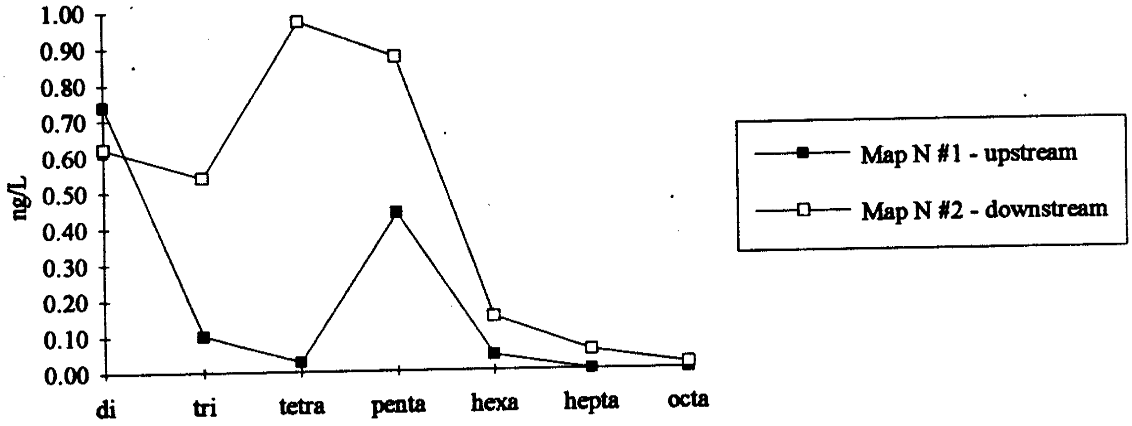


Figure 47. PCB homologs above and below Sinclair Refinery, Genesee River.

Friendship Foundries (❖2-15) has been a foundry since the late 1800s. It was closed under a NYSDEC Summary Abatement Order for failure to comply with air pollution regulations. Five hundred drums of wastes containing PCBs, solvents, and ignitables were discovered and removed. Investigations are on-going to determine if further wastes are at the site. PISCES were placed and recovered from an upstream location on the West Branch and from a downstream site on Van Campen Creek, a tributary to the Genesee River, (Map O #s 1 and 2 respectively).

PCB concentrations were low at both sites (1.5 and 1.3 ng/L upstream and downstream). Pesticides levels were also low.

CONCLUSIONS AND RECOMMENDATIONS

Methods

PISCES has a useful role in trackdown sampling but should be complemented with more quantitative methods. Pressure filtration on flat media (293 and 146 mm glass fiber filters) may have been inadequate. For example, despite published work to the contrary, it produced no mirex detections from Oswego River samples. Recoveries of PCBs from particles may also have been less than expected. The procedure recovers only small amounts of solids when operated over the course of an hour or so. Better field methods for suspended solids collection should be investigated.

The development of a laboratory device for the digestion and extraction of whole water, the "digestigator", was incomplete. This concept remains of interest and further development and comparison with other technologies ought to be considered.

PCB analyses for congeners by duel column gas chromatography with electron capture detection produced numerous false positives. The review of raw data became very time-consuming and the correction process left much to be desired. Perhaps future work should be done using mass-spectrometry.

PCBs

Of the four primary sampling sites, the Black River was the greatest PCB loading source to Lake Ontario while Eighteenmile Creek showed the largest concentrations. Few samples had PISCES "concentrations" below the water quality criterion. Because PISCES data are only semi-quantitative, arbitrary cut-offs for high and moderate contamination were chosen based on the distribution of surface water observations. The "high" cut-off level chosen, 25 ng/L, is approximately the 75th percentile and the "moderate" level is 10 ng/L, approximately the median of surface water concentrations. Areas in the survey with PISCES PCB concentrations greater than 25 ng/L on at least two occasions were:

Area	#obs.>25 ng/L / all obs.
Black River at Dexter, Jefferson County	3/13
Kelsey Creek/Oily Creek in Watertown, Jefferson County	3/6
Wine Creek, in Oswego County	5/10
Ley Creek in Syracuse, Onondaga County	4/12
Skaneateles Creek at Skaneateles Falls, Onondaga County	2/9
Lockport sewers, Niagara County	4/6
Eighteenmile Creek at Olcott Harbor, Niagara County	8/9

PCB concentrations obtained through PISCES were high (more than 25 ng/L) in a single sample at the following site:

Alcan outfall (only one sample taken; observed concentration was within permit conditions)

Moderate levels of dissolved phase PCBs (10 - 25 ng/L) were seen in 32 samples. Multiple observations in this range were reported from:

lower Genesee River
lower Oswego River
Sandy Creek
Barge Canal in Lockport

Moderate levels of dissolved phase PCB were seen only once from:

Barge Canal in Monroe County
Black Creek in Volney (only one sample taken. The observation may have been due to contaminated hexane)

The Monroe County sewer samples showed some level of poor surrogate spike recovery and had poorly resolved chromatograms. The remaining PISCES observations had total PCB concentrations less than 10 ng/L.

Additional sampling should be carried out to better define PCB sources to:

Black River above Dexter
Eighteenmile Creek, the Barge Canal in Lockport, Lockport sewers
Ley Creek in Syracuse
Sandy Creek upstream from Adams
Skaneateles Creek in the vicinity of Skaneateles Falls
Wine Creek and White Creek

Sampling problems prevented clear determination at the following sites:
Rochester sewers -- chromatographic interference
Black Creek in Volney -- hexane contamination
Onondaga Creek -- possibly incorrect sampling location

Mercury

Mean mercury concentrations in surface water (excepting Skaneateles Creek) are shown in **Figure 48** from those areas where three or more samples were collected. In terms of ranked mean concentrations, upstream and downstream sites were neighbors. At none of the locations were mean mercury concentrations less than the proposed water quality standard of 1.3 ng/L. Mean concentrations exceeded 5 ng/L only in Eighteenmile Creek.

Mercury concentration in urban sewers was much greater. Median levels from Lockport and Monroe County were 130 and 170 ng/L respectively. The median mercury concentration in Skaneateles Creek around the Stauffer Chemical site was 8.3 ng/L.

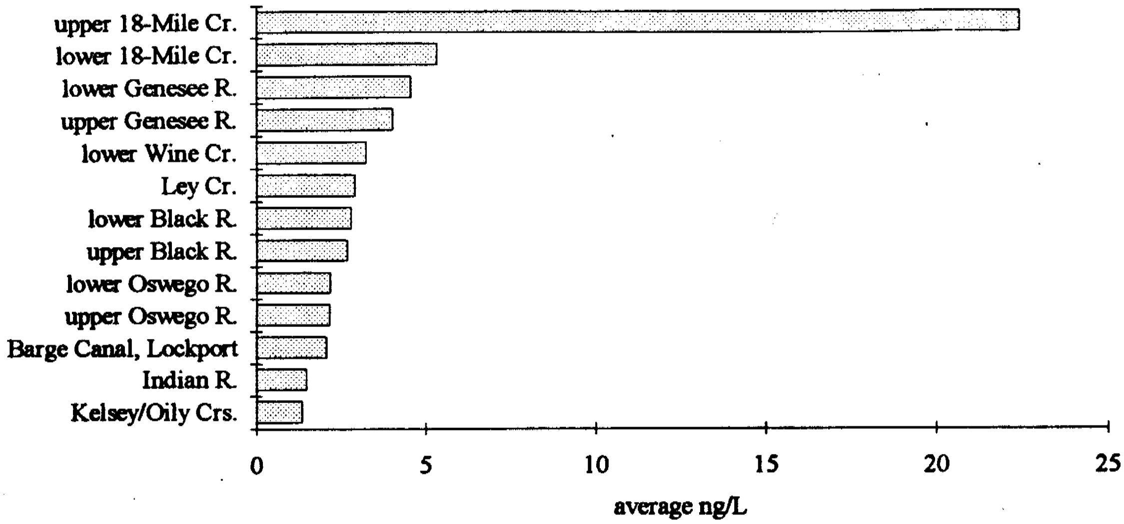


Figure 48. Mean mercury concentrations from surface waters (except Skaneateles Creek) where three or more samples were taken.

Additional mercury sampling should be carried out to better define sources to:

Skaneateles Creek
Rochester sewers
Genesee River
Eighteenmile Creek

Sediment cores suggest that concentrations of mercury in Eighteenmile Creek are rising but similar sampling shows decreasing concentrations in the Oswego River sediment core.

Pesticides

Sampling methods used here for pesticides were not optimal. However, "concentrations" are usually below standards. Exceptions may be occurring at:

Eighteenmile Creek / The Gulf
Genesee River
Irondequoit Creek (Oak Hill Country Club)
Johnson Creek at Lyndonville
Little Black Creek
Monroe County Barge Canal
Ox Creek
Rochester sewers
Wine Creek

These sites should be re-sampled for pesticides only if more quantitative procedures are used.

Table 25 summarizes the findings and recommendations for the PCBs, pesticides and mercury, substances that were measured from many sites.

Table 25. Summary of PCB, Pesticide, and Mercury Findings along with Recommendations for Future Sampling.

DEC Region	site or area	PCBs high	PCBs moderate	PCBs low	PCBs uncertain	resample for PCBs	resample for pest.	resample for Hg
6	Black R.	X				X		
6	Indian R.			X				
6	Kelsey/Oily Crs.	X						
6	Sandy Cr.		X			X		
7	Alcan Aluminum	X						
7	Armstrong			X				
7	Black Cr. at Volney				X	X		
7	Ithaca Fire Training			X				
7	Ley Cr.	X				X		
7	Onondaga Cr.			X	X	X		
7	Oswego Castings			X				
7	Oswego R.		X					
7	Ox Cr.			X			X	
7	Salmon R.			X				
7	Skaneateles Cr.	X				X		X
7	Wine Cr.	X				X		
8	Genesee R.		X					X
8	Irondequoit Cr.			X			X	
8	Johnson Cr at Lyndonville			X			X	
8	Monroe Co. Barge Canal		X			X		
8	Oak Orchard Cr.			X				
8	Oatka Cr.			X				
8	Rochester sewers				X	X		X
9	Barge Canal in Lockport		X			X		
9	Eighteenmile Cr.	X				X	X	X
9	Friendship Foundry			X				
9	Lockport sewers	X				X		X
9	Sinclair Refinery			X				

Table 25 indicates the distribution of high, moderate, and low PCB concentrations by sites. Usually the table recommends resampling sites with high PCB concentrations or where concentrations are uncertain. Some areas with high concentrations were not included as requiring resampling because sources are known. Some sites with moderate PCB concentrations were also recommended for resampling. Rural Sandy Creek was expected to have had lower concentrations than what was found. The Barge Canal sites in Lockport and Rochester ought to be revisited as part of the larger effort to understand PCB concentrations in those urban areas. Usually the sources of mercury and pesticides are unclear. Counter examples include mercury from the thermometer factory and the dental college both in Rochester. Because of the nature of pesticides' quantification by PISCES, no firm conclusions were reached concerning exceedences of standards. Areas recommended for pesticide resampling have PISCES "concentrations" in excess of standards but future sample should be quantitative.

Dioxins/Furans

Sampling for dioxins and furans was principally carried out in upper Eighteenmile Creek. The pressure filtration method may not have been successful in sampling wastewater. Better field methods are needed. Exceedences of the wildlife bioaccumulation guidance were seen in sediments from the Genesee River and Eighteenmile Creek. Soils from the Old Flintkote dump exceeded the wildlife protection value and also a human health protection value of 10 ng/g TOC. This site may require additional sampling to define the extent and magnitude of contamination.

