ROCHESTER EMBAYMENT REMEDIAL ACTION PLAN

CHAPTER 5
IDENTIFICATION OF POLLUTANT SOURCES

6/8/93

A. Introduction

This chapter discusses the sources of the pollutants and associated loading factors, measured and estimated, which may be contributing to use impairments in the Rochester Embayment Area of Concern (AOC) and attempts to identify persistent toxic pollutants that may have sources in the AOC drainage basin. The chapter acknowledges that pollutant sources that affect local waters do not all originate in our AOC. Available data on pollutant discharges are presented along with a discussion of the relative importance of point and non-point sources using the Genesee River as an example. Each pollutant or pollutant category is then described and its sources outlined.

1. Pollutants Identified and Investigated

Pollutant sources were identified by evaluating a selected list of pollutants and estimating loadings with available data. The pollutants investigated are: those that are associated with impaired uses (see Chapter 4); eleven critical pollutants identified by the IJC Water Quality Board; the pollutants that are exceeding criteria in Lake Ontario (see Chapter 4); and additional pollutants identified in the Niagara River Toxics Management Plan, and supplemented by a subcommittee of the RAP Technical Group (the Loading Task Group). The list of pollutants investigated is presented in Table 5-1. For further information on how each pollutant on Table 5-1 was added to the list, see appendix D.

Of this initial list of chemicals, an additional technical group (the Priority Pollutant Task Group) made an initial determination which pollutants were of greatest concern to the Rochester Embayment based on toxicity, environmental effects, bioaccumulation, persistence, linkage with the use impairments identified in chapter 4, or the known local pollutant loadings. This preliminary list is presented in Table 5-2. The Priority Pollutant Task Group is working to finalize the priority list through the development of a quantitative process that considers the above noted criteria. Upon further evaluation, it is possible that the pollutants on this initial list may not ultimately be considered as the highest priority pollutants. This work is expected to be finalized as part of Stage II of the Rochester Embayment Remedial Action Plan.

2. Reference Sources

Reference sources utilized in estimating pollutant loadings included the following:

State Pollution Discharge Elimination System (SPDES) permit compliance records
State air emissions permit compliance records
SARA toxic release inventory data
NYSDEC data on inactive hazardous waste sites
NYSDEC spill records
Atmospheric deposition data from local monitoring and from IJC monitoring project
Nationwide Urban Runoff Program (NURP) data on non-point source pollution in the Irondequoit Creek watershed
Studies by SUNY Brockport on pollutants in West Basin streams and ponds
U.S. Geological Survey water resources data reports (annual)
U.S. Army Corps of Engineers dredging data
Sediment analysis performed by Aqua Tech for the U.S. Army Corps of Engineers

3. Special Considerations

In estimating loadings, the following considerations emerge as possible sources of error or misinterpretation:

a. Non-detectables

Many pollutants show up on data forms as "not detected" or "below the detection limit." Detection limits depend on the analytical technology used to measure a specific pollutant and sometimes on the accuracy needed to meet standards; therefore, they may vary depending on the discharger. It cannot always be assumed that a chemical that was not detected was not present; it may have been present at a level below the detection limit. This possibility becomes significant for dischargers with very large flows (multiplying a small concentration by a large flow can yield a large annual load), and for chemicals that are harmful in concentrations so small that they are normally undetectable until they bioaccumulate in animals.

One way to present data containing "non-detects" is to give a range, the lowest value assuming the value was zero and the highest level assuming the value was at the detection limit.

To compute a single loading figure, many statisticians use a level of one-half the detection limit, allowing for a reasonable variation in chemical concentrations between zero and the detection limit. However, this method yields a loading figure for any chemical tested for, even if it has never been found and there is no reason to suspect its presence. The possible spurious loadings generated this way are most significant for the largest dischargers.

Therefore, the Ad Hoc Loading Task Group of the RAP Technical Group devised the following method to compute the loadings for direct State Pollutant Discharge Elimination System (SPDES) wastewater dischargers in the Rochester AOC drainage basin:

If 25% or more of the reported values are quantifiable, the remaining values reported at less than minimum detection limit (MDL) would be counted as one half the MDL in the loadings calculation.

If less than 25% of the reported values were quantifiable, the remaining values reported at less than MDL would be counted as zero in the loadings calculation.

b. Event Loadings

Regularly scheduled monitoring of a river or waste stream may not generate accurate annual loading figures because large percentages of the annual loadings of particular pollutants may occur during unusual events. Most pollutant discharges from streams occur during storms and snowmelt. Studies referred to in this chapter from the Irondequoit Basin and the Lake Ontario West Sub-basin included stream sampling during storm and snowmelt events as well as during base flow periods. But data collected by the U. S. Geological Survey (USGS) and the Dept. of Environmental Conservation (DEC) on the Genesee River is gathered on a scheduled basis, not necessarily during high runoff events. Thus it will tend to underestimate the total annual pollutant loading from the river.

Air emissions from industries may be highly variable over time. Many air toxics, for example, are products of incomplete combustion, which can occur when furnaces are temporarily operating at less than their design temperatures. These event loadings are not taken into account in the estimates of air emissions, which are based on normal operating conditions.

B. Pollutant Sources

1. Point Source Discharges

Table 5-3 lists total SPDES wastewater discharges of the pollutants on Table 5-1. The data is for the period October 1989 to September 1990. Pollutants not listed were not reported as discharged during that year. The data were calculated by the DEC using the "25% formula" described above for nondetectables. Table 5-3 includes all wastewater dischargers (municipal and industrial) in the Genesee Basin and those in the Lake Ontario West and Lake Ontario Central Sub-basins whose effluent goes directly to the lake. Therefore it includes the three major municipal wastewater treatment plants along the lake shore, but leaves out dischargers within the West and Central Sub-basins that discharge to smaller streams (whose contributions are relatively minor).

2. Atmospheric Deposition

The Canada Center for Inland Waters (CCIW), in a 1992 report, has estimated atmospheric deposition on Lake Ontario for a large number of chemicals not previously measured. The estimates are for deposition on each of the Great Lakes. Table 5-4 shows estimated atmospheric deposition on the embayment, the embayment basin (all three basins) and the Genesee Basin, calculated based on their area in comparison to the area of Lake Ontario based on the CCIW data.

Locally, atmospheric deposition is measured at Mendon Ponds Park in southern Monroe County and at Brockport in the western part of the county. The Brockport and Mendon Ponds data is shown at the end of Table 5-4. For the one parameter that appears in all 3 sites, lead, the figures are very different from each of the 3 sites. The same is true for total phosphorus and zinc that are common to the 2 County Sites, and to cadmium which is common to the CCIW and Brockport sites. An explanation for this discrepancy should be sought.

3. Air Emissions/Ambient Air Quality

Although atmospheric pollutants are transported to the AOC from a continent-wide area, local atmospheric discharges are important to recognize because each small area contributes to the problem as a whole and because they can be controlled locally.

Permitted discharges to the air are not sampled regularly, as are discharges to water. They are estimated based on limited testing and predictions based on that testing. Air discharges are not reported or filed on a watershed basis, so the data must be retrieved by county. Table 5-5 shows air emissions from a 5-county area. These are best estimates of actual emissions, which in most cases are less than the permitted amounts. The database was searched for all the chemicals on Table 5-1 except for cyanide, which was inadvertently excluded from the search. If a chemical does not appear under "stack emissions" on the table, it was not reported as discharged in any of the five counties. A "0.000" entry in the table indicates that there was at least one discharger of that substance in the county, but the amount discharged was less than .001 ton/yr (2 lbs/yr). A blank entry indicates no dischargers in that county. Of the five counties, Monroe is by far the largest source of all chemicals on the list except dioctyl phthalate (Orleans) and phenol (Allegany).

Evaporative or "fugitive" losses, as opposed to stack emissions, are important sources of air pollutants. These are being estimated for industrial facilities that fall under the "Right-to-Know" provisions of the Superfund Amendments Reauthorization Act of 1986 (SARA). This law requires certain ndustries using more than 10,000 lbs/yr or manufacturing/processing more than 25,000 lbs/yr of certain chemicals to file toxic release forms stating where the chemicals are going. The requirements apply to industries in Standard Industrial Classifications (SIC) 20-39 with ten or more employees. Table 5-5 shows these fugitive losses from Monroe County only. Certain other industries are not included within SIC classifications 20-39 but are responsible for both permitted point source discharges and fugitive emissions. No efficient means exist to quantify the magnitude or impacts of those discharges but they should not be assumed to be insignificant.

The surface area of the five counties on Table 5-5 is 3,214 square miles. The atmospheric deposition on these counties can be compared to the local point sources that are subject to reporting requirements. These local sources appear to be making a minor contribution to some air pollutants that fall on the area and a more significant contribution to others. For example, 2,858 pounds of lead and 12 pounds of arsenic are estimated to be generated annually in the 5-county area from point source air emissions, while the same area receives an estimated 45,000 pounds of lead and 4,300 pounds of arsenic via atmospheric deposition using the CCIW data. Known local PCB emissions are less than 2 lbs/yr, compared to approximately 37 pounds estimated to be deposited from the air. Cadmium sources appear to be more important locally; 500 pounds of cadmium are emitted in the 5-county area, compared to an estimated 3,100 pounds of cadmium deposited. There are no known point source air dischargers of pesticides or dioxin in the 5-county area.

Many sources of air emissions do not appear on the table. Vehicle exhaust and fuel evaporation are important sources of several pollutants, particularly lead and benzene (among AOC priority pollutants). In 1982, mobile sources accounted for 85% of total benzene emissions nationwide (Adler and Carey, 1989.) Evaporation from end uses is another source of air emissions -- for example, the evaporation of pesticide from fields and sprayers, and of paints and coatings when they dry.

Local ambient air quality data can help us understand the potential for airborne pollutants to fall to the ground and be discharged into local waterways. As of November of 1992, there are 3 sources of ambient air quality information that may be useful to consider to help understand current conditions, and to use as a baseline to compare against in the future.

The first is the New York State Air Monitoring System. The pollutant that is monitored by this program that is also of concern to water quality (on Table 5-1) is lead. The data shows that the amount of lead in ambient air has been decreasing. Levels monitored at a site in Rochester known as #2701-18N report annual geometric means of lead as follow:

Year	Annual Geometric Mean Lead
1985	0.35 μ/m3
1987	0.09μ/m3
1988	0.05μ/m3
1989	0.03 μ/m3

The State reports that lead concentrations have been declining statewide. Declines likely are due to the removal of lead additives from gasoline. (NYSDEC 1990).

Some ambient air monitoring data is also being collected at Eastman Kodak Company. This monitoring program was required by the NYSDEC as part of the permit to construct the facility expansion. The monitoring network began operation on 2/28/90 and will continue until the end of 1996. It should be noted that Kodak has begun implementing an emissions reduction program and additional emissions reduction activities are planned to be implemented by mid-1995. Data available for the period 10/1/91 to 12/31/91 from the quarterly report for the program prepared by Eastman Kodak has been reviewed. Chemicals that were sampled for under this program that are also of interest to water quality are dichloromethane (also known a methylene chloride), acetone, hexane, and toluene. These and other chemicals were sampled for in ambient air at 7 different sites in or near the Kodak Park area of Rochester. As an example of the kind of data available that can be used in the long term to compare progress against, Kodak ambient air data on dichloromethane is shown in table 5-6.

Some ambient air monitoring data was also collected at the Xerox Corporation facility in Webster New York near the eastern boundary of the Rochester Embayment for the period June 4, 1990 to August 27, 1990. Chemicals that were sampled for under this program that are also of interest to water quality are dichloromethane (also known as methylene chloride), methyl ethyl ketone, toluene, 111 trichloroethane, arsenic, nickel, and selenium. As an example of the kind of Xerox ambient air data available that can be used for further research, or for future comparison, see Table 5-7 taken from the report of monitoring at Xerox (Radian Corporation, 1990).

4. Landfills, Hazardous Waste Sites

Table 5-8 lists the inactive hazardous waste sites in the drainage basin that have been found to contaminate groundwater, soil or sediment near the site. The summary of Monroe County sites was done by Joe Albert of the Monroe County Department of Health. He used the publication, Inactive Hazardous Waste Sites in New York State (also known as "The Registry") (NYSDEC 1992) completed Superfund Phase II investigations, and other available analytical data at the Health Department. The data from the other counties is taken from "The Registry". The priority pollutants listed are those from Table 5-1. There are three hazardous waste sites that because of proximity to the Embayment or its major tributaries are of special concern. Information on these sites are summarized below.

The Genesee River Gorge in the City of Rochester is of particular interest because of its history and location. It extends from the Upper Falls to the Lower Falls, which form the southern boundary of the Rochester Embayment. The falls provided water power for the early industries. Many of the industries in this area produced and used toxic chemicals and disposed of them in an uncontrolled manner. It should be noted, however, that the early mill industries were generally not large scaleproducers of toxic and/or hazardous wastes. Two deep ravines on the west side were filled with 80-90 feet of waste, and landfilling was conducted along the river banks as well.

Coal gas was manufactured on both sides of the river between 1872 and 1952, producing an array of by-products including coal tar and cyanide (Morrison-Knudsen Engineers, Inc., 1986). Other industries included furniture manufacture, oil and naphtha storage, electric power production, metal fabrication, tool manufacture, dying operations, lantern manufacture, lithography, ink production, laundering (including solvent use), and garbage incineration.

The river gorge from the lower to upper falls was designated a New York State superfund site in 1983. The Phase I Superfund investigation identified 19 factories, 54 underground tanks (condition unknown) and 10 improper waste disposal sites as possible sources of the priority pollutants in the area. (RECRA Environmental, Inc., 1988). In addition, an abandoned mill race on the west side and old sewers that once served the industrial areas were possible areas for waste disposal and migration.