Mirex

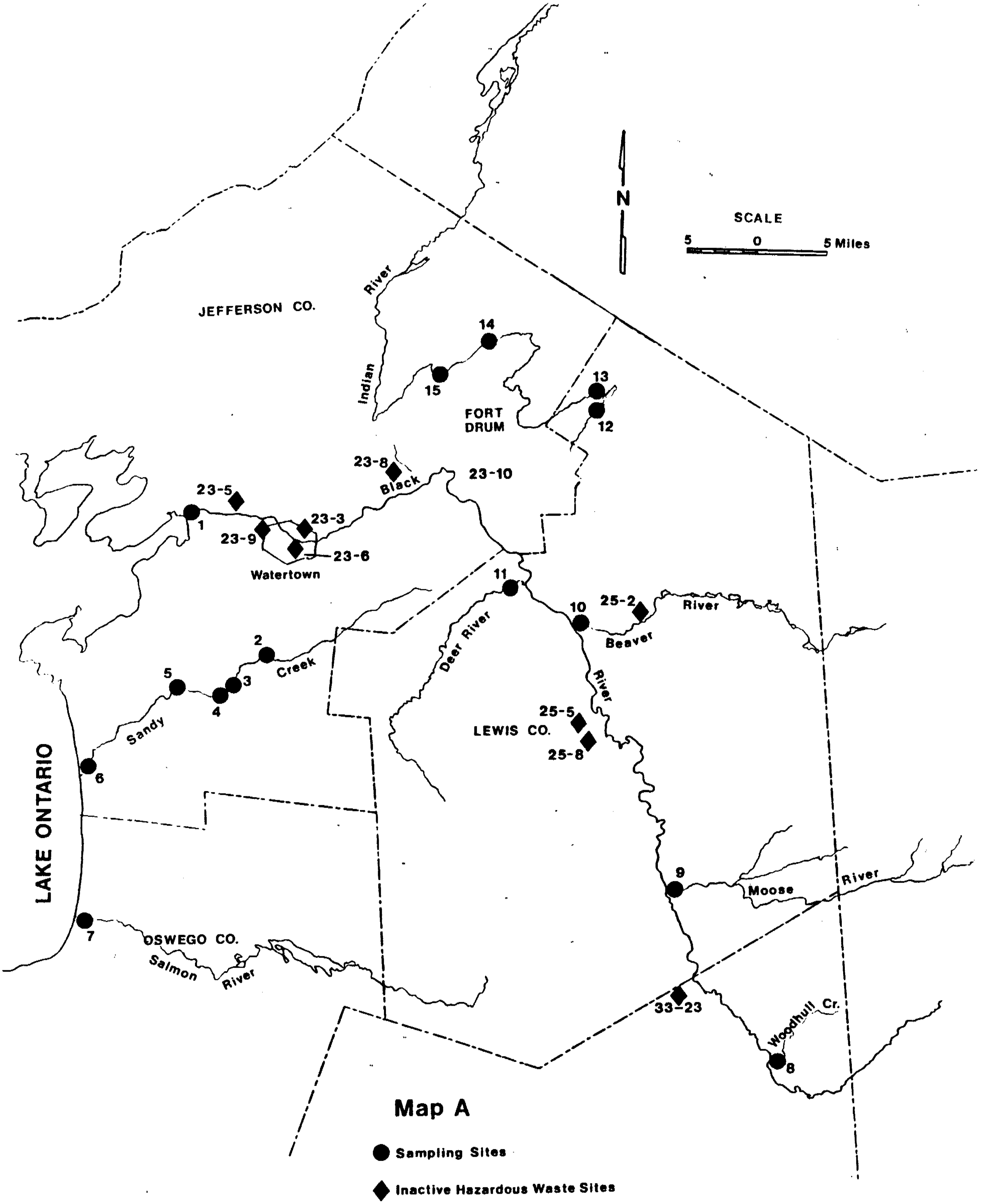
Mirex is more widely distributed than had been generally understood. Low concentrations were seen with about equal frequency in aqueous phase samples from Eighteenmile Creek, Genesee River, and Oswego River. None was detected in pressure filtration samples. Mirex was not sought from the Black River. A mirex source was found in Eighteenmile Creek. However, mirex concentrations seem to be low and further work may have a low priority.

PAHs

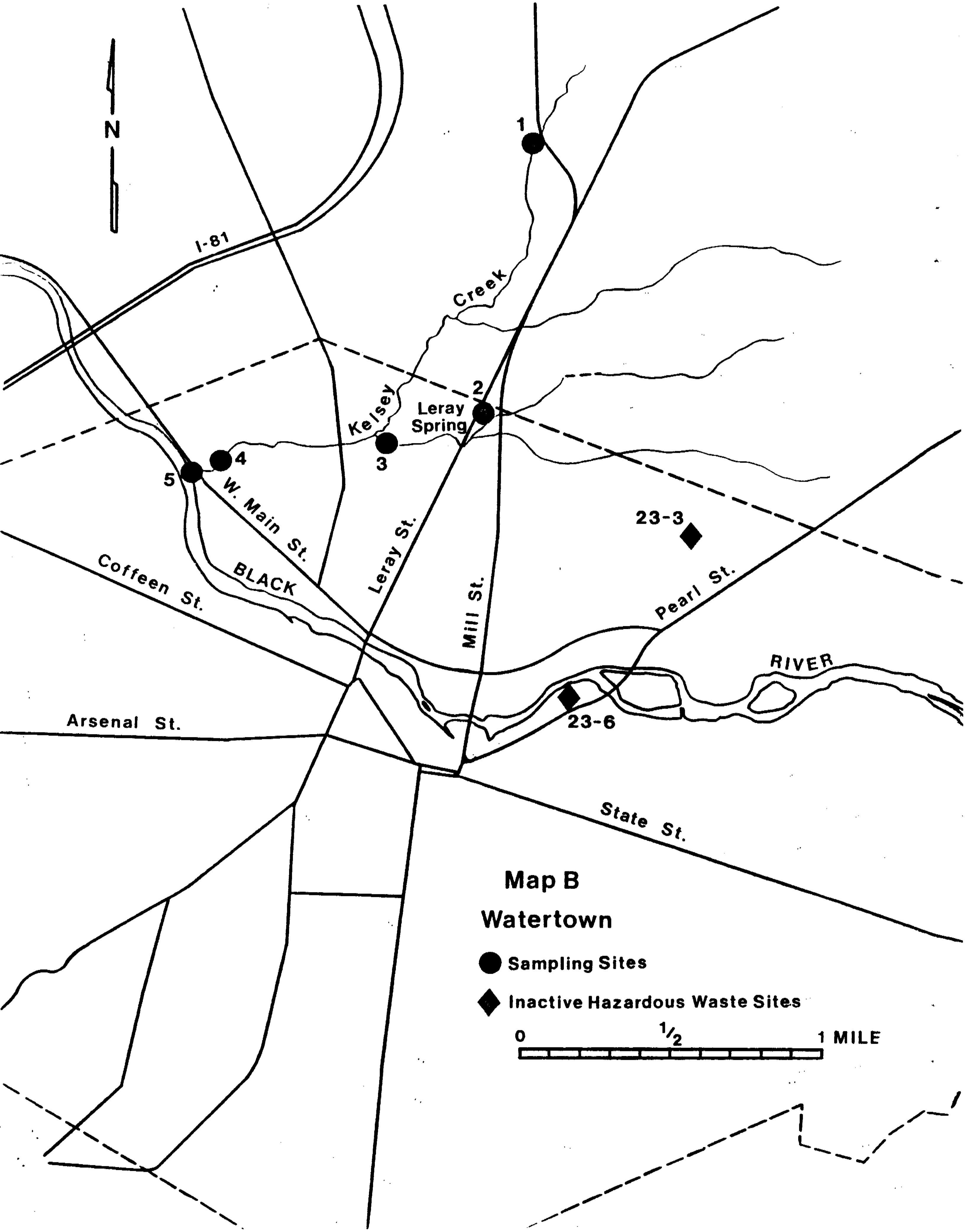
PAH concentrations from sediments exceeded dredging guidelines for the Genesee River (anthracene, benz(a)anthracene, and total PAHs) and Eighteenmile Creek (chrysene). Pressure filtration sampling from Irondequoit Creek found an increase as the creek passed a potential source but the concentrations were low relative to whole water ambient water quality criteria. Pressure filtration from Eighteenmile Creek found no PAHs.

MAPS

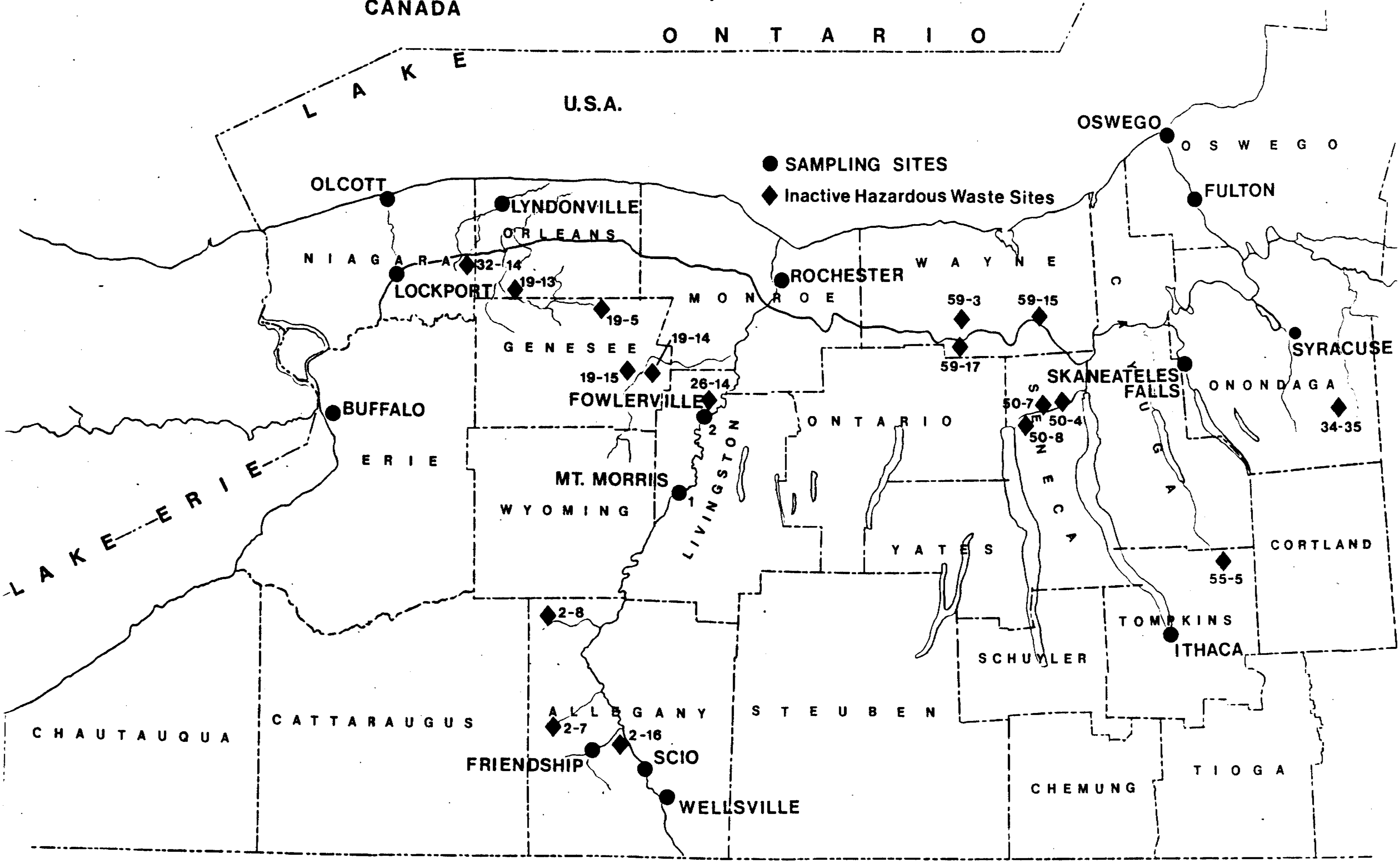
Maps A through S show the sampled water bodies, the approximate positions of the sampling sites, and approximate locations of inactive hazardous waste sites. Sampling sites are numbered. Names for the PISCES sample sites are given in the text (Table 4). Dissolved pesticides (Table 6) and suspended solids sampling sites (Table 7)are subsets of stations named in Table 4. Aqueous mercury samples are named in Table 8. Sediment samples are named in Table 9. Appendix I gives information for the inactive hazardous waste sites.

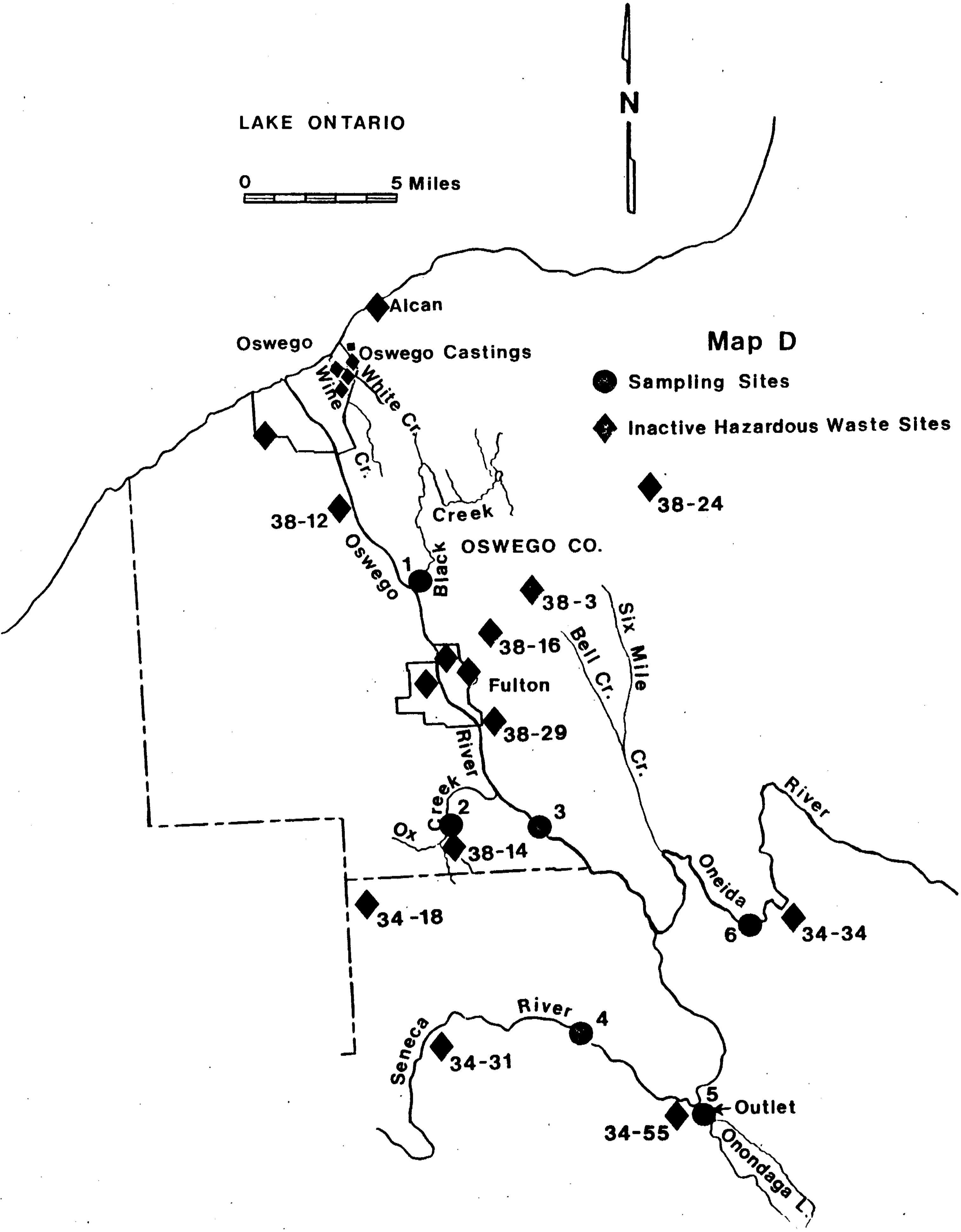

N
SCALE
5 0 5 Miles
JEFFERSON CO.
Indian River
14
15
FORT DRUM
13
12
23-8
23-10
Black
23-5
23-3
1
23-9
23-6
Watertown
11
10
25-2
River
Beaver
River
Deer River
2
5
3
4
Creek
Sandy
6
LAKE ONTARIO
25-5
LEWIS CO.
25-8
9
Moose
River
7
OSWEGO CO.
Salmon
River
33-23
Woodhull Cr.
8
Sampling Sites
Inactive Hazardous Waste Sites

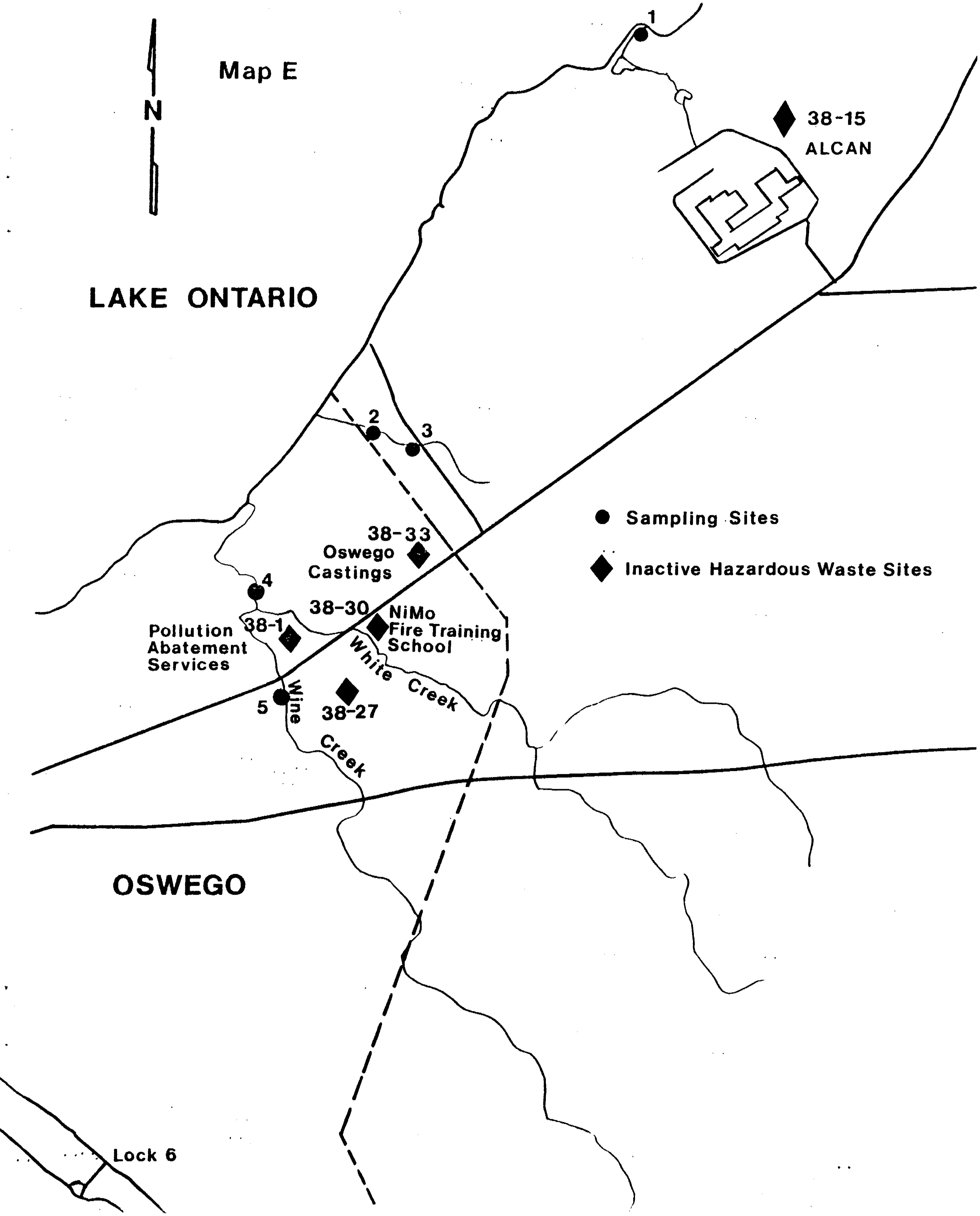
Map A

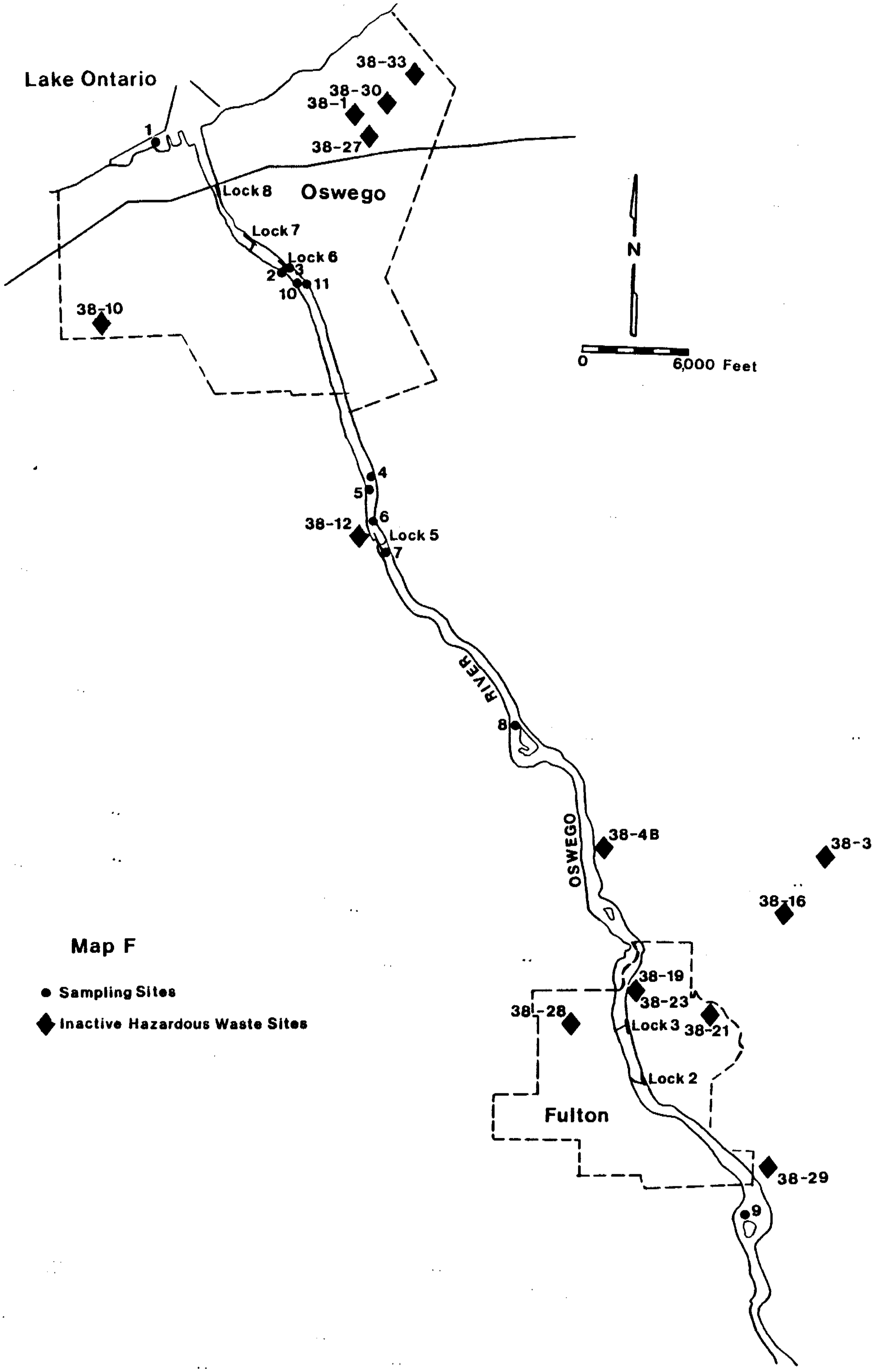

N
I-81
Creek
Kelsey
1
2
Leray Spring
3
4
5
W. Main St.
Leray St.
Mill St.
Coffeen St.
BLACK
RIVER
Pearl St.
23-3
23-6
Arsenal St.
State St.
Map B
Watertown
● Sampling Sites
◆ Inactive Hazardous Waste Sites
0
1/2
1 MILE

Map C

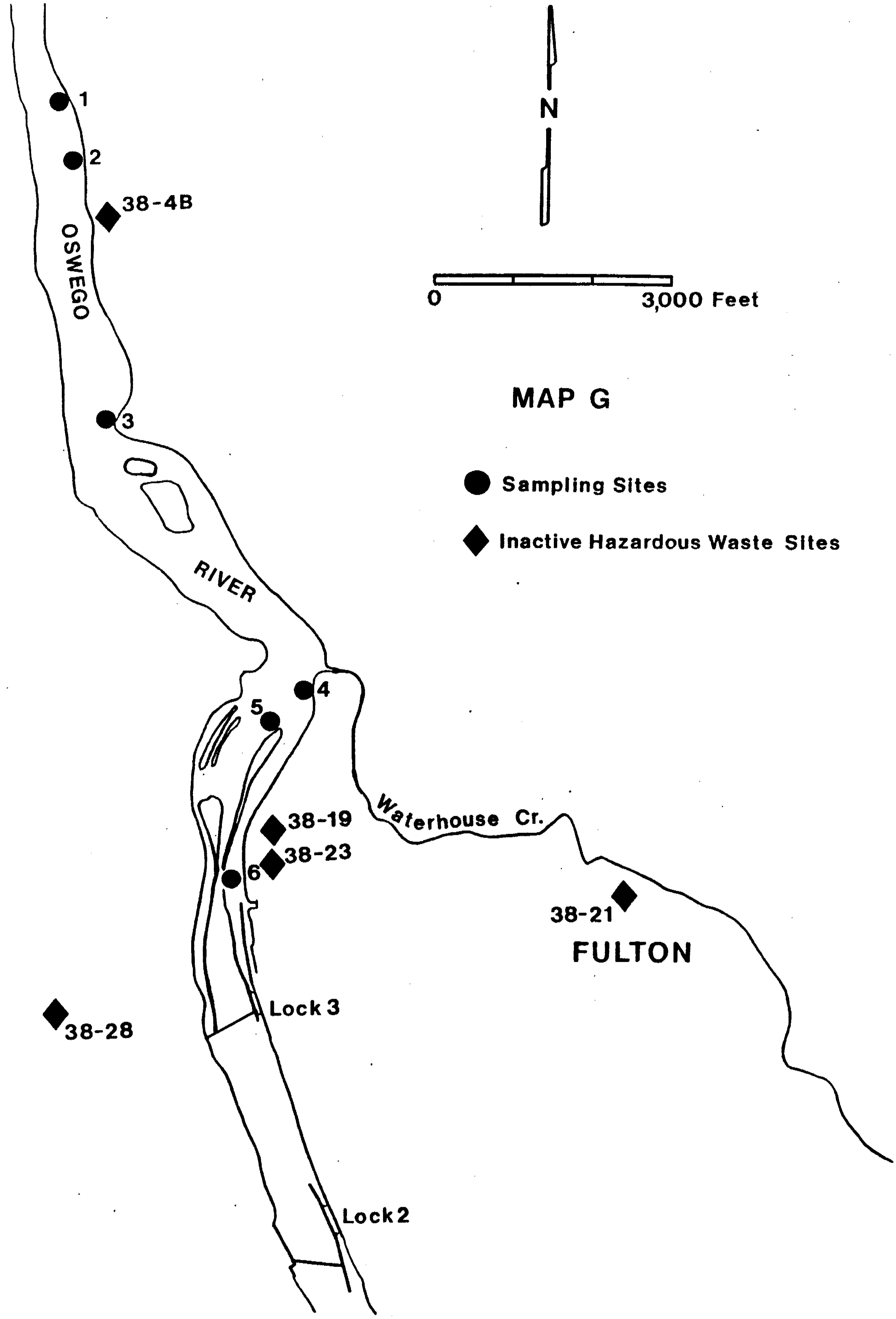

CANADA
LAKE ONTARIO
U.S.A.
LAKE ERIE
SAMPLING SITES
Inactive Hazardous Waste Sites
OLCOTT
LYNDONVILLE
LOCKPORT
BUFFALO
ROCHESTER
FOWLERVILLE
MT. MORRIS
FRIENDSHIP
SCIO
WELLSVILLE
OSWEGO
FULTON
SYRACUSE
SKANEATELES FALLS
ITHACA
NIAGARA
ORLEANS
GENESEE
MONROE
WAYNE
ERIE
WYOMING
LIVINGSTON
ONTARIO
YATES
SENECA
CAYUGA
ONONDAGA
OSWEGO
CORTLAND
TOMPKINS
SCHUYLER
CHEMUNG
TIOGA
STEUBEN
ALLEGANY
CATTARAUGUS
CHAUTAUQUA
32-14
19-13
19-5
19-14
19-15
26-14
2
1
2-8
2-7
2-16
59-3
59-15
59-17
50-7
50-4
50-8
34-35
55-5


LAKE ONTARIO
0
5 Miles
N
Map D
● Sampling Sites
◆ Inactive Hazardous Waste Sites
Alcan
Oswego
Oswego Castings
White Cr.
Wine Cr.
Creek
Black
38-24
38-12
Oswego
OSWEGO CO.
1
38-3
38-16
Bell Cr.
Six Mile Cr.
Fulton
38-29
River
Creek
2
3
Ox Creek
38-14
River
Oneida
6
34-34
34-18
River
4
Seneca
34-31
5
Outlet
34-55
Onondaga L.