Some wastes in the gorge have entered the bedrock under the river, where they have been detected in several locations. In the early 1970s, benzene, toluene, xylene and an oily substance were found seeping from the face of the Lower Falls. Upstream of the Lower Falls is a tunnel built in 1910 to carry water from the dam at the Middle Falls to the hydropower station at the base of the Lower Falls. (See Fig. 5-1). When RG&E dewatered this tunnel for maintenance in 1985, toxic materials were found to be seeping from its walls in several places. Further upstream, the Rochester Pure Waters District dug a tunnel under the river in 1985 to convey combined sewage to the Van Lare treatment plant. During excavation, a flow of toxic chemicals entered the tunnel through a joint in the shale. Several other contaminant seeps were also found in the tunnel. When the contamination was discovered, measures were taken to prevent the pollutants from entering the river. Excavated material was removed for safe disposal, and water pumped from the tunnel was stored in holding ponds, then pumped to the treatment plant. At one time a pond failed and briefly allowed the seep and water mixture to escape. After the project was completed, the ponds were backfilled. Due to the fact that the closure plan was not approved as submitted by the NYSDEC, a new sampling and risk assessment study is being proposed. (Blasland and Bouck Engineers, 1992).

While some of the contaminant seeps in different parts of the tunnels and the falls have similar constituents, it has not been possible to trace them to a specific source. The Phase I Superfund investigation was only able to assign a probable source to the contaminants in a pool at the base of the Lower Falls and in the RG&E tunnel; these appeared to be associated with coal tar. The City of Rochester subsequently confirmed similar seep constituents for the seeps from the face of the lower falls. This site is discussed further under "Chemical Seeps at Lower Falls" in the next section of this chapter.

The boundaries of the Genesee Gorge NYSDEC Superfund waste site were never exactly defined due to its complexity and extent. In 1991 the entire site was taken off the state registry of inactive hazardous waste sites, after the DEC determined that coal gasification sites were not hazardous under federal regulations (Negreau, 1991). Additionally, for those areas not affected by coal gasification activities, the NYSDEC was unable to demonstrate hazardous waste disposal. Two large areas within the Genesee Gorge had been coal gasification sites. One of them, which is adjacent to RG&E's Beebee Station at the Upper Falls, is part of an urban cultural park being developed by the City of Rochester. Rochester Gas &Electric is removing the coal tar from this area. But wastes from the other disposal areas in the gorge continue to be of concern for the RAP project.

The Inactive 28 acre Old Rochester City Landfill, also known as the Pattenwood landfill is located on the east side of the Genesee River, approximately one half mile south of the Lake Ontario shoreline. A Phase II New York State Superfund investigation was conducted by Engineering Science, Inc., and a report of that investigation was published in February of 1992. The following information comes from that report. The site was operated by the City of Rochester as a municipal landfill from 1956 to 1962 and was a wetland prior to landfilling for industrial and commercial purposes, railroad construction, and waste disposal. Between 1984 and 1988, soils from the site showed the presence of PCB's,and volatile organics. An excavation during the construction of houses in the vicinity of Timrod Drive uncovered buried drums containing low concentrations of PCB's and high concentrations of lead. To evaluate the contamination for the Phase II Superfund study, soil and groundwater samples were collected and analyzed. Nine volatile organic chemicals, 27 semivolatile compounds, and three pesticide compounds were detected in the subsurface soils at the site. The levels of lead at the site were also high. Many of the substances found at the site are those we have listed as a concern for water quality in Table 5-1. Compounds found in the site's groundwater exceeded groundwater standards for drinking for three volatile chemicals, and Endrin, barium, iron, lead, magnesium, manganese, sodium and zinc. The groundwater also had some levels of PCB's. The Phase II investigation notes that "Surface waters and sediments were not analyzed off site to evaluate the extent and impact of downstream contamination." and suggests that "An impermeable cover over the disposal areas would decrease the leaching and downward migration of contaminants."

The Rochester Fire Academy site is a 21-acre site on the west bank of the Genesee River in the City of Rochester. It is located approximately 11.5 miles upstream from the mouth of the Genesee River, and is technically outside the area of concern. Because of its close proximity to the River, further information on the site is included here. The site is used as a training facility by the City of Rochester Fire and Police Departments. Various chemicals supplied by many local hazardous waste generators were burned in the training procedures from 1955 to 1980. The NYSDEC listed this site as a Class 2 designation after findings from the State Superfund Phase I and Phase II studies. The City of Rochester has completed a remedial investigation (1991) and supplemental remedial investigation (1992) of the site. The clean-up feasibility study has been drafted and submitted to the NYSDEC. The reports indicate that the groundwater is contaminated primarily with chlorinated solvents and volatile aromatic compounds. Low levels of some semi-volatile organic compounds, trace levels of PCB's and elevated levels of iron and manganese were also detected. A supplemental Remedial Investigation was started in October of 1991 to further delineate soil contamination and determine aquifer characteristics.To fully evaluate remedial alternatives for the site during the feasibility study, soils treatability studies were done to evaluate soils treatment approaches. The assessment is that the major pathway of contaminant migration is by groundwater flow to the Genesee River. The primary contaminants thought to be migrating to the River from the site are volatile organics with an estimated loading of 77 kg/year and total iron and manganese with a total loading of 278 kg/year. The estimates are based on computer modelling estimates. Actual river water sampling has been performed and did not show a significant difference between upstream and downstream samples. Modelling estimates of PCB loadings are 0.01 kg/year (Malcolm Pirnie 1992).

5. Nonpoint Source Runoff

Data derived from Nationwide Urban Runoff (NURP) studies of the Irondequoit Basin (Kappel *et al.* 1986) were used to estimate stormwater runoff pollutant loadings to the embayment from its watershed. Only the Western, Central, and lower Genesee Basins were deemed similar enough to the Irondequoit Basin to utilize extrapolated NURP results. The upper reaches of the Genesee Basin have a very different type of landscape, with wooded hills and narrow valleys, as opposed to the more gently rolling agricultural landscape of the rest of the study area. Therefore runoff calculations using NURP data were not estimated for the Genesee Basin upstream of Geneseo. Methods used for calculating nonpoint source runoff loadings are outlined in detail in Appendix E.

The results of the runoff estimates are presented in Table 5-9. Table 5-13 also gives an indication of pollutants with large non-point source contributions.

6. Spills

Hazardous material spills and leaks are a historical potential intermittent source of chemical contamination in the drainage basin. The Monroe County Office of Emergency Preparedness compiled reported spill data from the Monroe County Health Department, the NYSDEC, the Nuclear Regulatory Commission and the Rochester Fire Department between *10-1-89* and *7-17-91*. A summary of those reported spills is included in Table 5-10. The most frequent reported spills were of petroleum based products. In many cases, an estimate of the volume of the substance spills was not available. From the information available, however, petroleum based products (11,053 gallons) and solvents (15,444 gallons) had the greatest cumulative quantities of spills.

The Coast Guard keeps track of spills on the Great Lakes. These spills do not appear to be a significant pollutant source. The only ones reported between October, 1989 and September, 1990 in the Rochester area were three sheens of oil or gas on the water, and a spill of one gallon of diesel oil (Cumming, J., pers. comm., 4/17/92).

7. Combined Sewer Overflows

The number of active Combined Sewer Overflows (CSOs) and the frequency of discharge have been greatly reduced as a result of the CSOAP program. The list below shows the combined sewer overflows that have been closed by the Monroe County Pure Waters District since July, 1991 and those that are still in operation (Steinfeldt, P., pers. comm., 10/13/92 and Murphy, S., pers. comm. 10/14/92). The Culver-Goodman Control Structure discharges very infrequently into Irondequoit Bay (last discharge 1986). The remaining active overflows discharge infrequently to the Genesee River. The first five active overflows were built as relief points for the CSOAP system and are expected to remain in operation for the foreseeable future.

Closed since July, 1991	Active November, 1992
Spencer Street West Overflow	Plymouth and Railroad O.
Mill St. and Factory St. O.	Culver-Goodman Control Structure
Front St./Inner Loop O.	Structure 45 - Maplewood Park*
Central Ave. and Inner Loop O.	Structure 243 - Seneca Park*
Water St. and Inner Loop O.	Structure 41 - Lake Ave. near Ambrose St.*
Main St. O.	Water St. and Inner Loop**
Charlotte Pump Station Bypass	
Browncroft Blvd. O. (Cross-Irondequoit Tunnel)	
Beach Ave. O.	
Latta Rd./River St. O.	
Hanford Landing O.	
Hastings St./Ravine Ave. O.	
Cliff St. O.	
South Ave. and Library O.	

* Designed to discharge on average twice per year.
** Scheduled for closure by 12/92.
"O." = Overflow

8. Sanitary Sewer Overflows

In addition to the occasional overflows from combined sanitary and storm sewers in the City of Rochester, there are locations throughout the county where pump stations that pump sewage up hill also have overflow points. At these locations, sanitary sewage is discharged occasionally when a major mechanical/and or electrical failure occurs at the pump station. As pump stations have been upgraded, these relief points have been eliminated. In the Rochester Pure Waters District,as an example, the following summarizes existing sanitary sewer overflow points:

Remaining Sanitary Sewer Overflows - Rochester Pure Water District

Elmwood Avenue Pump Station
Charlotte Pump Station
Boxart Street
Lakeshore Blvd.
Browncroft Blvd.

9. Other

The pollutant sources discussed above do not represent all sources, but only those for which there is a good base of information. Other sources are discussed in section D in connection with individual pollutants.

C. Comparative Importance of Point and Non-point Sources of Pollutants: Genesee River Example

Because the USGS publishes data on river flow and pollutant concentrations at Charlotte Docks near the mouth of the Genesee River each year, it is possible to calculate the total discharge of pollutants from the river and compare this to the input from known discharges to the river. This way the contributions of point and non-point source discharges can be estimated. The USGS also publishes river flow and pollutant measurements for Geneseo, near the center of Livingston County. This allows the Genesee River to be divided into two segments for comparison between the upper and lower basins.

The data that are available from the USGS Water Resources Data Reports are primarily for conventional pollutants and heavy metals, not for organochlorine pesticides or other trace organics. Water quality parameters are measured from about 4 to 10 times per year (usually in spring, summer and fall). Flow is recorded daily. The method used for calculating annual loadings from these data is described in appendix E.

Point source discharges were obtained through the use of SPDES permit compliance data on file at NYSDEC. This information reveals the amount actually discharged, rather than the permitted amount. The Loading Task Group formula (see page 5-2) was used to compute discharges for October 1990 - September, 1991.

Table 5-11 shows total loadings and loadings per square mile for the Genesee River above and below Geneseo. Even though the lower basin is more highly urban and industrial, the upper basin contributes half or more of all the pollutants listed. The area of the upper basin is 58% of the area of the entire basin, so it would be expected to contribute 58% of the pollutants if area were the only factor.

For comparison, the IJC calculated Genesee River loadings as follows for some of the metals on Table 5-11 (Stevens, 1988). The loadings calculated in this study were somewhat lower than the values from 1981 and 1982.

IJC Estimate of Genesee River Loadings

Parameter	Loading (tons/yr)	
	1981	1982
Cadmium	3	<5
Copper	40	40
Lead	40	30
Zinc	150	260

The Monroe County Health Department also estimated that 359 tons of total phosphate (PO_4) and 46 tons of ortho-phosphate were discharged from the Genesee River to the Rochester Embayment in Water Year 1984 which ran from October 1983 to September 1984 (Monroe Co. Dept. of Health, 1986). These values are not directly comparable to total phosphorus loadings in Table 5-11.

Table 5-12 shows the relative annual inputs of chemicals to the embayment from dredging and from normal river flows. For most parameters, the amount entering the lake from river flows is an order of magnitude higher than the amount entering the lake through dredging. Approximately 15% of the pollutant-containing material settles on the river bottom and must be mechanically moved to the lake; the rest reaches the lake on its own. Arsenic and phosphorus are the notable exceptions; about 55% of the arsenic and 35% of the total phosphorus loaded into the lake appear to be transported in the dredged sediments. A possible explanation for the arsenic result is that it was used as a pesticide in the past and is primarily associated with sediments from eroded soil. Phosphorus loadings to the river have declined substantially since the Pure Waters and CSOAP programs were initiated, but previous discharges of this nutrient may have built up in the sediments. Another concern with phosphorus is that the estimate of river loading is one of the least reliable in this study. There were very few samples taken during high flow periods, and the correlation of phosphorus concentrations with flow was less than for most other parameters (see Appendix E).

Table 5-13 compares the contributions of permitted discharges and dredging inputs to other pollutant sources in the Genesee Basin. For most parameters, SPDES discharges in the Genesee Basin appear to be a relatively small percentage of the discharges to the river from other sources.

However, most of the major wastewater generators in Monroe County no longer discharge to the river or its tributaries. Their effluent is directed into the publicly owned sewer system, treated, and eventually discharged outside or near the limits of the embayment. Although this effluent has little effect on the Embayment itself, it does reach Lake Ontario. Table 5-14 compares the discharges of the Genesee River with those of the three largest municipal treatment plants along the lake. The discharges of pollutants from the river are 10--100 times greater than that of the treatment plants , with the exception of phosphorus. These calculations show the river discharging a little more than twice the amount of the treatment plants. Additional study should be conducted to validate the phosphorus loadings.

Tables 5-11 through 5-15 show the relative importance of non-point sources in Genesee River loadings. In order to explore the contribution of land runoff to those non-point sources, the results from the Nationwide Urban Runoff Program (NURP) study in the Irondequoit Basin (Kappel *et al*, 1986) were used to estimate runoff from the portion of the Genesee Basin downstream (below) Geneseo. Four pollutants were used for this calculation, since their yield per unit area showed a predictable relationship to the amount of impervious surface in the watershed (see Figures 5-2 - 5-5). The results are shown in Table 5-15. Table 5-15, also compares runoff values calculated using NURP data with nonpoint source inputs to the river that were calculated using total river discharges minus SPDES discharges.

For lead and phosphorus, the two methods yield values that are within an order of magnitude, which can be considered comparable given the uncertainty of the methodology. Values for total suspended solids are higher for the calculations based on total Genesee River flow. This result is to be expected due to bank erosion, resuspended sediments from the river bed, and upstream agricultural uses that are more intensive than that in the test watershed in the Irondequoit Basin. The Genesee River is known to carry a higher sediment load than others in the region.

Values for zinc are much higher for the NURP extrapolation; the reason for this may be related to the fact that the Irondequoit Basin streams were sampled during storm events and therefore give a more accurate (and higher) estimate of total pollutant loadings, especially for pollutants that are more highly concentrated in storm flows. However, values for zinc measured by SUNY Brockport in the West Sub-basin (Makarewicz *et al.* 1990) also appear much lower than those measured in the Irondequoit Basin. The West Sub-basin streams were sampled throughout the year, including during storm events. Table 5-16 compares loadings per unit area for the entire Genesee Basin and for selected watersheds in the Western and Central sub-basins.

One major source of pollutants in land runoff is atmospheric deposition. Not all pollutants deposited on the drainage basin reach waterways, as some are retained in the soil, vegetation or groundwater. But it is instructive to compare the estimated atmospheric deposition on watersheds to the estimated loadings from waterways. Table 5-17 shows this comparison for those chemicals that have numbers for both input and output. The input from the air appears to be closest to the output from the Genesee river for lead and mercury. The 1990 study of small streams in the West Basin (Makarewicz *et al.* 1990) compared atmospheric deposition at Brockport and loadings from Salmon and Otis Creeks. The results are also shown on Table 5-17. Nutrient loadings exceeding yields could indicate uptake by biota in the basin and a relative lack of major human pollutant sources.

The NURP study, in 1980-81, found that six times as much lead was being deposited from the air as was being discharged by streams in the Irondequoit Basin. Lead deposition was considerably higher then due to the prevalence of leaded gasoline.

Figures 5-6 through 5-9 visually summarize the importance of various pollutant sources to the Embayment. These figures are meant to show, by the size of the arrows, the relative amounts of pollutants by geographic source.

D. Pollutants Known or Possibly Causing Impairments in the AOC

1. Mirex/Photomirex

Mirex is a persistent chlorinated compound that is resistant to biological and chemical degradation. It is converted to photomirex by sunlight with the loss of one chlorine atom per molecule. Both compounds are insoluble in water but dissolve in fatty tissue and adhere to sediment particles. Mirex was originally used as an insecticide and fire retardant and was produced in Niagara Falls, NY. It is no longer produced or used in New York (NYSDEC, 1989).

There are no known local sources or mirex. The primary source of mirex affecting the Rochester Embayment is probably the site of the former Hooker Chemical Co. in Niagara Falls and the contaminated sediments and dumps associated with it. This firm was the principal producer of mirex from 1959-1967 (Litten, 1980). Mirex-contaminated sediment also exists in the Oswego River due to a one-time experimental use of mirex at Armstrong-Cook in the 1960s (NYSDEC, 1989).

Sources of mirex to Lake Ontario are summarized below (Strachan, 1991). This table does not represent the more recent atmospheric deposition data shown in Table 5-5.

Sources of Mirex to Lake Ontario (%)

Rain and Snow	Dry Fall	Upstream Atmos.	Other Upstream	Tributaries
1	3	0	91	5

Note: "Rain and snow" and "dryfall" refer only to direct deposition on the lake surface. "Upstream atmos." refers to direct deposition on the surface of upstream Great Lakes. Any air pollutants deposited on the land surface of the watershed and washed into the lake are included under "tributaries." "Other upstream" includes tributary input to upstream Great Lakes and direct discharges to those lakes.

Once mirex is in the lake environment, it accumulates in the fatty tissue of fish and their predators. It can be transported around the lake and its basin through the movement of animals and sediments.

2. Dioxin

Dioxins are chlorinated organic compounds with low water solubility that bind to sediment and soil particles and concentrate in fatty tissues. Dioxins bioaccumulate moderately in the aquatic environment. They are by-products of incomplete combustion in the presence of chlorine and are found in fly ash and other products of these processes. They are also by-products of the alkaline treatment of chlorinated phenols (NYSDEC, 1990b, pp. V-26-27).

The principal source of dioxin in the biota of Lake Ontario is the Niagara River drainage basin, where toxic chemicals have been discharged to the environment or stored in a large number of waste sites. Dioxin was probably released as a by-product by a chemical plant on the Niagara River that once produced trichlorophenol for use in pesticides. This manufacturing process was discontinued in the mid-1970s (Environment Canada *et al*. 1991).

There are no known local sources of dioxin. However, since dioxins can be produced by the combustion of chlorine-containing items such as industrial chemicals, plastic, and bleached paper, incinerators and fly-ash disposal sites are possible sources. Research in Indiana showed that dioxins and furans are found in the ambient air of urban areas and appear to have multiple sources, both large and small (Hites, R., pers. comm., 10/5/92).

There are incinerators in the AOC for medical waste, chemical waste, industrial solid waste, and sewage sludge. In addition, there are abandoned fly ash landfills and an old city incinerator site adjacent to the lower Genesee River.

3. Polychlorinated Biphenyls (PCB's)

PCBs are mixtures of chlorinated biphenyls with different degrees of chlorination. They are quite insoluble in water and adhere readily and strongly to sediments, soils, and fatty tissue. Because they are non-flammable and have useful heat exchange and electrical insulation properties, they have been used extensively in the electrical industry in capacitors and transformers. They were also used in lubricating and cutting oil formulations as well as in pesticide formulations, adhesives, plastics, inks, paints, and sealants. The use of PCBs, except in closed systems, has been banned in the United States since the late 1970s (NYSDEC, 1990a, p. 5-3).

The IJC Science Advisory Board determined the sources and fate of PCB in Lake Ontario to be the following (Strachan, 1991):

Sources of PCB in Lake Ontario (%)

Rain and Snow	Dry Fall	Upstream Atmos.	Other Upstream	Tributaries
3	3	1	82	12

Note: "Rain and snow" and "dryfall" refer only to direct deposition on the lake surface. "Upstream atmos." refers to direct deposition on the surface of upstream lakes. Any air pollutants deposited on the land surface of the watershed and washed into the lake are included under "tributaries." "Other upstream" includes tributary input and direct discharge to upstream lakes.

PCB Fate in Lake Ontario (%)

Volatilize (back to atmosphere)	Sediment	Outflow (to St. Lawrence River)
53	30	17

According to the above tables, tributaries contribute 12% of the PCB to Lake Ontario. Most of the tributary input in the AOC is believed to come from atmospheric deposition on the watershed. Elevated PCB levels in fish are found throughout New York State. The large percentage of PCBs that are volatilized from water ensures that PCBs continually cycle between air and water. (Note: the above tables do not reflect more recent atmospheric deposition data as shown in Table 5-4.) PCB sources in the Lake Ontario Basin outside the AOC include sediments in the Buffalo River, dredge spoil deposited at Times Beach, near the mouth of the Buffalo River (NYSDEC, 1989), and the Oswego River. The Oswego River AOC has three permitted PCB dischargers and PCB-contaminated sediments (NYSDEC, 1990a). Once PCBs are in the lake environment, they accumulate in the fatty tissue of fish and their predators, can be transported around the lake and its basin through the movement of animals and sediments.

There are no permitted dischargers of PCB to waterways in the Rochester Embayment AOC drainage basin, but there is one air discharger in Monroe County, emitting 2 lbs/yr. or less.

Other potential sources of PCBs within the basin are related to the once-widespread use of PCB-containing items. Because PCBs were used in electrical equipment, they remain in some older appliances, medical equipment, transformers, capacitors, electric motors, etc. that were made before PCBs were phased out. PCBs may exist at junkyards or scrap processors where these items have been stored or recycled. PCB's were also used in some inks and papers. Of all the PCBs manufactured and used in the U.S., 54% are still in use and 21% are buried in landfills, according to the IJC. PCBs can leak, spill or evaporate from these locations, and can be released during incineration or accidental burning of PCB-containing materials (Virtual Elimination Task Force, 1991).

PCBs in the electrical distribution system are often located outdoors where spills and leaks can directly affect the environment. Beginning in 1985, EPA regulations required utilities to remove PCB-capacitors from accessible locations such as utility poles and PCB transformers from areas near food or feed storage. The equipment is still allowed in closed systems but phaseout is encouraged. The seven largest utilities in New York State must submit biennial reports to the Public Service Commission regarding their PCB-containing equipment (Johnson, R. E., pers. comm., 7/23/92). Table 5-18 shows this information for the large utilities within the basin.

Mineral oil is another fluid used in transformers. Due to past maintenance operations, some of this oil has become contaminated with various levels of PCB's. RG&E is testing the larger transformers and replacing any contaminated oil. The smaller, pole-top transformers are being checked according to a routine maintenance schedule. It will take approximately 20 years to check all 50,000 pole-top transformers (Williams, J., pers. comm., 7/17/92).

In addition to the major utilities, other small utilities, villages, and industries maintain substations and electrical equipment that could contain PCBs. Some PCBs may remain on or near utility poles where equipment leaked or was vandalized in the past.

4. Chlordane

Chlordane is a pesticide that has been banned in New York State since 1985. It was once used for fumigation of homes and for agricultural crops. Residues could remain in building materials, soils and sediments. The fact that chlordane is causing an impairment only in Irondequoit Bay probably reflects the fact that this was the only area where carp were tested for chlordane. (See Table 4-3 for results of fish analysis.)

5. Polynuclear Aromatic Hydrocarbons (PAHs)

Polynuclear aromatic hydrocarbons (PAHs) are a diverse class of compounds consisting of substituted polycyclic and heterocyclic aromatic (benzene) rings. PAHs are formed as a result of incomplete combustion of organic compounds. Among the PAHs are compounds such as benzo(a)pyrene and benzo(a)anthracene. PAHs are present in the environment from both natural sources and human activities. As a group, they are widely distributed in the environment.

PAHs adsorb strongly onto suspended particulates and biota and their transport is determined largely by the patterns of sediment deposition and resuspension in the aquatic system. PAHs dissolved in the water column are believed to degrade by direct photolysis at a rapid rate. The fate of those PAHs which accumulate in the sediment is thought to be biodegradation and biotransformation by benthic organisms.

Benzo(a)pyrene is one of the most toxic PAHs. It has been documented to cause liver tumors in freshwater fish (NYSDEC, 1990b, p. V-33).

Common sources of PAHs include petroleum and derivatives, coal tar and derivatives, bitumen-based paints and coatings, diesel engine exhaust, used crankcase oil, incinerator residues, and fly ash (RECRA Environmental, 1988).

Possible local sources of PAHs are old coal gas production facilities in the Genesee Gorge, nearby landfill sites, and fly ash dumps in the gorge and near the river mouth. As discussed earlier in the description of the chemical seeps at the Lower Falls, PAHs were found seeping into two tunnels under the river, and appear to be traveling in faults and fractures in the rock. A contaminant pool forming from chemical seeps at the Lower Falls during low river flows, contained PAHs and appeared to be derived from coal tar. PAHs can also be released from asphalt and transported to the river via storm sewers. Airborne sources include vehicle exhaust and emissions from stationary sources.

6. Oxygen Depletion

The depletion of dissolved oxygen in the water occurs when organic matter such as sewage decomposes and uses up oxygen (biological oxygen demand, BOD), or when chemical wastes react with oxygen (chemical oxygen demand, COD). Oxygen-demanding substances can remain in sediments for many years, consuming oxygen when the sediments are disturbed.

The dissolved oxygen content in the lower river improved dramatically after Kodak upgraded its facility to include secondary treatment in 1972 (Sutherland, 1975), but CSOs and stormwater discharges continued to lower the oxygen levels periodically and to contribute to sediment oxygen demand. The Wastewater Facilities Plan for the Combined Sewer Overflow Abatement Project (CSOAP) showed that benthic oxygen demand was greatest about two miles upstream from the river mouth, and that this demand was capable of depressing the river's dissolved oxygen content below 5 mg/L during low flows (Erdman Anthony *et al.* 1976, figs. IV-10 and IV-42). This projection was one of the justifications for the CSOAP program.

Now, dissolved oxygen is generally adequate in the water of the lower Genesee. But sediment oxygen demand remains due to past discharges from wastewater treatment plants, stormwater discharges, CSOs and other sources. The benefits of CSOAP on sediment oxygen have not been fully realized, since the project was so recently completed. A remaining source of oxygen demanding chemical is the Monroe County Airport. Runoff of airplane deicing fluids (primarily glycol) is a problem. Monroe County is in the process of designing a collection system to insure that deicing fluids will not run off into the Genesee River.

7. Metals

Metals can reach the water system from natural sources such as soil and rock, and from waste discharges, dumpsites, and atmospheric deposition. Because they are elements, they cannot be broken down or destroyed through treatment, but they can be bound in stable compounds that are less bioavailable than others. "Low levels of metals are common in waters across New York state. Cadmium, copper, lead, mercury, nickel and zinc were the most frequently identified pollutants during statewide sampling and analysis of surface waters in 1986" (NYSDEC, 1990a, p. 5-35). Most metals adhere to sediments and are eventually deposited at the bottom of lakes and rivers, where they may be remobilized by benthic organisms or anoxic conditions.

Wastewater discharges of metals to the AOC are listed in Table 5-3. Eastman Kodak is a large point source discharger of cadmium, chromium, copper, lead, mercury, nickel, silver and zinc to the drainage basin. The Van Lare treatment plant, which discharges to the lake, is the only discharger which exceeds Kodak's discharges of copper and nickel. Municipal water systems will be required to add chemicals to the water distribution systems to control pipe corosion. The chemicals proposed for use are zinc phosphorus salts, silicate, and other phosphorus compounds. The use of thse materials may reduce loadings of copper and lead to municipal wastewater teatment systems, but increase loadings of zinc and phosphorus. Very little arsenic or manganese is generated by any permitted discharger. As shown in Table 5-13, non-point sources appear to supply the majority of all of these metals with the exception of silver.

Non-point sources of arsenic are primarily agricultural lands where arsenic-based pesticides were applied in the past. Non-point sources of lead include airborne lead-based fuels and the combustion of waste oil and trash. The corrosion of copper plumbing pipes is responsible for a portion of the copper that is received by wastewater treatment plants.