Map E
N
LAKE ONTARIO
1
38-15
ALCAN
2
3
● Sampling Sites
◆ Inactive Hazardous Waste Sites
38-33
Oswego
Castings
4
38-30
NiMo
Fire Training
School
Pollution
Abatement
Services
38-1
White Creek
Wine Creek
5
38-27
OSWEGO
Lock 6

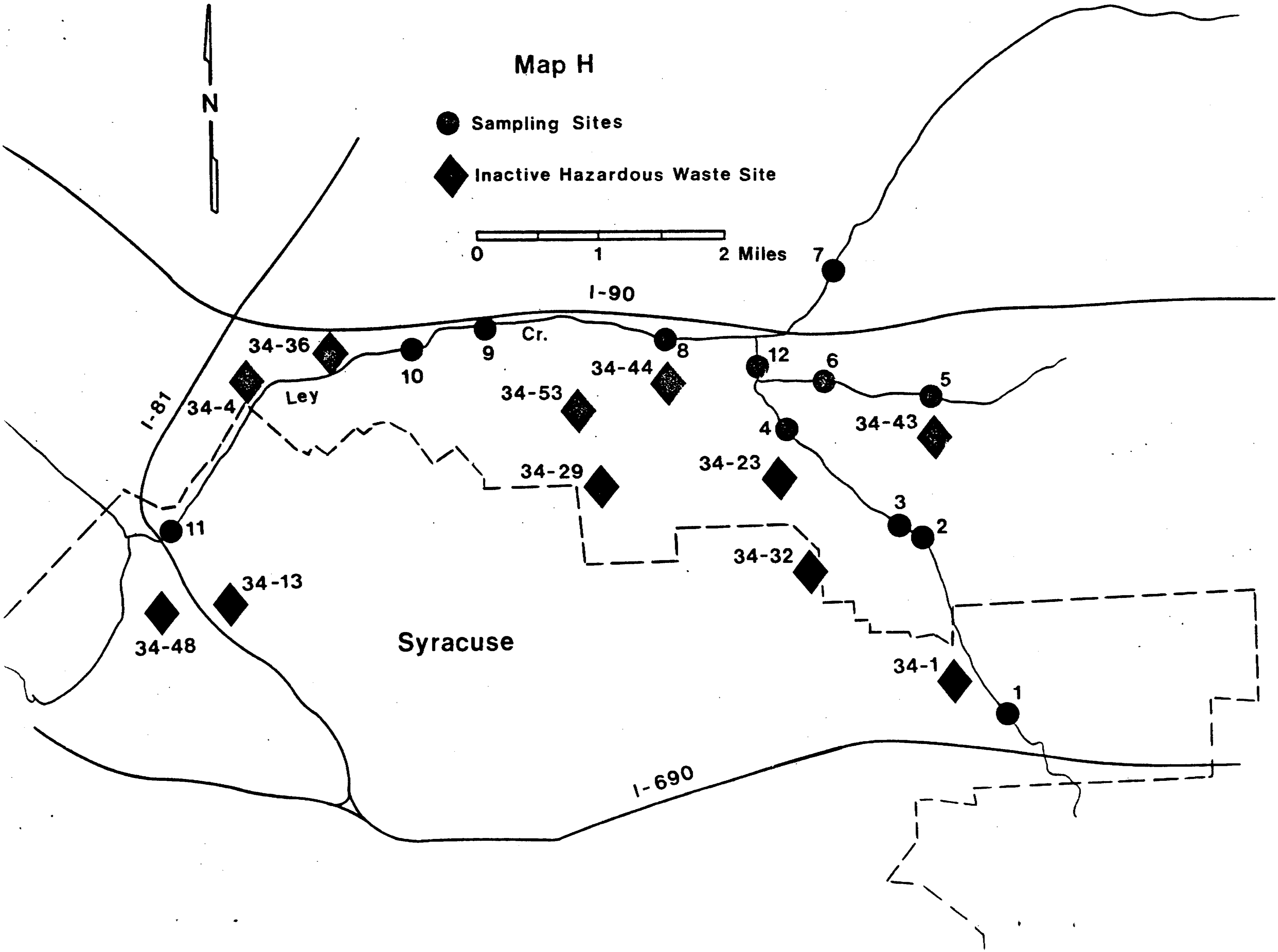

Lake Ontario
1
Lock 8
Oswego
38-33
38-30
38-1
38-27
Lock 7
Lock 6
2
3
10
11
38-10
N
0
6,000 Feet
4
5
6
38-12
Lock 5
7
RIVER
8
OSWEGO
38-4B
38-3
38-16
38-19
38-23
38-28
Lock 3
38-21
Lock 2
Fulton
38-29
9
● Sampling Sites
◆ Inactive Hazardous Waste Sites

Map F



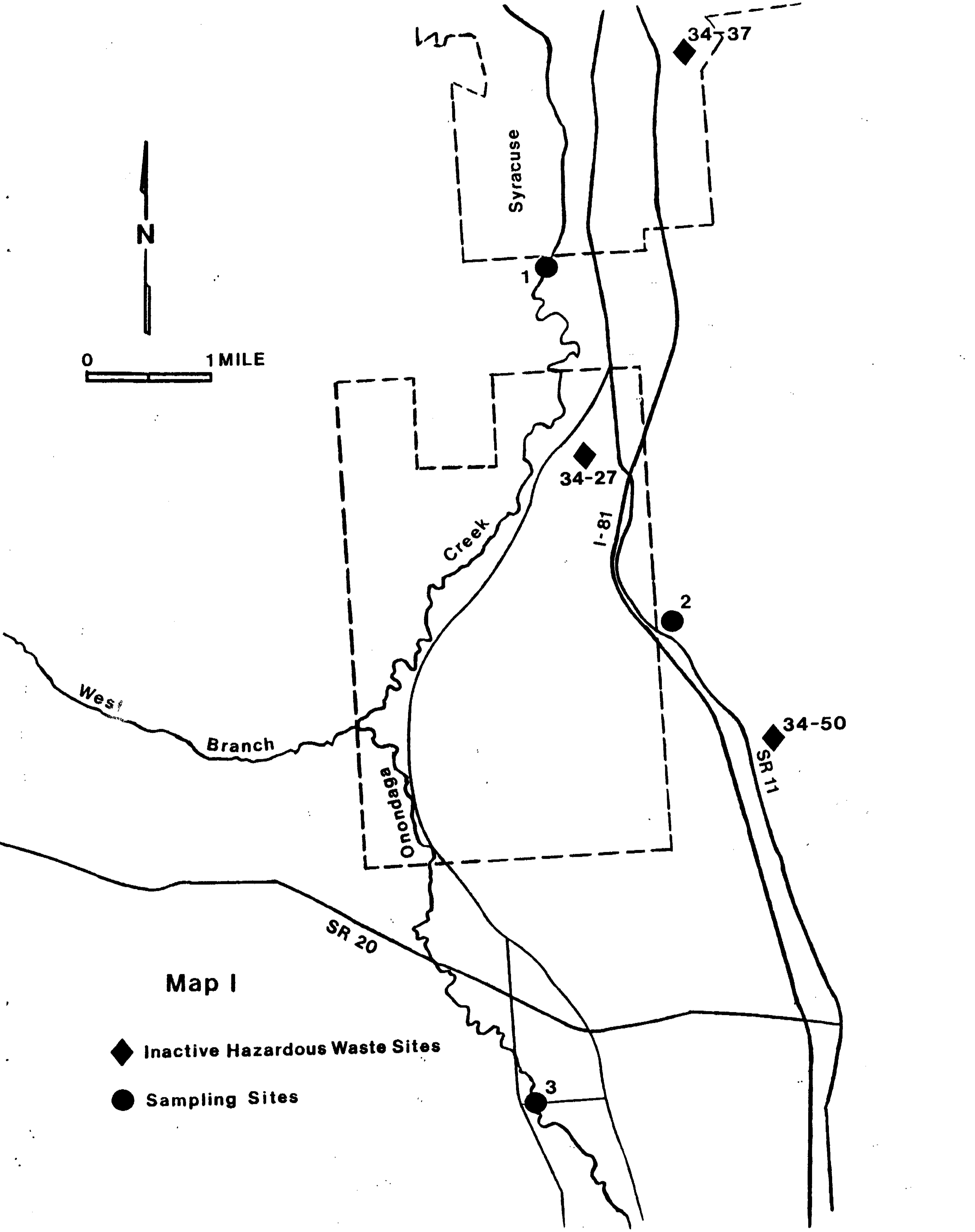
MAP G

N
0
3,000 Feet
● Sampling Sites
◆ Inactive Hazardous Waste Sites
OSWEGO
RIVER
1
2
3
4
5
6
38-4B
38-19
38-23
38-21
38-28
Waterhouse Cr.
FULTON
Lock 3
Lock 2