Municipal wastewater treatment plants also receive a great variety of industrial wastewater. All dischargers to public or private sewers tributary to the Monroe County Pure Waters sanitary sewer system must conform to the Monroe County Sewer Use Law. For some discharges, this means conducting pretreatment. Some metals do enter the municipal wastewater system from industry, however. Those metals which are removed from the water at Van Lare are currently captured in the sludge, which is burned. A portion of the metal content currently returns to the air with burning, and can be deposited on land or in water with precipitation or dryfall. The remainder becomes part of the ash, which is landfilled. The location of the landfill used depends on the hauler. Ash can be stored at the Van Lare in clay lined lagoons site for up to a year before it is hauled. Stored ash, is currently in a contined area with runoff captured and returned to the plant for treatment. The ash has been tested for leachability and has not exhibited hazardous characteristics under Extraction Procedure (EP) and Toxicity Characteristic Leaching Procedure (TCLP) testing. The Monroe County Department of Environmental Services has identified this as a concern and will be working to develop an improved ash-handling system. New federal sewage sludge regulations will be also be issued by the U.S. Environmental Protection Agency in December of 1992 that will result in a reduction of sludge incineration emissions. Municipalities will have 2 years to comply with the new regulations that will require advanced technology to reduce emissions.

A recent study of mercury contamination concluded that more than half of the nation's mercury emissions come from coal fired power plants and municipal waste incinerators. Other sources include mercury vaporized from the biocides in latex paint, other fossil fuels, breakage of fluorescent lamps during disposal, and the incineration of medical and industrial wastes. New York State ranks second after Ohio in total annual mercury emissions, and is in a region of high mercury emissions per square mile (Clean Water Fund/Clean Water Action, 1992). Atmospheric deposition appears to account for most of the mercury discharged by the Genesee River. However, NYSDEC data indicate only three air dischargers emitting less than 2 lbs/yr of mercury to the air in Monroe, Livingston, Allegany, Genesee and Orleans counties. Therefore, it appears that most mercury loadings to the Rochester Embayment are from sources beyond the Embayment watershed. Studies ongoing or planned by federal and/or international agencies should be sought to help address this issue.

Lead can enter water from many sources. This biggest source would appear to be from the air. Estimated amounts of air deposition in the embayment watershed range from 41,675 lbs/year using CCIW data to 178,461 pounds per year calculated using data collected in Brockport. This can be seen in table 5-4. There are also some wastewater discharges of lead. One potential source of lead to waterways is the use of lead paint for the painting of bridges. Agencies conducting bridge painting take precautions to prevent the lead paint from reaching waterways, but some residual loss to the waterways is likely.

Some of the cadmium that reaches waterways comes from vehicle tires. Cadmium is contained in tires and wears off onto road surfaces. Cadmium loading from this source could be estimated based on the average concentration of cadmium in tires, tire wear per lane mile, and lane miles of road in the drainage basin. Ed Olinger at the NY Dept. of Transportation office in Rochester made contacts in October, 1992 to see if calculations had been done on tire cadmium content and wear, but was unable to find such information. This type of research could be conducted in the future.

Inactive hazardous waste sites and dumps are other likely sources of metals contamination. Two of the three landfills cited in section B of this chapter cite metal groundwater contamination. Table 5-8 also gives an indication of other places where metals are known to be problems at past landfill sites.

8. Cyanide

Cyanide is not known to be causing any impairments in the AOC. However, high levels of cyanide are found in both Genesee River and Irondequoit Bay sediments. Cyanide is used in plating industries and was a by-product of coal gas production. It was once a component of commonly-used pesticides, and remains in the soil in some agricultural areas.

Table 5-3 shows that 6,928 pounds per year of cyanide are discharged via wastewater in the Genesee basin and in the portion of the Lake Ontario West and Lake Ontario Central basins that direct their treated wastewater directly to Lake Ontario. Of that, 3383 pounds per year are discharged into the Genesee Basin, 3510 pounds per year directly to Lake Ontario, and the remaining 35 pounds per year to the Lake Ontario Central Basin. We were not able to obtain air loading data in time to include in this document.

9. Fecal Coliform Bacteria

Fecal coliforms are bacteria that live in enormous numbers in the intestines of all humans and most other warm-blooded animals. They are used as an indicator of fecal contamination, indicating the probable presence of pathogenic bacteria such as *salmonella*. Fecal coliform can grow in wet, decomposing organic debris like leaf piles. The sources of the bacteria were discussed in Chapter 4 under "Beach Closings."

Fecal coliform bacteria are used as an indicator of beach water quality. They reach the beaches via streams and the river, where their numbers increase sharply with stormwater runoff. The bacteria get into the stormwater via many pathways including improper connections of sanitary sewers with storm sewers, broken sanitary sewer laterals, rotting organic debris (much of which is natural such as leaf fall and *Cladophora* algae), and the feces of domestic and wild animals, including seagulls who feed on contaminated debris. The large quantity of *Cladophora* that washes up on the beaches is related to an excess of the nutrient phosphorus which causes an overabunance of this kind of algae to grow in the embayment.

10. Ammonia

Ammonia has been of concern in the lower Genesee River during dredging. During dredging, ammonia in the sediments is released to the water column where it can be acutely toxic to fish. Most ammonia toxicity is attributable to the unionized form (NH_3), rather than the ionized form (NH_4^+). The NH_3--NH_4^+ equilibrium is both pH and temperature dependent with the concentration of unionized ammonia (NH_3) rising as either pH or temperature or both increase. NYSDEC standards for total ammonia were revised in 1991 to consider this equilibrium and to ensure concentrations of the unionized fraction (NH_3) were below toxicity thresholds at varying pH and temperature. Standards are also more stringent for higher water quality classifications such as salmonid spawning habitats. (The Genesee River has a relatively high pH.)

The sources of ammonia are complex, since ammonia can be formed from other nitrogen-containing compounds through chemical reactions and bacterial activity. Nitrogenous wastes come from many sources, including sewage, fertilizer, and natural debris such as plant material and manure.

The "nitrogen cycle" refers to the transformations between elemental nitrogen in the air, nitrates, nitrites, ammonia, and complex organic molecules containing nitrogen. Ammonia often (but not always) is highest in places where there is a deficiency of oxygen. That tends to be the case with the sediments in the lower Genesee.

11. Phenols

Phenols are listed as possible sources of fish tainting because in 1981, the EPA measured high values of phenol at the mouths of Sodus Bay, Salmon Creek in Wayne County, and the Genesee River. The source of the high readings is not known. EPA monitoring in subsequent years found no detectable phenol in the river. Table 5-3 shows phenol and total recoverable phenolics from wastewater point sources. The largest wastewater discharger to the drainage basin is Atochem. The Van Lare treatment plant is the largest discharger to the lake. Atmospheric point sources of phenol are highest in Allegany County.

12. Sediment

Suspended solids loadings are nearly all from non-point sources. Information contained in Figure 5-13 indicates that these point-sources account for only 2% of the total suspended solids loading to the Embayment from the Genesee Basin. Figure 5-10 shows an estimate of suspended solids loadings per unit area. This gives an indication of the areas from which the highest amounts of non-point sources of sediment come from. The Canaseraga Creek watershed is the most prominent source area. Intensive agricultural areas on calcareous soils were among the highest contributors to suspended solids loadings, according to the Genesee River Pilot Watershed Study (Hetling et al. 1978).

Table 5-20 shows sediment loadings from cropland and streambank erosion that the Soil Conservation Service estimated for the watersheds of the Genesee Basin in 1974. The Canaseraga

Creek watershed had the highest total loading, three quarters of which was from cropland. Black Creek (Genesee County), Oatka Creek, the middle Genesee (Mt. Morris to Henrietta) and Conesus Lake watersheds followed in order of total sediment load. All received the majority of their sediment from cropland erosion. Upper Honeoye Creek had the highest loading per acre, 80% of which was from cropland. Several of the creeks, primarily in the upper Genesee Basin, had a greater sediment load from bank erosion than from cropland. Using data provided in the March 1975 SCS Report entitled "Erosion and Sediment Inventory", it is estimated that 480,000 tons per year of sediment enter the Genesee River from stream and river bank erosion in the stretch from Mt. Morris to Rochester.

The Pilot Watershed Study found that in 1974-75 the suspended solids loadings at Mt. Morris were 74-79% of the suspended solids loadings at the mouth of the Genesee River. The present study found that the suspended solids loadings at Geneseo were approximately 54% of the loadings at the mouth. Sample sites for both studies were below the confluence of Canaseraga Creek with the Genesee. The results seem to indicate either that some of the erosion in the upper basin has been controlled since the mid-1970s, or that more sediment is now being generated in the lower basin. Both trends are probably occurring, since total loadings at the mouth of the Genesee have not changed a great deal (1,027,000 tons in 1975; 551,000 tons in 1976; 626,000 tons in water year 1990). Bear in mind that the methods for computing loadings in the two studies differed. (Precipitation can also affect sediment loadings. Precipitation at Rochester was 30.6" in 1975, 34.3" in 1976, and 36.0" in water year 1990, but data on amounts, intensity and locations in other parts of the basin would be needed in order to tell whether this was a significant factor in the differences.)

In urban and suburban areas, as in rural areas, suspended solids come from unprotected soil and streambank erosion; however, the causes of those conditions are different. In urban and suburban areas, unprotected soil is more likely to be associated with construction sites than with agriculture. Streambank erosion also can be accelerated by real estate development due to the increase in impervious surfaces, which cause increased storm flows in local streams. Numerous studies in individual watersheds have shown construction sites to be a significant source of sediment in urban areas.

The NURP study found that sediment yields from watersheds in the Irondequoit Basin increased with increasing percentages of impervious surface (see Figs. 5-2 - 5-5). The highest sediment yields came from the three small study sites: Cranston (moderate-density residential), Southgate (commercial/residential), and East Rochester (high-density residential). Sediment yields from those sites ranged from 0.1 to 0.8 tons/acre per year -- considerably less than the 4 tons/acre and up that are typical for row crops and construction sites, but higher than the yields from low density residential and low-intensity agricultural land (woodlots, hayfields etc.).

Localized sediment problems in smaller streams in the basins are important and will be addressed in the basin plans. But in terms of solids loadings to the embayment itself, the Genesee River is by far the most important contributor. The sources of sediment in the river appear to be: 1) cropland erosion, 2) streambank erosion, and 3) runoff from developed and developing areas.

13. Phosphorus

Calculations for the Genesee Basin earlier in this chapter show that approximately 10% of the total phosphorus discharged by the river is from permitted point sources. This ratio is less than that of 15 years ago, when the Genesee Basin Pilot Watershed Study found that 15% of the total phosphorus came from point sources in 1975 and 23% in 1976. The total amount of phosphorus discharged by the river decreased from over 800 tons in 1975 and over 500 tons in 1976 to less than 400 tons in 1989-90. The decrease in point source and total loadings is consistent with the efforts to remove direct wastewater discharges from the river.

The IJC has calculated total phosphorus loadings to Lake Ontario from sources within its basin (excluding the phosphorus contained in Lake Erie water entering from the Niagara River). Major sources listed from the AOC were the Genesee River, the Van Lare wastewater treatment plant, and the Northwest Quadrant wastewater treatment plant. These sources together accounted for an average of 15% of the phosphorus loading to the lake in Water Years 1983 through 1985 (Rathke and McRae, 1989, Vol. III, Tables 3.0-8, 3.0-13 and 3.0-19).

Point source phosphorus loadings from 1989-90 are shown in Table 5-3. The largest dischargers to the Embayment watershed are the Gates-Chili-Ogden wastewater treatment plant and the Kodak wastewater treatment plant. The largest discharger to the lake is the Van Lare WWTP.

Figure 5-11 and 5-12 show the predictions of the Pilot Watershed Study concerning non-point phosphorus sources. The most important sources of particulate phosphorus appear to be the areas around the Genesee Gorge in Livingston County and downstream of Avon. Soluble phosphorus sources for the most part increase downstream. As explained in the study, the numbers indicating phosphorus loading per unit area overestimate the amount actually detected through stream sampling, but the maps are useful for showing the patterns of source areas. The Pilot Watershed Study (Hetling et al. 1978) finds that the highest phosphorus loadings per unit area came from intensive agricultural lands on calcareous soils, and from cultivated mucklands.

The NURP study in the Irondequoit Basin found that non-point phosphorus loadings generally increased with an increase in impervious surfaces (see Appendix E), with a high density residential area having the greatest phosphorus yields during storms. An active construction site that was monitored had similarly high phosphorus loadings. Atmospheric phosphorus deposition on the watershed equalled 65% of the annual yield measured in Irondequoit Creek (Kappel *et al.*1986).

In 1990, SUNY Brockport studied the pollutant loadings to Long Pond in Greece, which is considered hyper-eutrophic. They found that 89% of the phosphorus loadings to Long Pond came from Northrup Creek, and 56% of the loadings to the creek were from the Spencerport wastewater treatment plant (Makarewicz, *et al.* 1990). Therefore, approximately half of the annual phosphorus inputs to the pond were due to the treatment plant effluent. During summer low flows, the effluent contributed nearly 100% of the phosphorus entering the pond.

In both Northrup and Buttonwood Creeks, water quality of point sources entering the creek was measured in July and August. The highest phosphorus concentrations other than the treatment plant effluent came from pipes draining lawns, golf courses and housing developments. A plot of phosphorus concentrations along both creeks shows increases near lawns, a golf course and a cattle pasture. Though these phosphorus sources are important during the summer algae season, they are a minor portion of total annual phosphorus loads. For the streams in the Irondequoit Basin and the West Basin that have been sampled year round, between 35 and 94% of phosphorus discharges were found to occur during snowmelt and spring runoff (Makarewicz *et al.* 1990; Kappel *et al.* 1986).

The Makarewicz & Kappel studies also computed the phosphorus loadings per unit area; this is a useful way of determining where the problem areas are, as shown in Table 5-20. "Diversion" refers to the diversion of treated wastewater from the Irondequoit Basin to the Van Lare WWTP on Lake Ontario.

14. Litter

Litter reaches waterways through direct littering and dumping from shore or boats, and through the transport of litter via storm sewers and stream flows. Litter on the bottom of the Genesee River can be brought up during dredging and drift onto nearby beaches.

Littering behavior is encouraged by areas that are not kept clean, since people will throw trash where they see other trash.

15. Dead Fish

The annual die-off of Pacific salmon and trout in the Genesee River is a natural occurrence that results in aesthetic problems of odors and unsightliness. The abundance of the fish is a result of the NYSDEC stocking program. The periodic die-offs of alewives in Lake Ontario are due to population explosions and crashes that these fish experience. The two phenomena are related because the salmonids are stocked partly to reduce the numbers of alewives so that population crashes will be less likely. Recently the population of alewives in the lake has been declining to the point where it is feared they might not supply adequate prey for the usual numbers of stocked game fish. Zebra mussels complicate the picture by consuming plankton and possibly restricting the amount of food available to other organisms such as alewives. Reductions in phosphorus in Lake Ontario, which spur plankton growth, may also be contributing to the reduction of the alewife population. The management of trophic relationships between several non-native species in Lake Ontario is a complicated task that is not always predictable.

Locally, fish cleaning by anglers in the lower Genesee creates dead fish odors in the area. The City of Rochester has established a fish cleaning station in the area that is helping to alleviate this problem.

16. Chemical Seeps at Lower Falls

The chemical seeps at the Lower Falls allow pollutants to directly enter the Genesee River. The seeps were investigated by the Monroe County Environmental Management Council (Landfill Review Committee, 1979) and sampled as part of the sediment toxics survey (Monroe Co. Dept. of Health, 1986). They were also studied as part of the Phase I investigation of the Genesee Gorge inactive hazardous waste site under the State Superfund (RECRA Environmental, Inc., 1988). Seeps were sampled by the City of Rochester in 1988 (Malcolm Pirnie, 1988). The seeps are on the face of the Lower Falls on the western side. Those near the top of the falls contain high levels of benzene, toluene and xylene (BTX). A separate seep further down contained an oily, creosote-like substance, and a contaminant pool at the base of the falls contains PAHs (see Tables 5-21 and 5-22). All of the seeps are in the Grimsby sandstone formation. As discussed above under "inactive hazardous waste sites," wastes are traveling through the fractured rock under the river, and chemicals similar to those at the Lower Falls (including BTX and PAHs) have been found in the RG&E tunnel upstream of the falls in the same sandstone formation. The specific sources of each type of contamination are not known. However, both the RECRA Environmental and the City of Rochester studies find that the most probable source of the contaminants at the base and face of the lower falls, and in the RG&E tunnel are from coal tar.

Other possible sources for the seeps include chemical storage areas or dumped material just west of the Lower Falls. Several industries, including a furniture manufacturer, were once located at the outlet of a gorge known as "Deep Hollow" that emptied immediately upstream of the falls. This industrial area was abandoned, and from the 1930s until the mid-1970s it was used as a dumping ground. The hollow was filled and the factory sites covered over (Landfill Review Committee, 1979). Included in the debris dumped in the hollow were construction and demolition debris and 50 ft. of old auto bodies. Seepage within the former gorge could be bringing buried materials to the face of the falls. An abandoned mill race that ends adjacent to the Lower Falls on the west side could be a contributing factor as well.

17. Physical Disturbances

Physical disturbances include filling and draining of wetlands, removal of riparian vegetation, and development near shorelines. In the 19th century, logging, agriculture and water-powered industry were the primary causes of disturbance. More recently, residential, commercial and recreational development have spread throughout the area and are continuing rapidly. Public projects have had major impacts as well. The opening of Irondequoit Bay and the construction of the Lake Ontario Parkway are examples. Figures 5-13 and 5-14 show how wetlands along the last few miles of the Genesee were removed for marina construction and river widening between 1952 and 1969, showing the effects of both public and private projects.

E. Other Persistent Toxics

The pollutants discussed in the previous section were those that have been linked to impairments in the AOC. There may also be a need to reduce the discharge of persistent toxics due to potential concerns for human health. Work is being done as part of the Stage II RAP to identify all pollutants of concern. These will be addressed further in the Stage II RAP.

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Hites, R. Dept. of Public and Environmental Affairs. Indiana University, Bloomington.

Johnson, R. E. Power Transmission Planner. NYS Public Service Commission.

Steinfeldt, P. N. Engineer. Monroe County Pure Waters.

Williams, J. Manager, Environmental Science. Rochester Gas and Electric Corp.

FIGURE 5-1. GENESEE GORGE

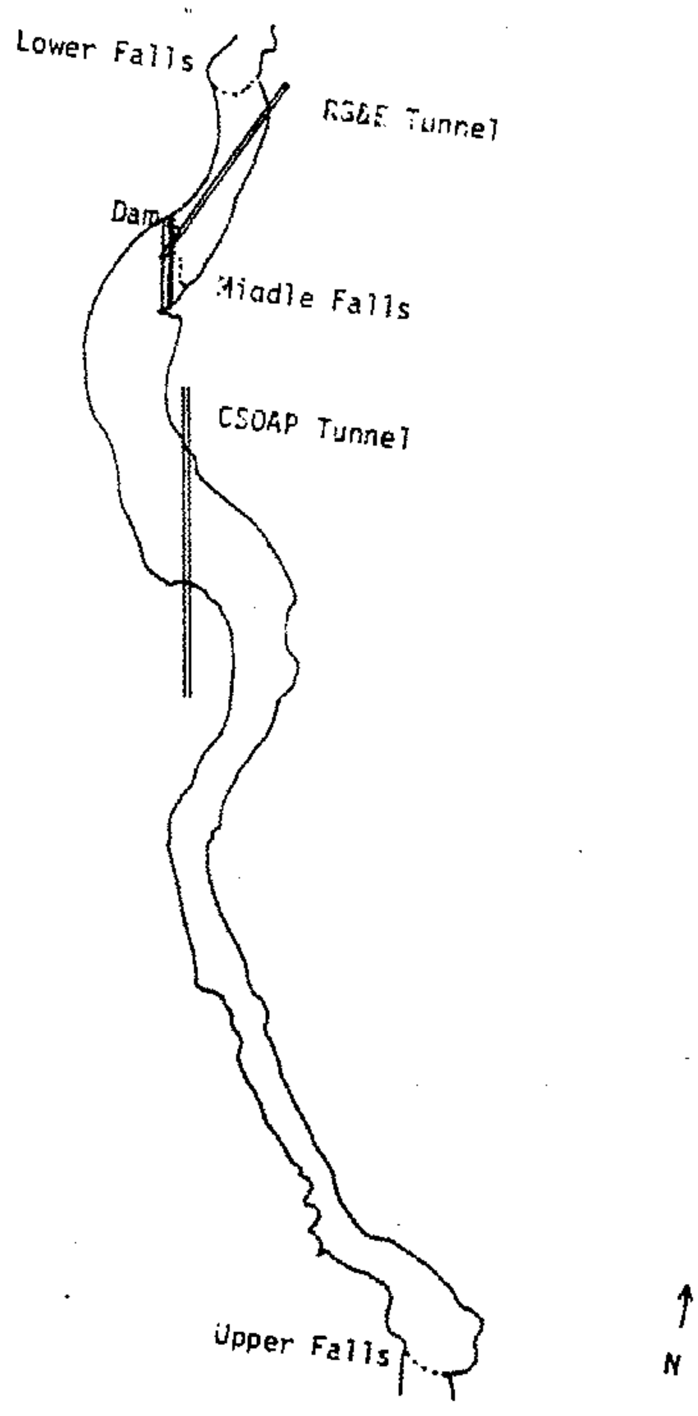
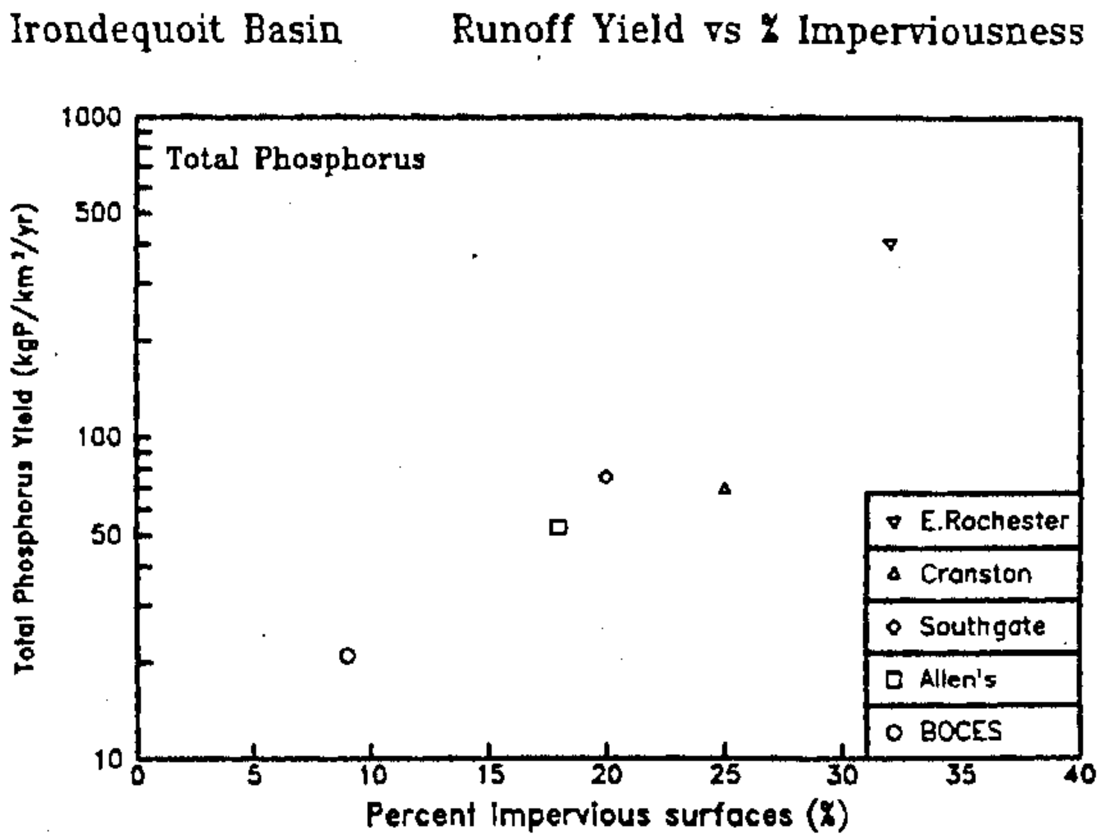


FIGURE 5-2. RUNOFF YIELD OF PHOSPHORUS
IRONDEQUOIT BASIN, 1980-81



Results from Nationwide Urban Runoff Program study (NURP). Graph by Monroe Co. Health Dept. Environmental Lab.