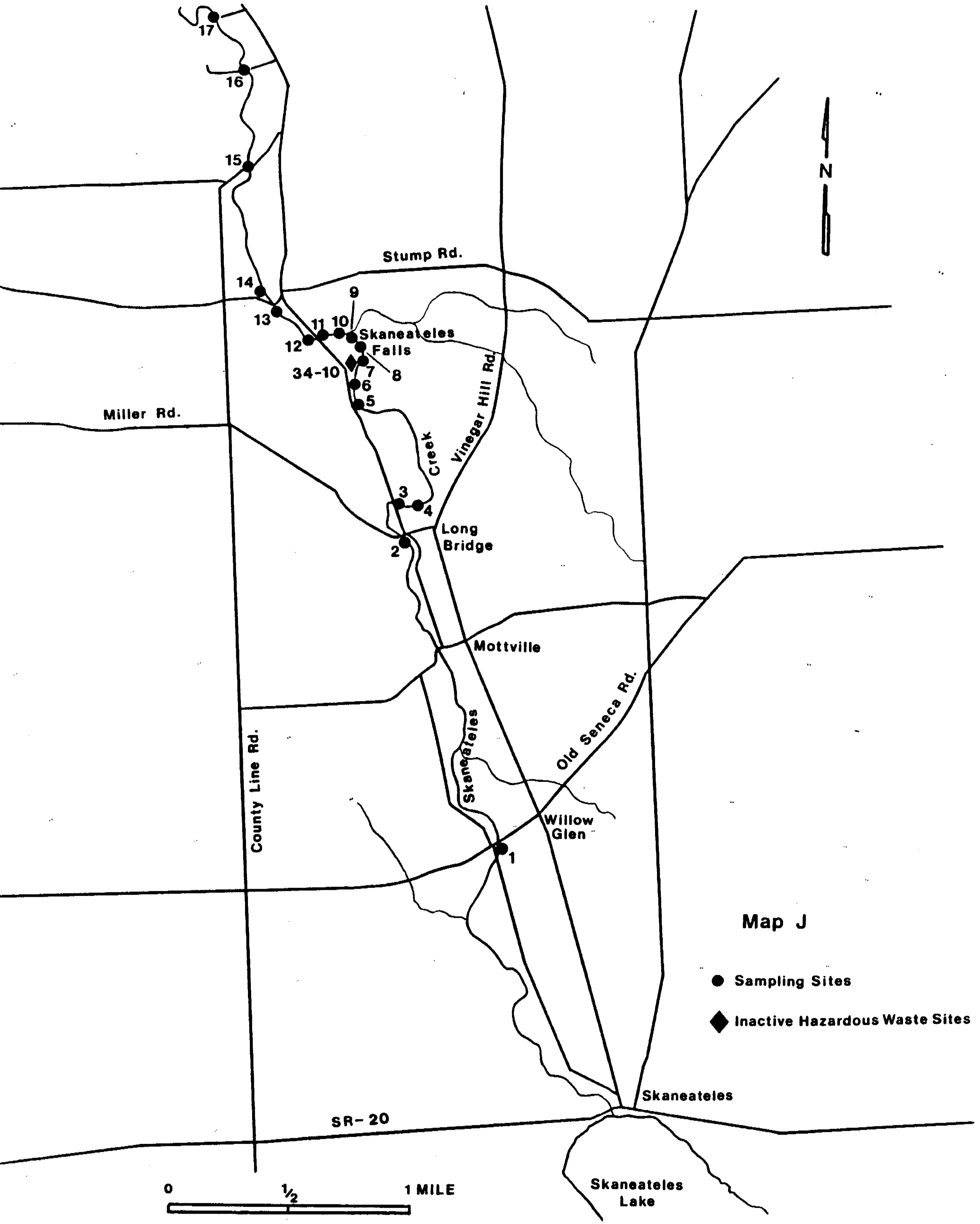


Map H

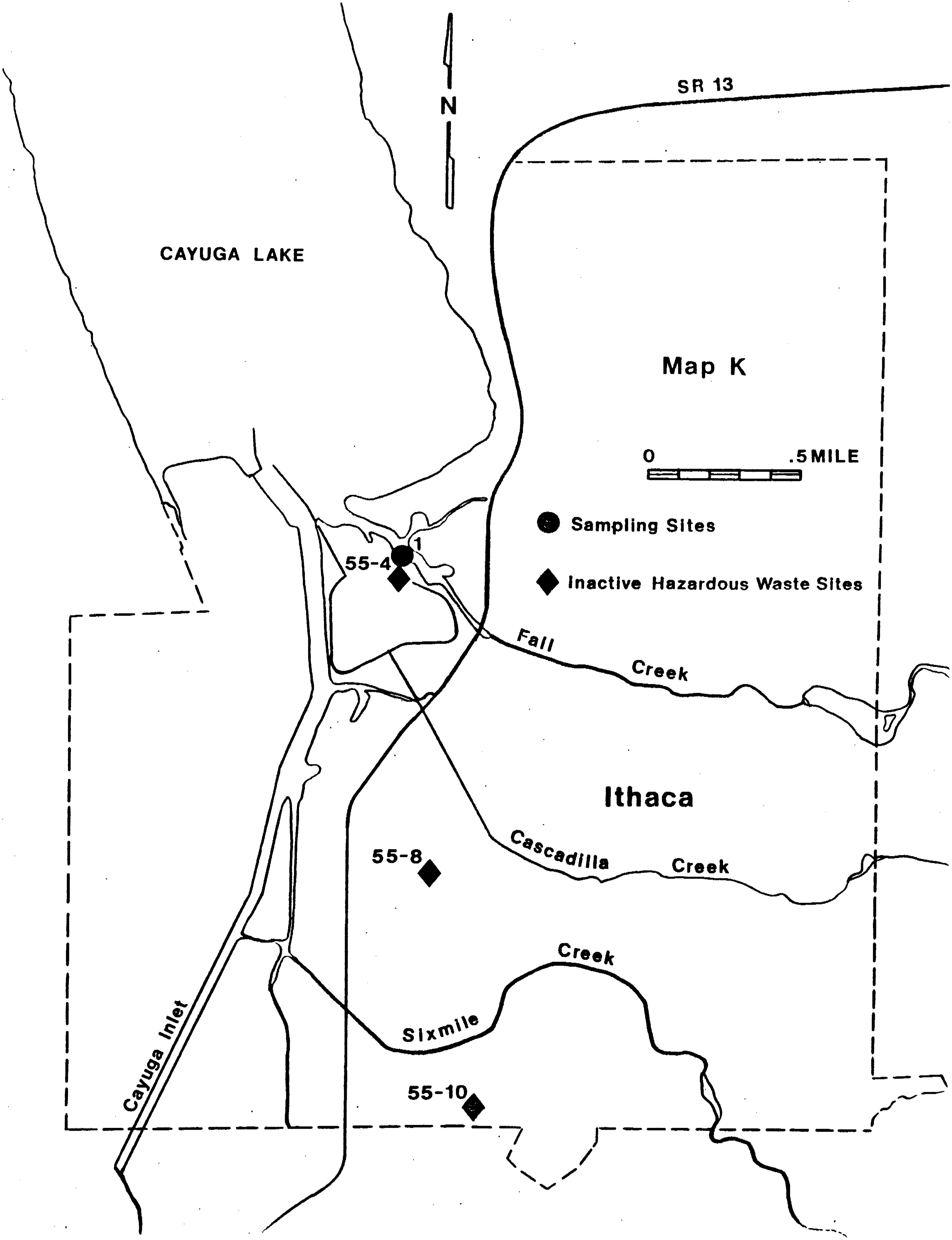
N
Sampling Sites
Inactive Hazardous Waste Site
0
1
2 Miles
I-90
I-81
I-690
Cr.
Ley
Syracuse
1
2
3
4
5
6
7
8
9
10
11
12
34-1
34-4
34-13
34-23
34-29
34-32
34-36
34-43
34-44
34-48
34-53


34-37
Syracuse
N
0
1 MILE
1
34-27
Creek
I-81
2
34-50
SR 11
West
Branch
Onondaga
SR 20
3
◆ Inactive Hazardous Waste Sites
● Sampling Sites

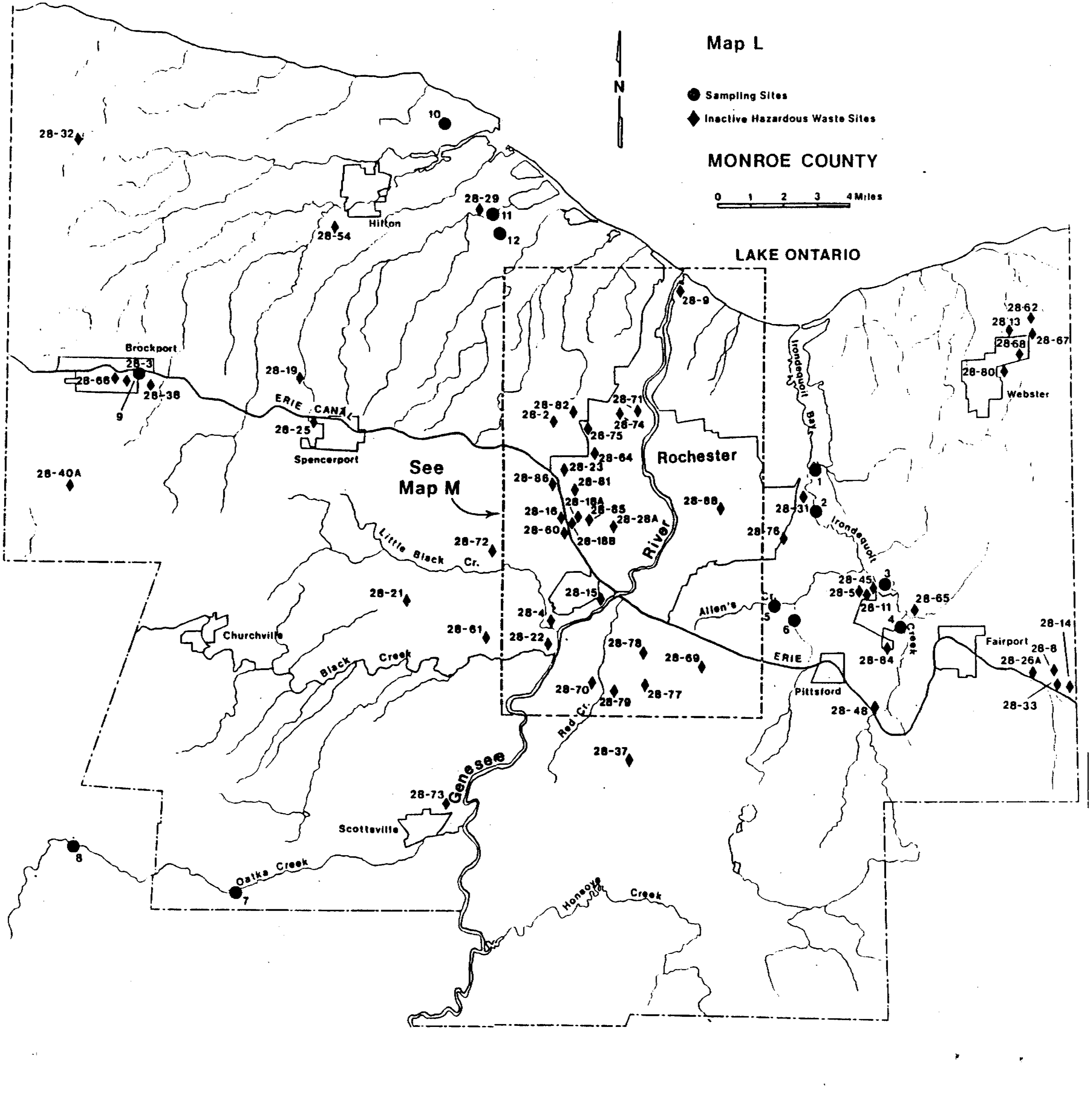
Map I

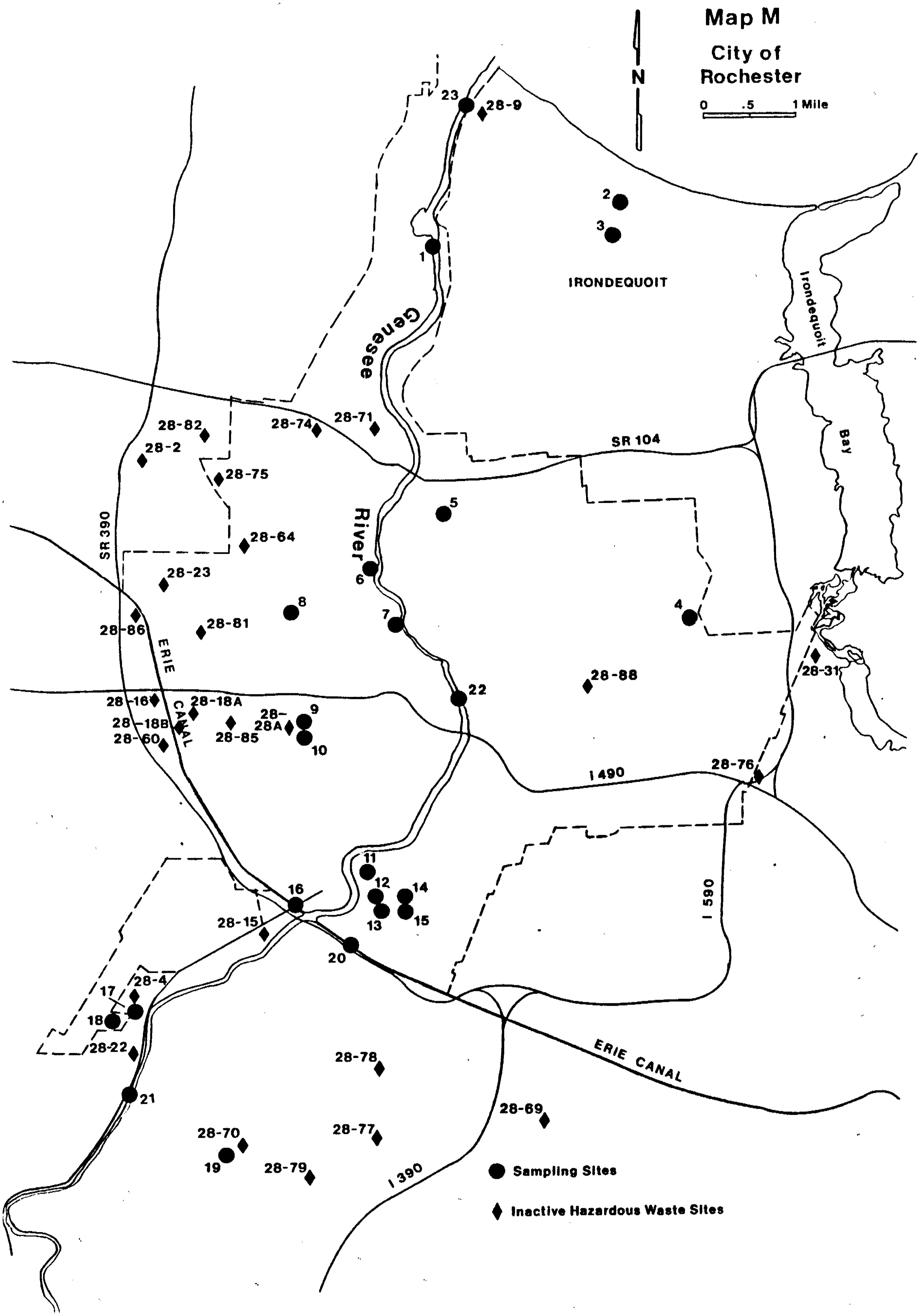

Map J

N
Stump Rd.
Miller Rd.
County Line Rd.
Vinegar Hill Rd.
Old Seneca Rd.
SR- 20
Skaneateles Falls
Skaneateles Creek
Long Bridge
Mottville
Willow Glen
Skaneateles
Skaneateles Lake
34-10
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
● Sampling Sites
◆ Inactive Hazardous Waste Sites
0
1/2
1 MILE