FIGURE 5-3. RUNOFF YIELD OF SUSPENDED SOLIDS
IRONDEQUOIT BASIN, 1980-81

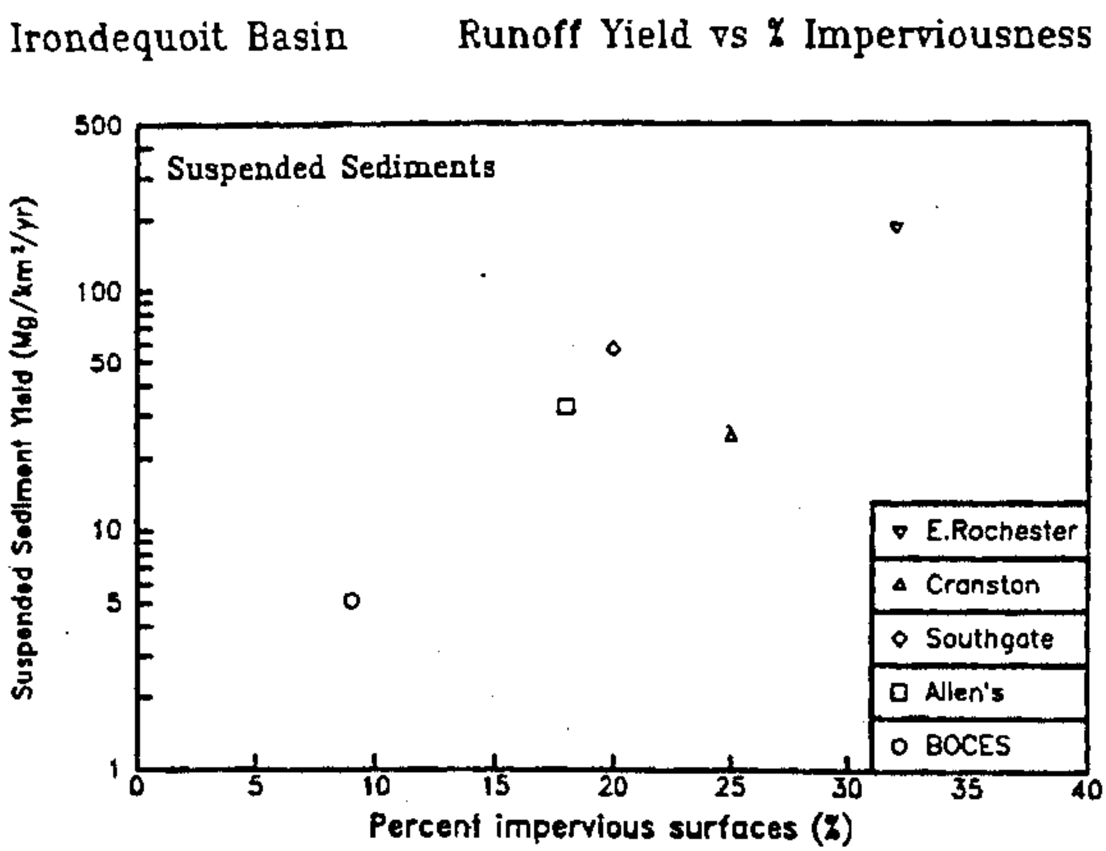


FIGURE 5-4. RUNOFF YIELD OF LEAD
IRONDEQUOIT BASIN, 1980-81

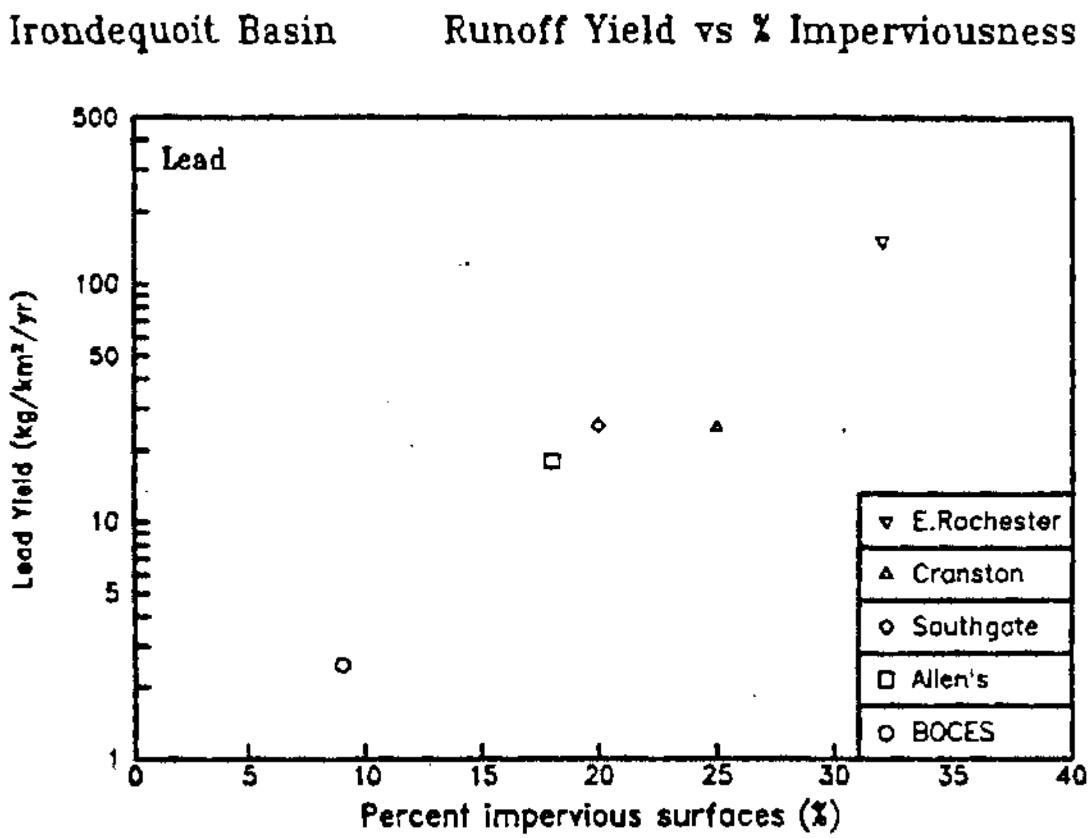
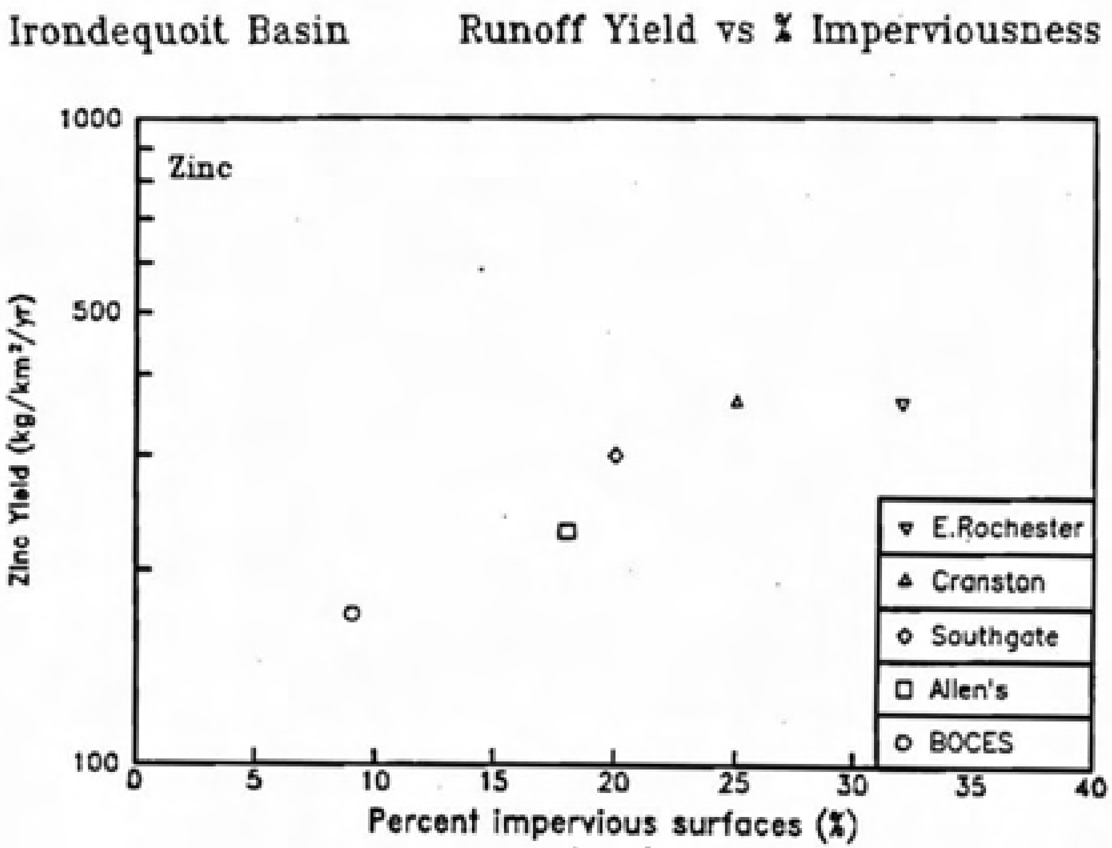


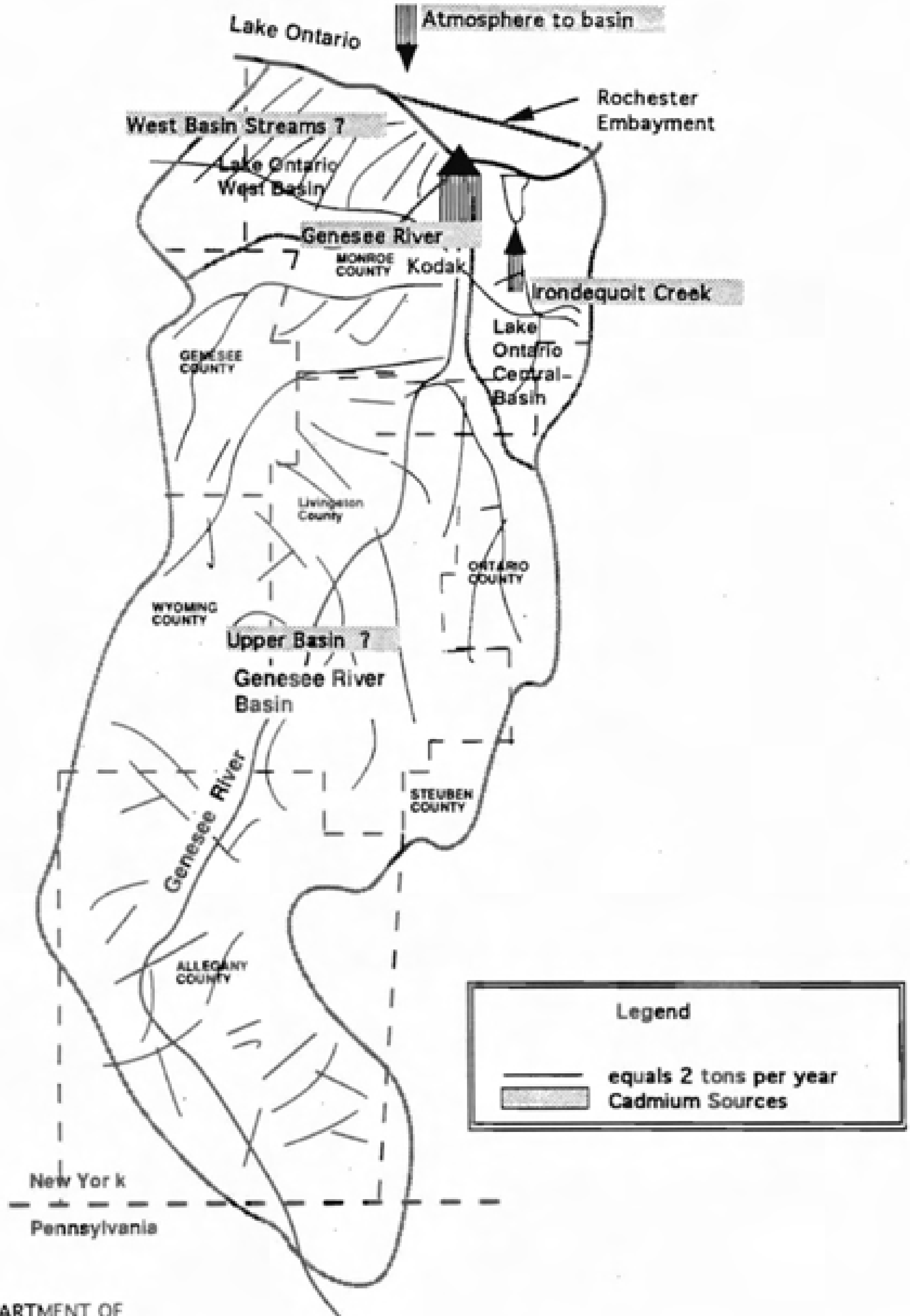
FIGURE 5-5. RUNOFF YIELD OF ZINC
IRONDEQUOIT BASIN, 1980-81



5-6

CADMIUM SOURCES

to the Rochester Embayment



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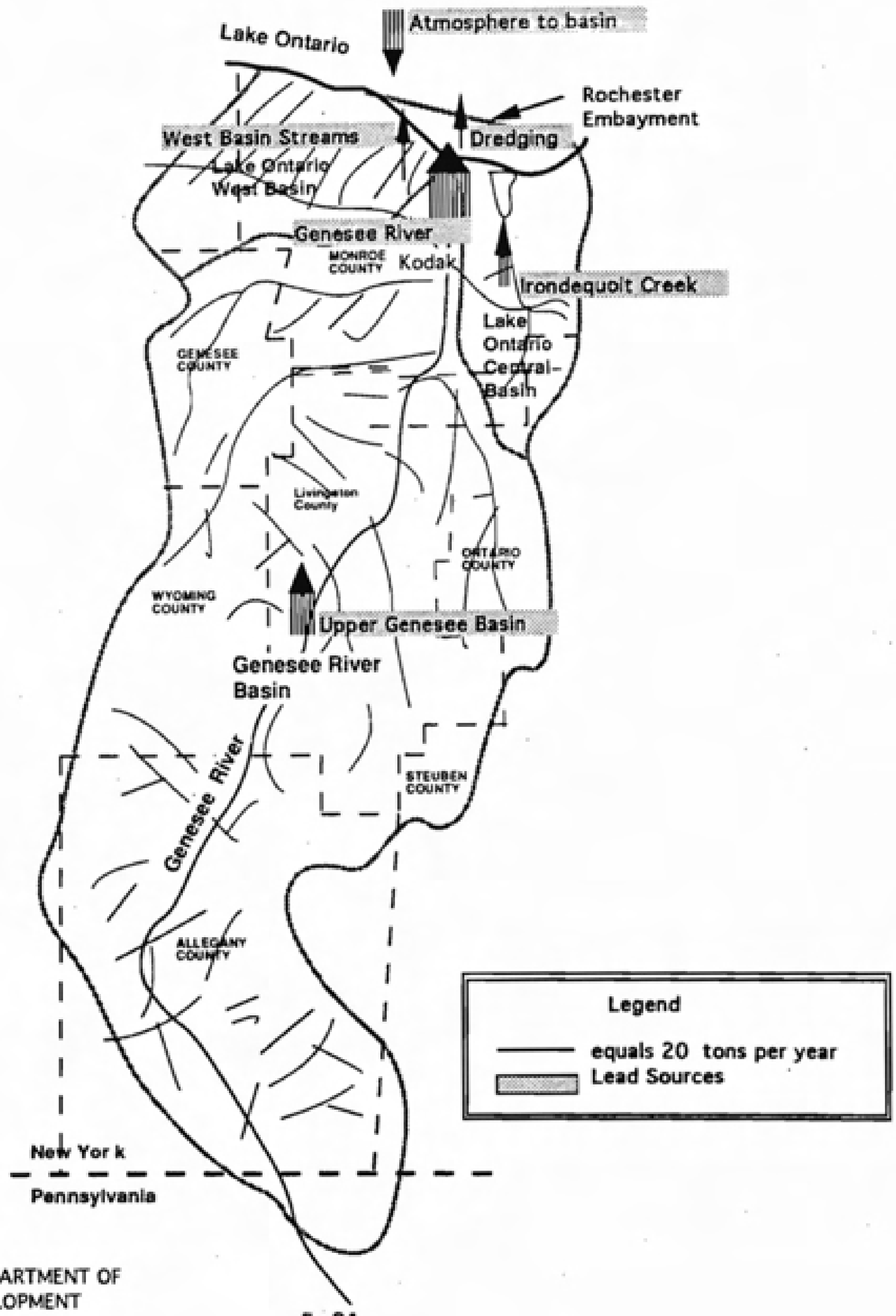
5 - 7
LEAD SOURCES
to the Rochester Embayment

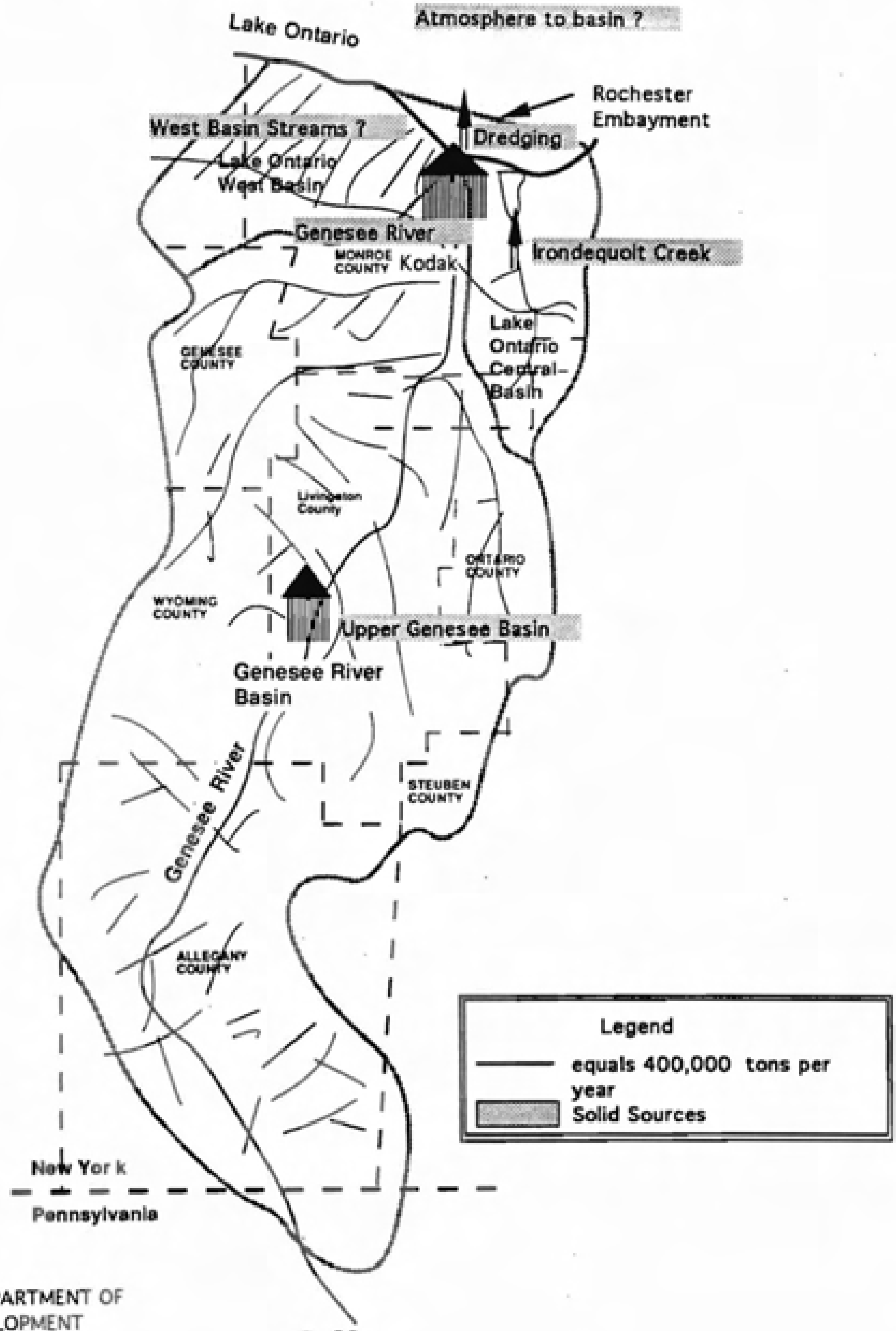


MONROE COUNTY DEPARTMENT OF
PLANNING AND DEVELOPMENT

5- 8

SOLIDS SOURCES

to the Rochester Embayment



MONROE COUNTY DEPARTMENT OF
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5-9
PHOSPHORUS SOURCES
to the Rochester Embayment

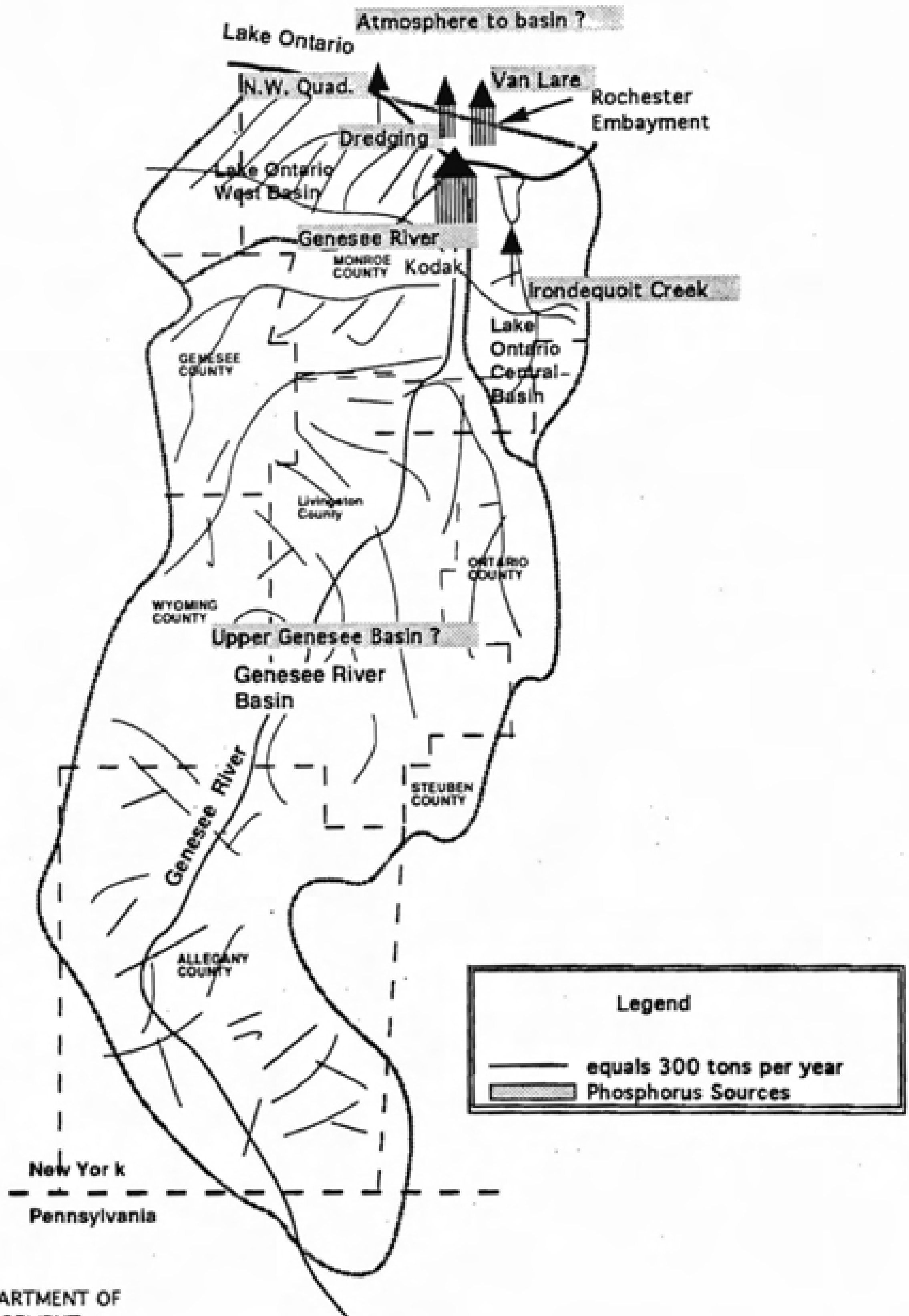

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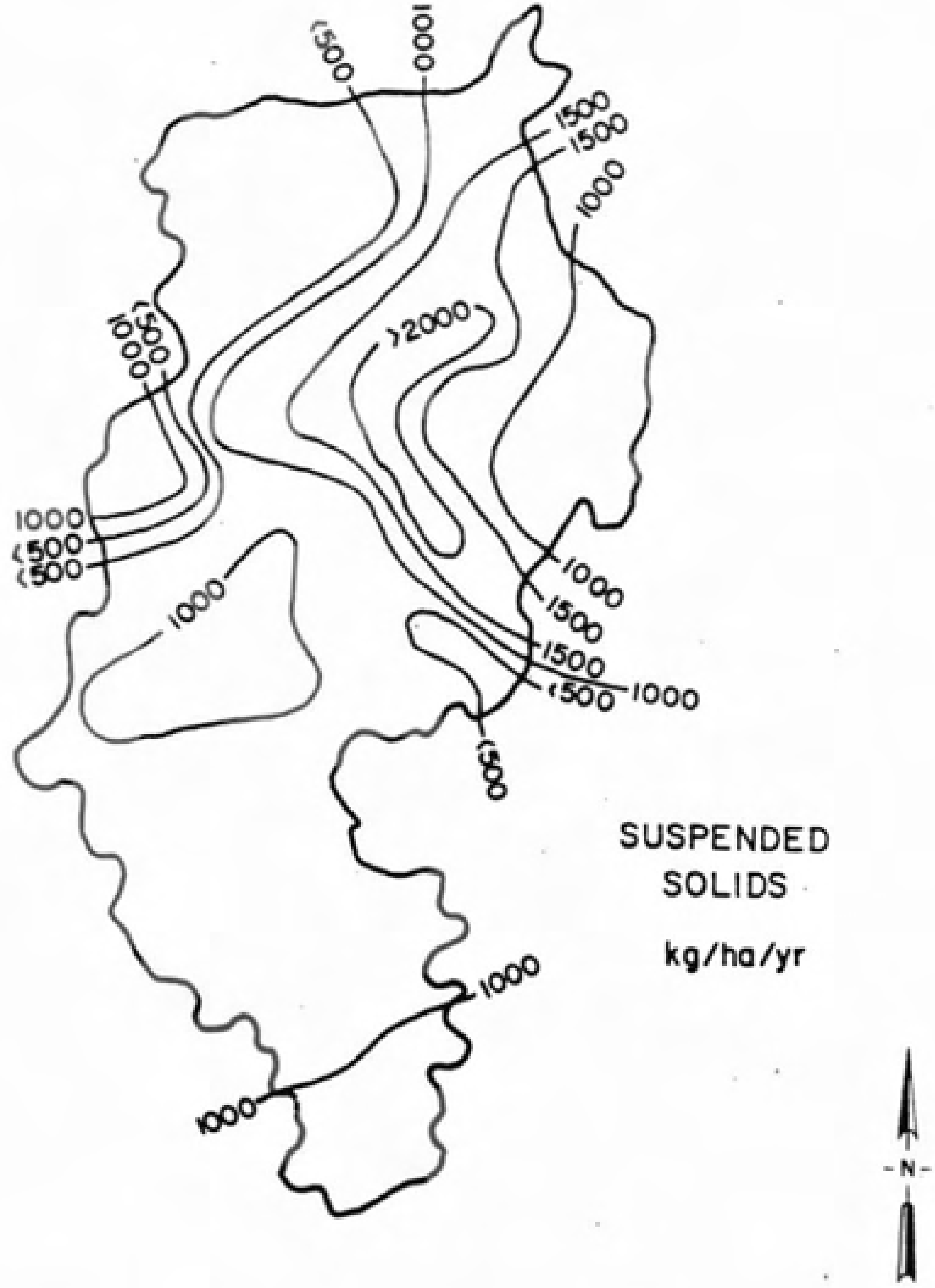
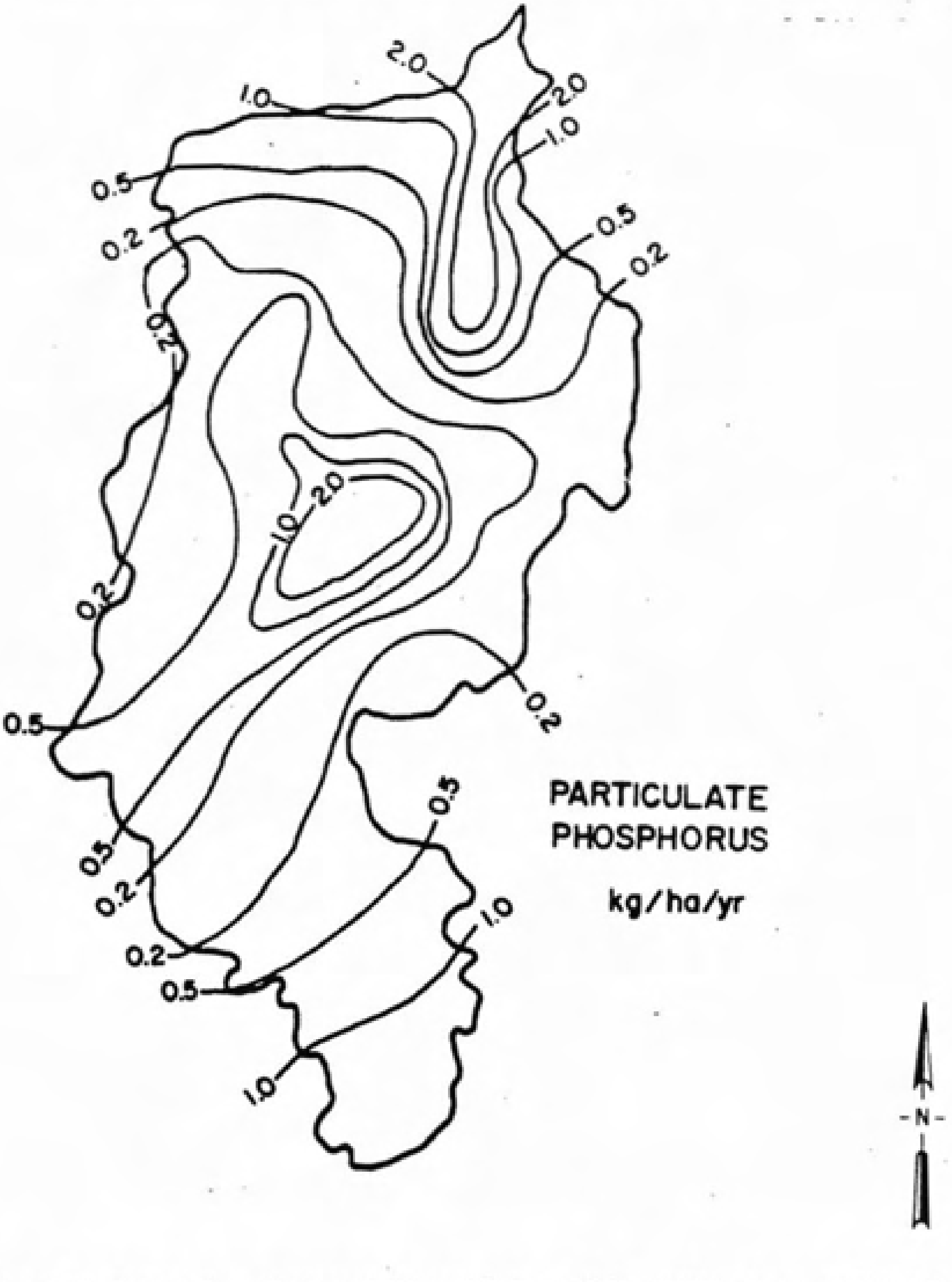
FIGURE 5-10
SUSPENDED SOLIDS SOURCE AREAS IN GENESEE BASIN