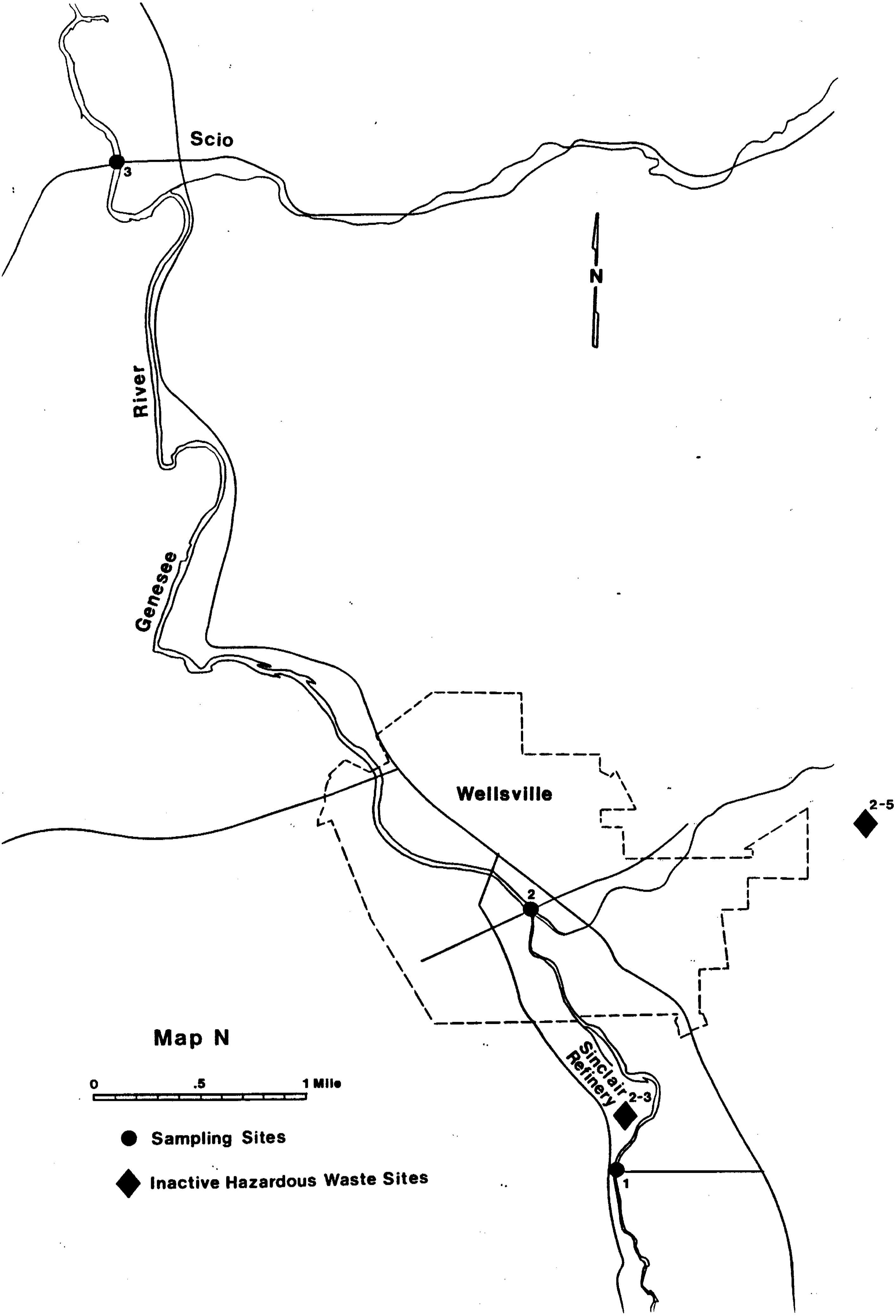
SR 13
N
CAYUGA LAKE
Map K
0
.5 MILE
● Sampling Sites
◆ Inactive Hazardous Waste Sites
1
55-4
Fall
Creek
Ithaca
Cascadilla
Creek
55-8
Creek
Sixmile
Cayuga Inlet
55-10


Map L
N
● Sampling Sites
◆ Inactive Hazardous Waste Sites
MONROE COUNTY
0 1 2 3 4 Miles
LAKE ONTARIO
Rochester
See Map M
River
Genesee
ERIE CANAL
ERIE
Irondequoit Bay
Irondequoit Creek
Allen's Cr.
Little Black Cr.
Black Creek
Red Cr.
Oatka Creek
Honeoye Creek
Brockport
Hilton
Spencerport
Churchville
Scottsville
Pittsford
Fairport
Webster
1
2
3
4
5
6
7
8
9
10
11
12
28-2
28-3
28-4
28-5
28-8
28-9
28-11
28-13
28-14
28-15
28-16
28-18A
28-18B
28-19
28-21
28-22
28-23
28-25
28-26A
28-28A
28-29
28-31
28-32
28-33
28-37
28-38
28-40A
28-45
28-48
28-54
28-60
28-61
28-62
28-64
28-65
28-66
28-67
28-68
28-69
28-70
28-71
28-72
28-73
28-74
28-75
28-76
28-77
28-78
28-79
28-80
28-81
28-82
28-84
28-85
28-86
28-88

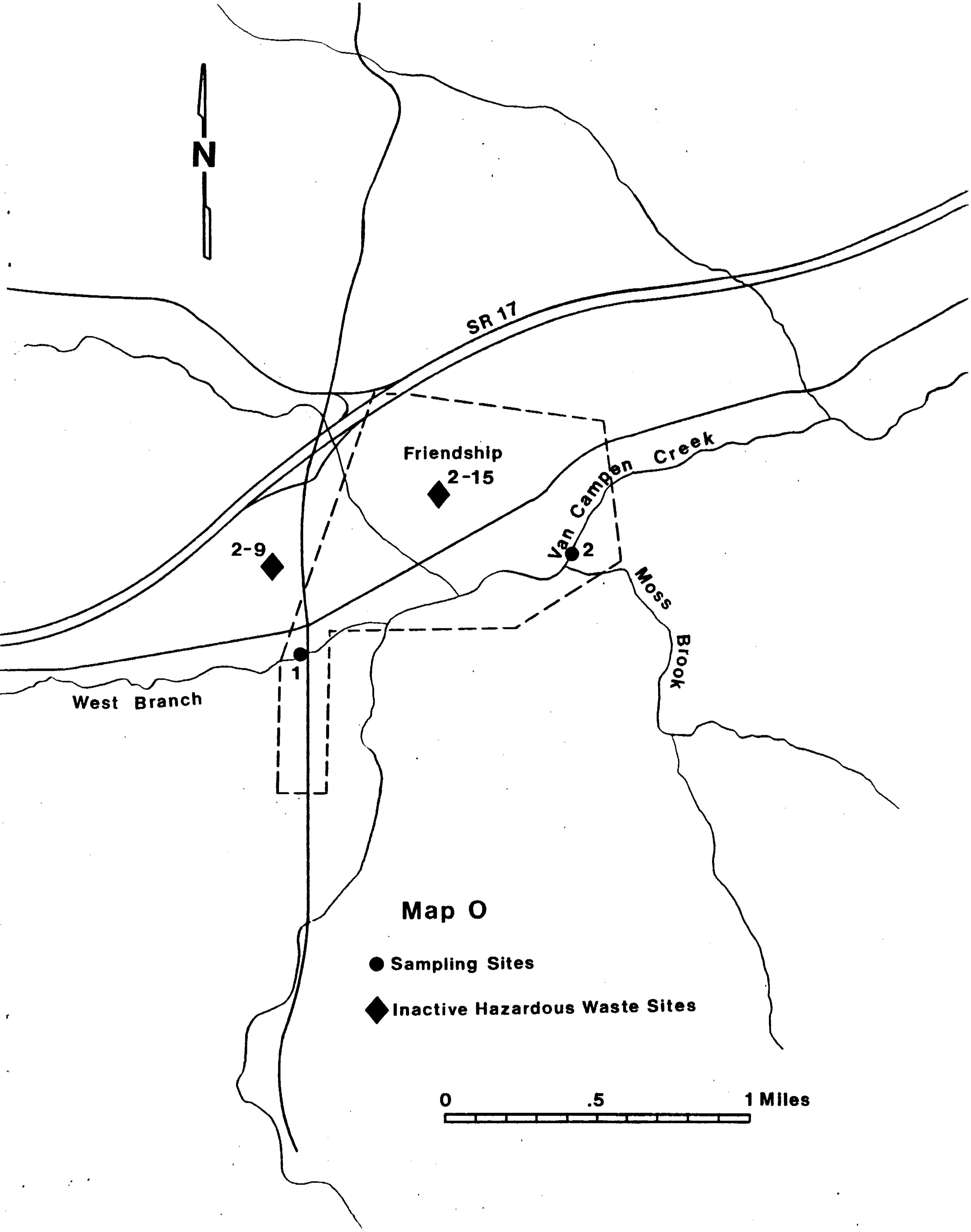


Map M

City of Rochester

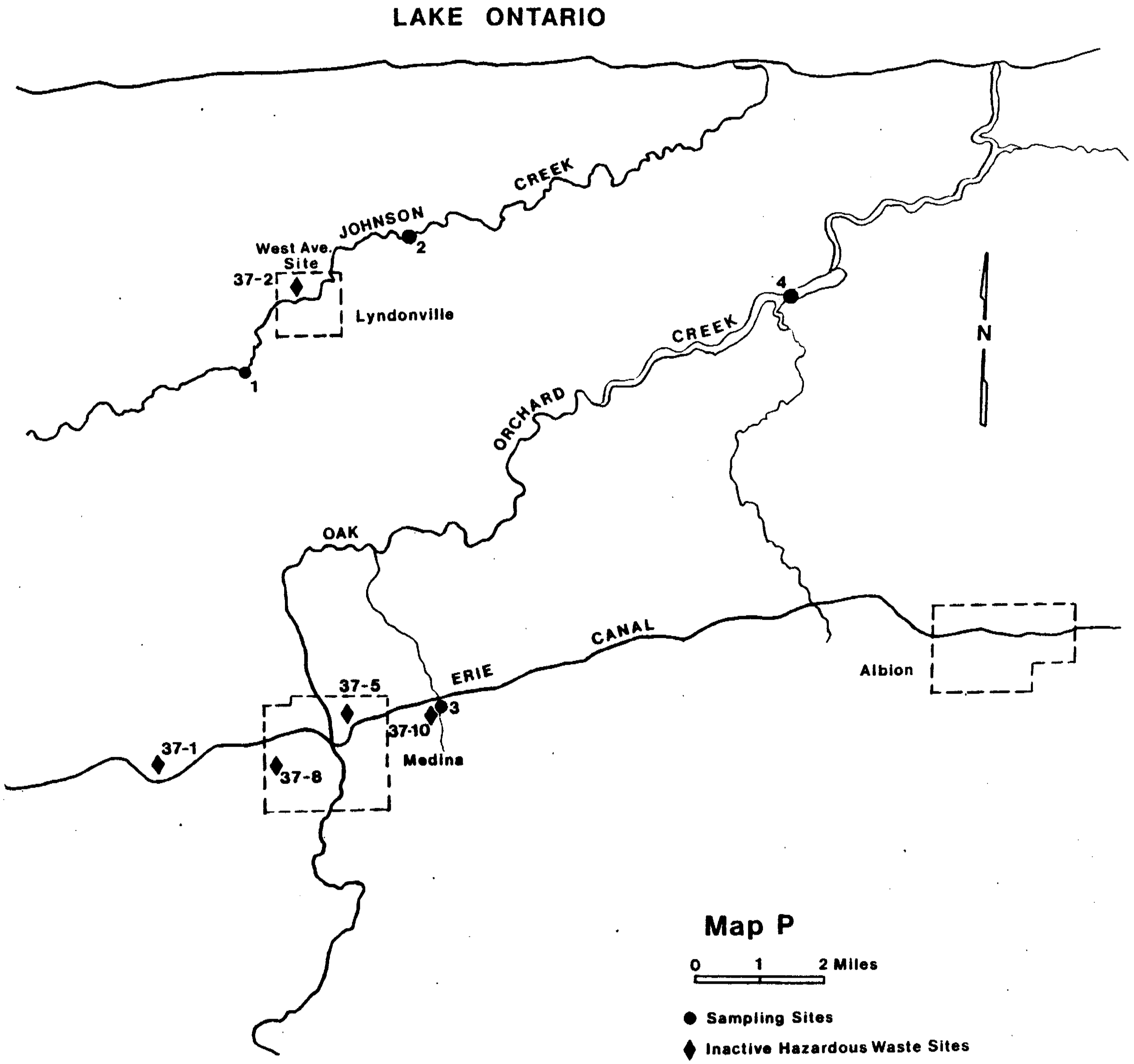

Scio
3
N
River
Genesee
Wellsville
2-5
2
Sinclair Refinery
2-3
1
0
.5
1 Mile
● Sampling Sites
◆ Inactive Hazardous Waste Sites

Map N



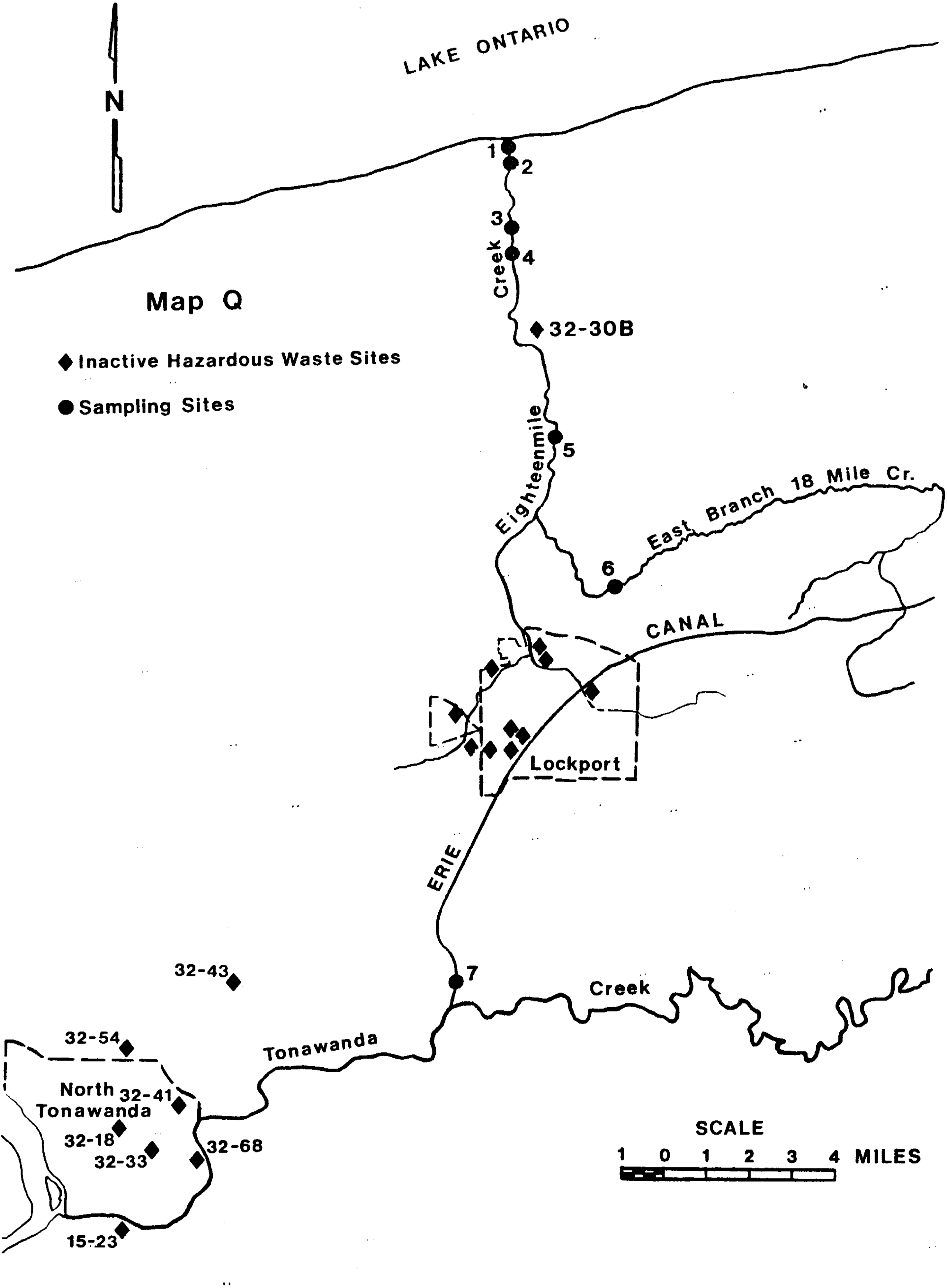
Map O

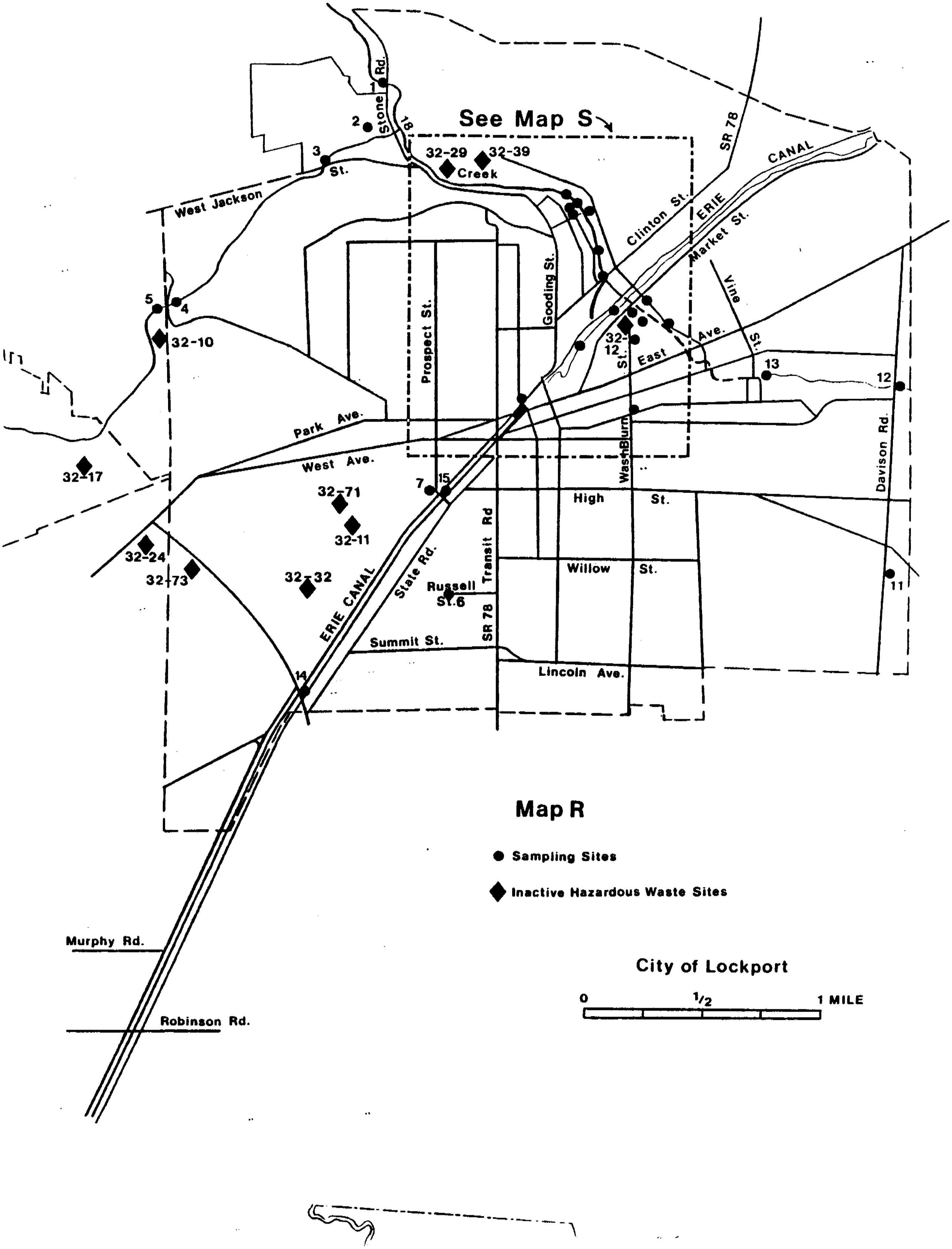
N
SR 17
Friendship
2-15
2-9
Van Campen Creek
2
1
Moss Brook
West Branch
● Sampling Sites
◆ Inactive Hazardous Waste Sites
0
.5
1 Miles



Map P

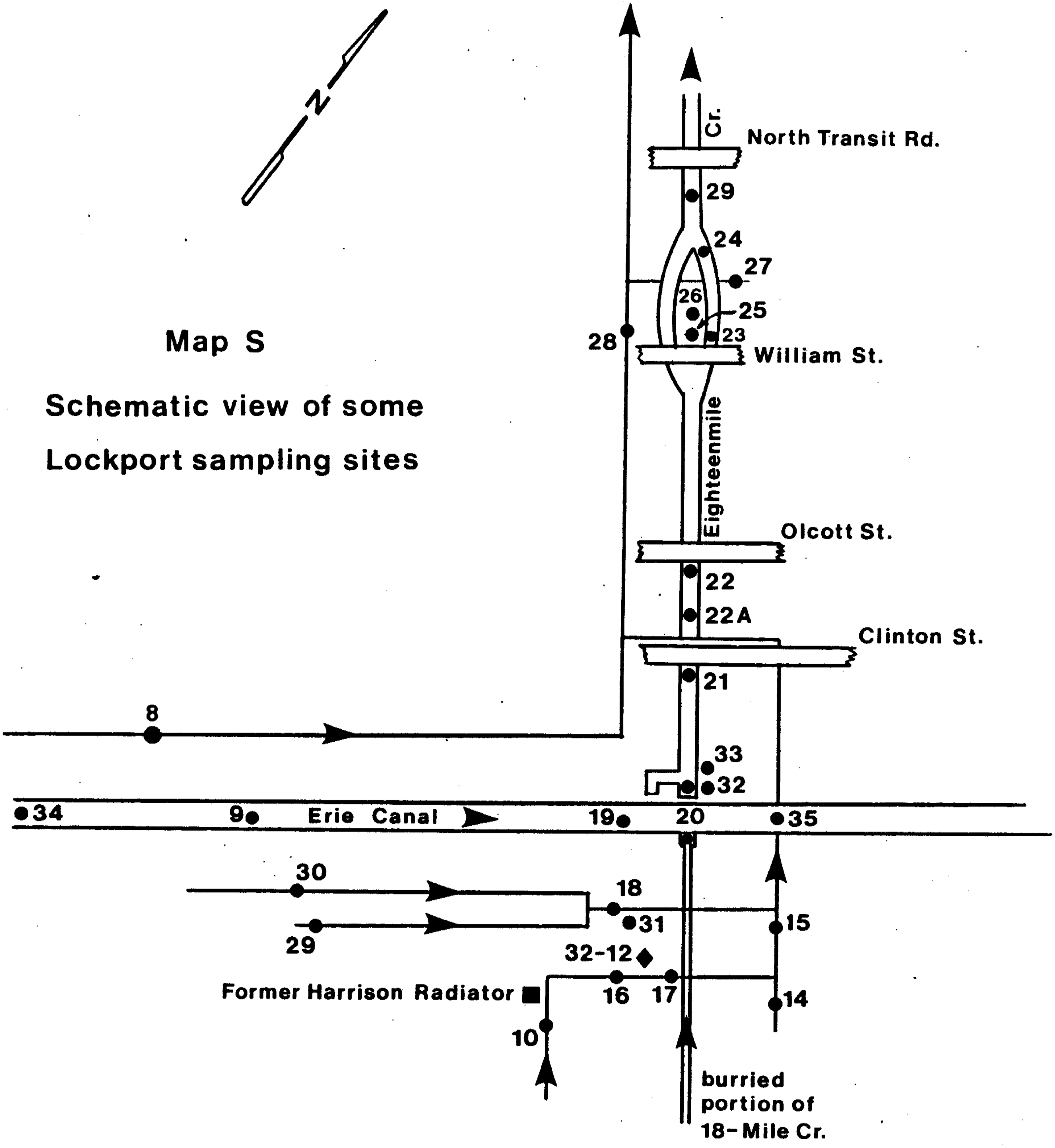
LAKE ONTARIO
JOHNSON CREEK
West Ave. Site
37-2
2
Lyndonville
1
4
ORCHARD CREEK
N
OAK
ERIE CANAL
Albion
37-5
37-10
3
Medina
37-1
37-8
0 1 2 Miles
● Sampling Sites
◆ Inactive Hazardous Waste Sites


N
LAKE ONTARIO
Map Q
◆ Inactive Hazardous Waste Sites
● Sampling Sites
1
2
3
4
5
6
7
Eighteenmile Creek
32-30B
East Branch 18 Mile Cr.
CANAL
Lockport
ERIE
Tonawanda Creek
32-43
32-54
North Tonawanda
32-41
32-18
32-33
32-68
15-23
SCALE
1 0 1 2 3 4 MILES



Map R

City of Lockport



Map S

Schematic view of some Lockport sampling sites

Appendix I - Inactive Hazardous Waste Sites.

Number	Map	Name	Class.	Target Chemicals	Surface Water	Site Status
6-23-005	A	DEC Brownville Pest. Build.	3	pesticides	Trout Cr. to Black River	RA completed in 92
6-23-008	A	Fort Drum Waste Dis. Areas	2		Indian River	RI/FS in progress
6-23-009	A	Bomax Manufacturing	2		Black River	contaminated soil IRM completed, RA in progress
6-23-010	A	Crown Cleaner Inc.	2		Black River	Carbon filtration installed for village by SSF.
6-25-002	A	Swiss Road Site	2a		Beaver R. to Black R.	PSA underway
6-25-005	A	Paine Jones	2a	heavy metals	Mill Cr. to Black R.	PSA completed, Phase II confirmed soil and surface water contamination.
6-25-008	A	AMF:Trinity Ave.	4		Mill Cr. to Black R.	RI/FS completed in 86, currently groundwater is being treated.
6-33-023	A	Boonville Village Dump	2a		Black River	Phase I completed, Phase II underway.
6-23-003	B	New York Air Brake	2	PCBs, heavy metals	Kelsey Cr. & Oily Cr.	RI/FS Completed,RD in progress
6-23-006	B	Abe Cooper Surplus Co.	2	PCBs, heavy metals	Black River	RI/FS Completed,RD in progress
7-34-035	C	Pompey Solvent Center	2	PCBs	Butternut Cr. to Oneida Lake	RI/FS completed, negotiations for RD/RA in progress.
8-19-005	C	Byron Barrel Site	2	PCBs	Oak Orchard Cr.	RD underway
8-19-013	C	Iroquois Nat'l Wildlife Refuge	2		Oak Orchard Cr.	RI completed.
8-19-014	C	Lehigh Valley Derailment	2		Oatka Cr.	RI/FS in progress.
8-19-015	C	Target Products	2a		Oatka Cr.	PSA in progress
8-26-014	C	Tennesse Gas Pipeline	2a	PCBs	Bidwell Cr. to Genesee River	Phase II completed
8-50-004	C	Tantalo Landfill	2		Black Br. to Seneca River	RI/FS in progress
8-50-007	C	R.L. Seeler Scavenger	3	heavy metals	Black Br. to Seneca River	PSA in progress
8-50-008	C	Geneva Coal Gasification	2	PAHs	Seneca Lake	Task -3 Investigation completed 88,
8-59-003	C	Agrico	2a		Ganargue Cr.	PSA in progress
8-59-015	C	Old Erie Canal		PCBs	Erie Canal	PSA in progress
8-59-017	C	Newark Florist				Draft site investigation under review
9-02-007	C	Deming Electroplating	2a	heavy metals	Six Town Cr. to Cold Cr. to	RA in progress
9-02-008	C	Ballard Farm	2a		Black Cr. to Genesee River	PSA completed 93,
9-02-016	C	Belmont BOCES	4	PAHs	Genesee River	RA completed,groundwater monitoring
9-32-014	C	FMC Corp.	2		Johnson Cr.	RA completed ,off site RI/FS in progress
7-34-018	D	NYS DEC pesticide storage	3		Ox Cr.	RA completed
7-34-031	D	Van Buren Town Landfill	2		Seneca River	RI/FS completed in 92,ROD signed
7-34-034	D	Clay Town Landfill	2	PCBs	Oneida River	RI completed
7-34-055	D	GE Farrell Rd.	2	PCBs, metals	Seneca River	negotiation for RI/FS
7-38-014	D	Clothier Site	4	PCBs	Ox Cr. to Oswego River	RA completed.
7-38-024	D	Burton Junkyard	delisted		?	
7-38-001	E	Pollution Abatement Services	2	PCBs	Wine Cr.	RA completed supplental RD work underway.
7-38-015	E	Alcan	2a	PCBs	Lake Ontario	PSA completed.
7-38-027	E	East Seneca St. Dump	delisted		White & Wine Creeks	
7-38-030	E	NiMo Fire training	2	PCBs	White Cr.	RI/FS began 7/93
7-38-033	E	Oswego Castings	2	PCBs (Aroclors 1248 and 1254)	Lake Ontario	RI/FS began 7/93
7-38-003	F	Volney Landfill	2		Bell to Six Mile Cr. to Onieda R	NPL site RI/FS completed, ROD signed in 1987.
7-38-010	F	Irwin Property	2	from PAS	Lake Ontario & Harbor	2 Phase II investigations completed.
7-38-012	F	Columbia Mills Co.	2	PCBs, heavy metals	Oswego River	IRM completed, RA began 2/95
7-38-016	F	Old Fulton City Dump	3		Waterhouse Cr. to Oswego R.	Phase I and II investigations completed
7-38-029	F	Miller Brewing Co.	2		Oswego River	RI completed FS in progress.
7-38-019	G	Fulton 6th Ward	delisted		Oswego River	
7-38-021	G	Keck Farm	delisted		Waterhouse Cr. to Oswego R.	
7-38-023	G	Fulton Terminal Site	2	PCBs, metals	Oswego River	RD in progress.
7-38-028	G	Colture Property	2a	PCBs	Lake Neatahwanta	P2 completed, delisted 4/1995
7-38-04B	G	Armstrong Cork	delisted		Oswego River	
7-34-001	H	Bristol Labs	2a		South Branch Ley Cr.	PSA in progress
7-34-004	H	Crouse Hinds	3		Ley Cr.	Phase I completed in 1987.
7-34-013	H	Quanta Resources	2		Onondaga Cr.	Phase II completed
7-34-023	H	Valenite	2a	heavy metals	South Branch Ley Cr.	PSA completed 1991.
7-34-029	H	Old Syracuse Die	2	PCBs	Ley Cr.	RA completed in 94
7-34-032	H	Prestolite Co.	delisted		South Branch Ley Cr.	
7-34-036	H	Salina Town Landfill	2a	PCBs	Ley Cr.	PSA completed, being considered for listing as class 2 site
7-34-043	H	UTC Carrier	2		Sanders Cr.	RCRA closure plan approved,
7-34-044	H	Ley Cr. PCB dredgings	2	PCBs (Aroclors 1242, 1248, and 1260)	Ley Cr.	RI/FS being performed.
7-34-048	H	Clark Property	2		Onondaga Cr. & Lake	RI/FS in progress,
7-34-053	H	Syracuse China	2	heavy metals	Ley Cr.	RI/FS to begin 12/94
7-34-027	I	Onondaga Nation	2	mercury	Onondaga Cr.	drum removal in progress Phase I & II complete
7-34-037	I	Brighton Ave. Landfill	2a	PCBs	?	PSA completed 11/94 , delisted 5/95
7-34-050	I	Tennessee Gas Pipeline	2	PCBs	Onondaga Cr.	RI/FS to be completed in 95
7-34-010	J	ICI Americas (Stauffer)	2		Skaneateles Cr.	FS in progress
7-55-004	K	Ithaca Fire Training	2a		Bay at Fall Cr. Outlet	P2 completed 90 , delisted 5/95
7-55-008	K	NYSEG	2	PAHs	Cayuga Inlet	P2 completed , RI/FS in progress
7-55-010	K	Morse Industrial Corp.	2		Six mile Cr.	RI/FS in progress, IRM low volume pump and treat.
8-28-003	L	Former GE&Black&Decker	2	metals	Brookport Cr.	RCRA program, groundwater IRM pump and treat
8-28-005	L	Alcan	2	heavy metals	Irondequoit Cr.	RI/FS in progress.
8-28-008	L	Plumb Gravel Pit	2a		Thomas C. to Irondequoit C.	PSA in progress.
8-28-011	L	Sigismondi	2	metals	Irondequoit Cr.	IRM soil removal, PSA completed 1992.
8-28-013	L	Xerox Landfill	4		Four Mile Cr.	RA complete; site is closed.
8-28-014	L	High Acres Development	3	metals	Thomas C. to Irondequoit C.	P1 & P2 completed, monitoring required under 360 permit.
8-28-019	L	Monarch Sand&Gravel	delisted		Buttonwood Cr.	
8-28-021	L	Golden Rd. Disposal	2	PCBs	Little Black Cr.	P2 report completed RI/FS to begin 2/95
8-28-025	L	Spencerport Dump	3	pesticides	Canal or Buttonwood Cr.	P2 completed in 1986, delisted.
8-28-026A	L	Little League	3		Thomas C. to Irondequoit C.	Phase II completed 91,leachate problems continue.
8-28-029	L	Greece Landfill Flynn Rd.	delisted		Black Cr.	
8-28-032	L	Hamlin Town Dump	2		Sandy Cr.	PSA in progress, IRM drum removal 93,
8-28-033	L	Perinton Landfill	2a		Thomas C. to Irondequoit C.	PSA completed,further investigation needed
8-28-037	L	Henrietta Dump	2a		Red Cr.	PSA in progress, further investigation needed
8-28-038	L	Brockport Landfill	2		Otis Cr.	Phase II completed 91,DEE negotiating for RI/FS
8-28-040A	L	Sweden 3; Chapman	2	heavy metals	Salmon Cr.	RI/FS completed, ROD signed 1994, IRM drum removal.
8-28-045	L	NYS Dot Pittsford	2a		Irondequoit Cr.	P2 found site related contaminants in tributary water samples.
8-28-048	L	Pittsford Town Dump	3		Irondequoit Cr.	Phase II completed 1992.
8-28-054	L	Beehler & Radford	2a	metals	Salmon & Buttonwood Crs.	PSA to be completed in 96
8-28-061	L	Bausch & Lomb	2	heavy metals (lead)	Black Cr. & Trib. by Airport	RI/FS in progress, groundwater and soil contamination detected.

Appendix I - Inactive Hazardous Waste Sites.

Number	Map	Name	Class.	Target Chemicals	Surface Water	Site Status
8-28-062	L	R.D. Specialties	4	metals	Four Mile Cr.	RI/FS completed 1990, ROD signed 1991.
8-28-065	L	George A Robinson	2	solvents	Irondequoit Cr.	DEE in process of investigation,site poses sig. threat to environ.
8-28-066	L	Former 3M/Dynacolor Plant	2a	heavy metals	Brockport Cr.	PSA in progress,soil and groundwater assessment needed.
8-28-067	L	Xerox:Salt Road	2		Four Mile Cr.	RCRA regulated, IRM pump and treat in use,
8-28-068	L	Xerox:Building 209	2		Four Mile Cr.	RCRA regulated, soil and groundwater under study.
8-28-072	L	Erdle Perforating	2		Little Black Cr.	RI/FS in progress,fruther study needed
8-28-073	L	Tom Paxton Chevrolet	2a		Genesee River	Phase II completed 91, minimal contamination
8-28-080	L	Xerox Building 201	2	metals	Four Mile Cr.	RCRA program, soil and groundwater contamination detected.
8-28-084	L	Autohous of Rochester	2		Irondequoit Cr.	IRM removal of soil and a leach tank., monitoring well installed.
8-28-002	M	Kodak Weiland Rd.	2a	heavy metals	Trib. to Paddy Hill Cr.	RCRA investigation completed.
8-28-004	M	Xerox Corp. Landfill	delisted		Little Black Cr.	
8-28-009	M	Rochester Landfill Pattonwood	delisted		Lower Genesee River	
8-28-015	M	Rochester Fire Academy	2	PCBs	Genesee River	contaminated soil IRM; RI/FS & RD completed; RA begun 3/95.
8-28-022	M	Scottsville Rd. Chili 2	delisted		Genesee River	
8-28-028A	M	Taylor Instruments	4	elemental mercury	Roch. Storm Sewers	asphalt cap in place more information required
8-28-031	M	Brighton Town Landfill	delisted		Irondequoit Cr.	
8-28-069	M	Xerox:Henrietta	2		Allens Cr.	IRM 5 sites to be pumped and treated,RI/FS is planned.
8-28-070	M	John St. General Testing	delisted		Red Cr.	
8-28-075	M	Burrough's UNISYS	2		Paddy Hill Cr.	IRM pump and dispose to POTW, RI/FS underway.
8-28-076	M	Scobell Chemical	2		Irondequoit Cr.	IRM completed, source removal IRA in progress
8-28-077	M	Roehlen Engraving	2		Red Cr.	RI/FS completed 1994, soil and groundwater conmination detected.
8-28-078	M	Dolling Corp.	2		Red Cr.	RI/FS completed 1992, ROD signed 1992,
8-28-079	M	Stuart Oliver Holtz	2		Red Cr.	RI/FS in progress, soil and groundwater contamination detected
8-28-082	M	Eastman Kodak	2		Paddy Hill Cr.	Investigation / sampling underway, significant contamin.
9-02-003	N	Sinclair Refinery	2	heavy metals	Genesee River	ROD issued by EPA 1985.
9-02-009	O	Jones Chemical	3		Van Campen Cr.	no hazardous waste disposed on site
9-02-015	O	Friendship Foundries	2	PCBs	Van Campen Cr.	Emergency RA completed, PSA proposed.
8-37-001	P	FMC Corp.	2	pesticides	Jeddo C. to Johnson C.	ROD signed RA underway.
8-37-002	P	Lyndonville West Ave.	2	PCBs, heavy metals, pesticides	Johnson Cr.	PSA completed, RI/FS to begin 3/95, pesticides in sewers
8-37-005	P	Horan Rd. Landfill	2a		Fish & Oak Orchard Crs.	PSA completed in 92, drums to be removed, no sig. threat.
8-37-008	P	Fisher-Price	2		Oak Orchard Cr.	RI/FS in progress, groundwater contamination confirmed.
8-37-010	P	JI Case	2	pesticides, heavy metals, mercury	Unnmed Trib.- Fish C-Oak Orchard	one IRM completed, RI/FS to begin 8/94.
9-15-023	Q	Exolon Corp.	2a		Tonawonda Cr.	PSA in progress,
9-32-018	Q	Durez Div. Occidental	2		Pettit Flume (Little River)	RI/FS completed,IRM off site Pettit Flume clean-up 1994.
9-32-030B	Q	AKZO Chemicals	3		18 Mile Cr.	RCRA program, investigation needed
9-32-033	Q	Holiday Park	3		Tonawanda Cr.	Phase II completed 85,
9-32-041	Q	Wurlitzer	2a	heavy metals	Sawyer C to Tonawanda C.	Phase II completed 92, PSA to begin in 1994.
9-32-043	Q	Frontier Chemical	2	PCBs, heavy metals	Bull to Sawyer C to Tonawanda C.	RI/FS completed 1991, ROD signed 1992, RD/RA underway.
9-32-054	Q	Niagara Sanitation	3	heavy metals	Sewer C. to Tonawanda C.	Phase II completed 1989, confirms groundwater and soil contamination.
9-32-068	Q	Botanical gardens	3		Tonawanda Cr.	Phase II completed, contaminated groundwater detected.
9-32-010	R	Lockport City Landfill	2	PCBs, heavy metals	The Gulf	RI/FS completed,ROD signed 92, groundwater contamn. confirmed.
9-32-011	R	Diversified Manufacturing	3		Erie Canal	Phase I completed, no significant contamination found.
9-32-012	R	Dussault Foundry	2a	PAHs	Erie Canal	Phase I completed, no hazardous waste present
9-32-017	R	Harrison Radiator	4	heavy metals	The Gulf	waste piles removed, long term monitoring
9-32-024	R	Niagara Co. Refuse	4	heavy metals	The Gulf	site closed , groundwater seepage & leachate collection installed.
9-32-029	R	Norton Labs	2a		18 Mile Cr.	Phase II completed 88,
9-32-032	R	Guterl Specialty Steel	2a		Erie Canal	PSA in progress,additional data needed
9-32-039	R	Van de Mark Chemicals	2a		18 Mile Cr.	Phase I completed 87, groundwater monitoring wells to be installed.

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