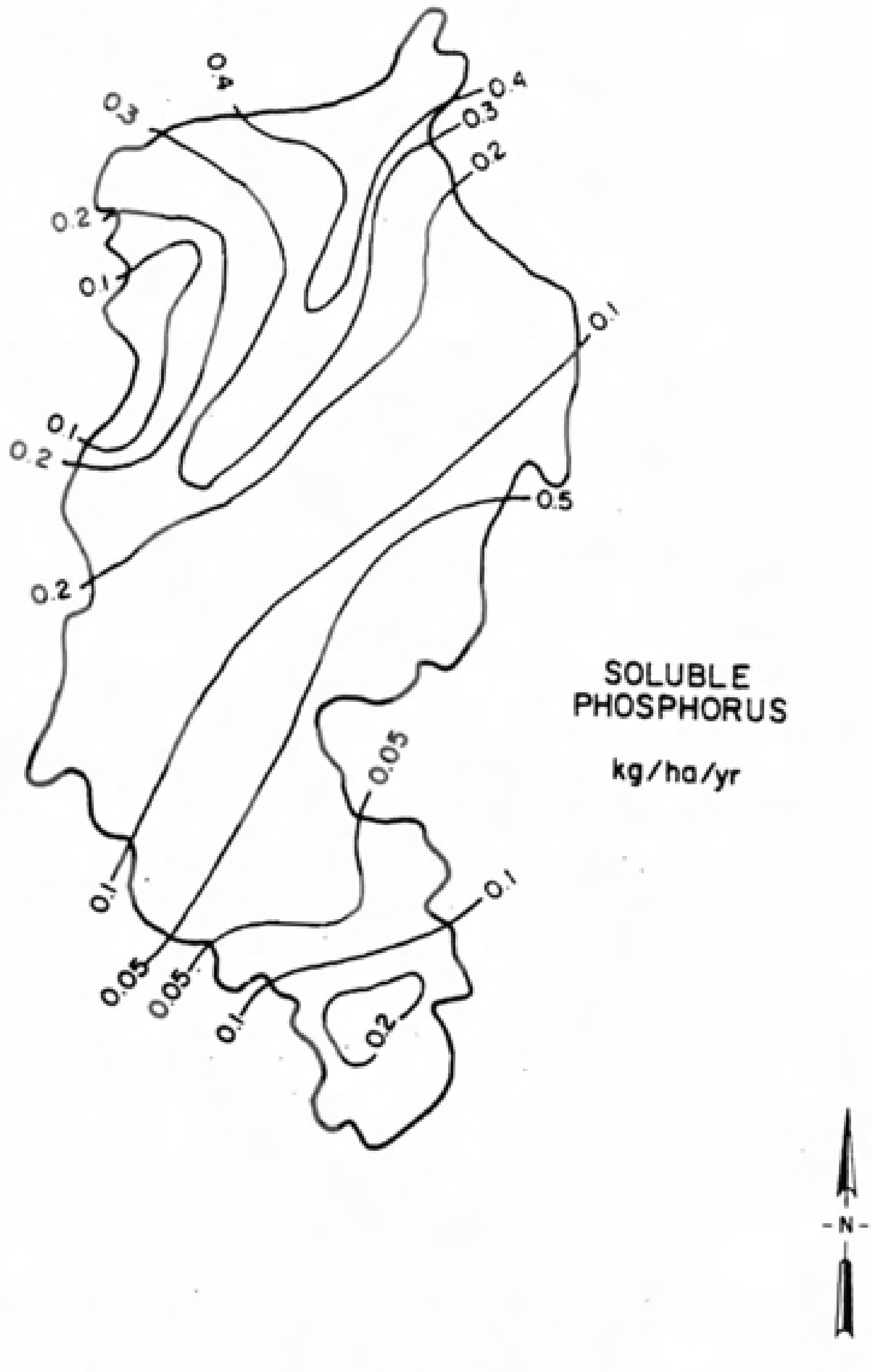
Source: Heltling, L. J., Carson, G. A., Boulton, P. W., and Rafferty, M. R. (1978). Genesee River pilot watershed study: summary pilot watershed report. Submitted to IJC International Reference Group on Pollution from Land Use Activities. Albany: NYSDEC.

FIGURE 5-11
PARTICULATE PHOSPHORUS SOURCE AREAS IN GENESEE BASIN



Source: Heltling, L. J., Carson, G. A., Boulton, P. W., and Rafferty, M. R. (1978). Genesee River pilot watershed study: summary pilot watershed report. Submitted to IJC International Reference Group on Pollution from Land Use Activities. Albany: NYSDEC.

FIGURE 5-12
SOLUBLE PHOSPHORUS SOURCE AREAS IN GENESEE BASIN



Source: Hetling, L. J., Carson, G. A., Boulton, P. W., and Rafferty, M. R. (1978). Genesee River pilot watershed study: summary pilot watershed report. Submitted to IJC International Reference Group on Pollution from Land Use Activities. Albany: NYSDEC.

FIGURE 5-13
LOWER GENESEE RIVER AREA, 1952

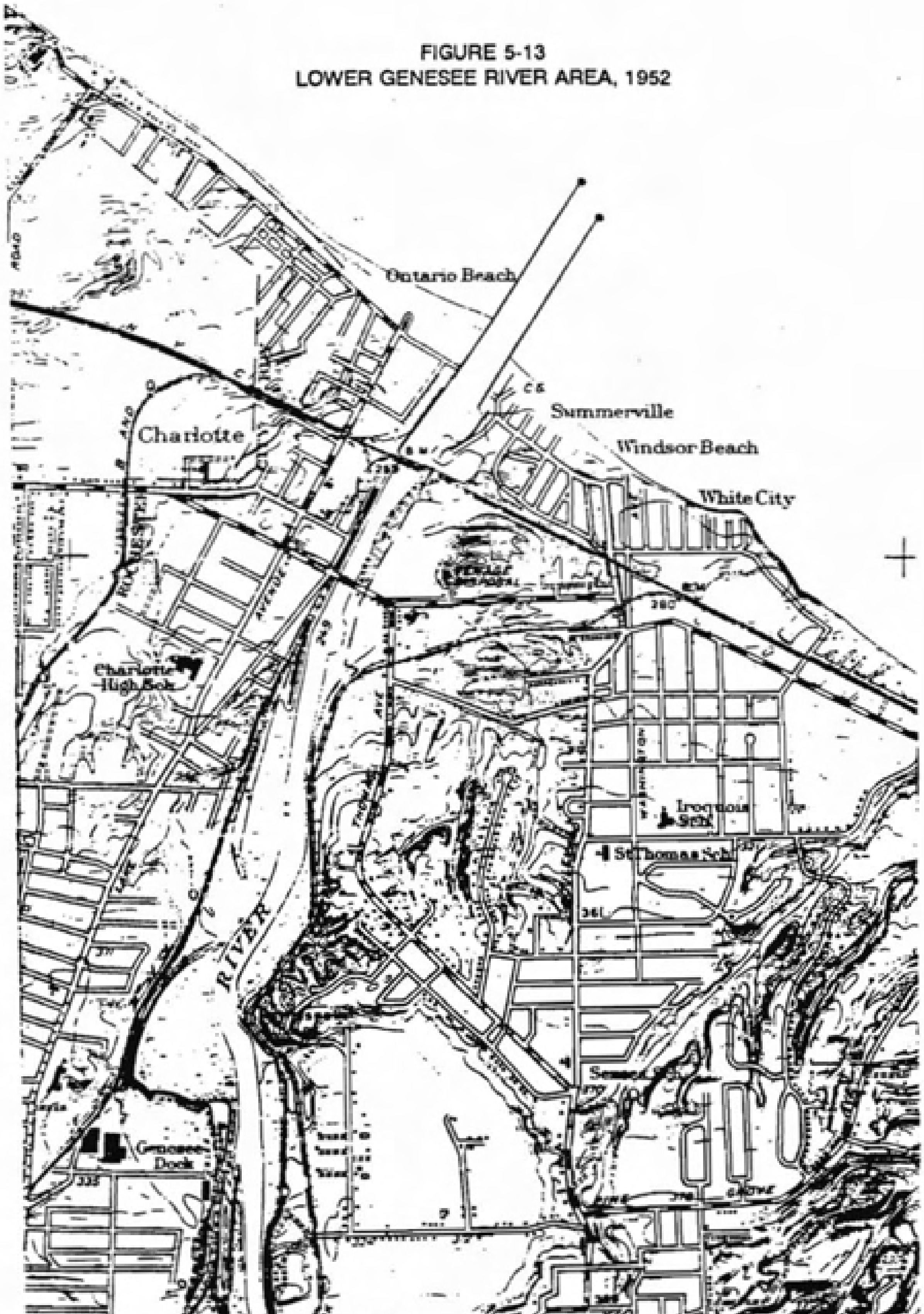


FIGURE 5-14
LOWER GENESEE RIVER AREA, 1969

TABLE 5-1. PRIORITY POLLUTANTS FOR THE ROCHESTER EMBAYMENT

Inorganics	Organics	
Metals	**Pesticides**	**Other organics (cont.)**
Aluminum	Aldrin	Di-n-octyl phthalate
Arsenic	Chlordane[1,2]	Dioxin (2,3,7,8-TCDD)[1,2,3]
Barium	Dieldrin[2,3]	Fluoranthene
Cadmium[1]	DDT and metabolites[2,3]	Furan (2,3,7,8-TCDF)
Chromium	Endosulfan, total	Haptanone
Cobalt	Endrin	Hexachlorobenzene[2,3]
Copper[1]	Heptachlor & Hep. epoxide	Hexachlorobutadiene
Iron[1]	Hexachlorocyclohexane (BHC), total	Hexane
Lead[1]		Methylene chloride
Manganese	Methoxychlor	Methyl ethyl ketone
Mercury[2,3]	Mirex and photomirex[1,2,3]	Octachlorostyrene[2]
Molybdenum	Toxaphene [3]	Pentachlorobenzene
Nickel	**Other organics**	Pentachlorophenol
Selenium	Acetone	Phenol[1]
Silver	Benzene	PCB (Polychlorinated biphenyls)[1,2,3], total
Strontium	Benzo (a) anthracene	Pyrene
Vanadium	Benzo (a) pyrene	1,2,3,4-Tetrachlorobenzene
Zinc[1]	Benzo (b) fluoranthene	1,2,4,5-Tetrachlorobenzene
	Benzo (k) fluoranthene	Tetrachloroethene (or -ethylene)
Other inorganics	Bis (2-ethylhexyl) phthalate	2,3,4,5-Tetrachlorophenol
Alkylated lead	Carbon tetrachloride	2,3,5,6-Tetrachlorophenol
Cyanide[1]	Chloroform	Tetrahydrofuran
Phosphorus[1]	Chlorinated dibenzofurans[3]	Toluene
Sediment[1]	2-Chlorotrifluorotoluene	1,2,3-Trichlorobenzene
	4-Chlorotrifluorotoluene	1,2,4-Trichlorobenzene
	Chrysene	1,3,5-Trichlorobenzene
	1,2-Dichlorobenzene	1,1,1-Trichloroethylene
	1,3-Dichlorobenzene	Trichloroethene (or -ethylene)
	1,4-Dichlorobenzene	2,4,5-Trichlorophenol
	Dichlorobromomethane	2,4,6-Trichlorophenol
	2,4-Dichlorotrifluorotoluene	2,3,6-Trichlorotoluene
	3,4-Dichlorotrifluorotoluene	2,4,5-Trichlorotoluene

[1] Known or suspected of causing use impairments in the Rochester Embayment.
[2] Exceeds standards or criteria for Lake Ontario.
[3] IJC critical pollutant.

Table 5-2
PRELIMINARY LIST OF HIGH PRIORITY POLLUTANTS

The Priority Pollutant Task Group of the RAP Technical Group began work on October 2, 1992 to identify the highest priority pollutants from the list identified in Table 5-1. To date, that group has identified 20 chemicals deemed to be of highest priority. At this time (6-8-93) the Priority Pollutant Task Group is going through a process to prioritize these top 20 pollutants. Until that is done, the following list, in no particular order, is outlined below. The prioritized list will be included in the Stage II RAP.

Dioxin
Furan
Mirex
PCB
DDT & Metabolites
Aldrin
Dieldrin
Heptachlor & Epoxide
Chlordane
Toxaphene
Mercury
Benzo (a) Pyrene (PAH's)
Hexachlorobenzene
Alkylated Lead
Phosphorus
Cadmium
Silver
Cyanide
Methylene Chloride (also known as dichloromethane)
Phthalates (Bis-2-ethylhexyl and Di-n-octyl)

NOTE: This is not a permanent list. This will change with new information. The process is flexible and is intended to respond to new information. This table will be revised during the development of the Stage II RAP, and included in the Stage II RAP.

Table 5-3
Wastewater Discharges of Selected Pollutants
Genesee River Basin and Direct Dischargers to Rochester Embayment of
Lake Ontario
October 1990 to September 1991

Pollutant Name	Annual Load-Pounds/Year
Phosphorus, Total	392,051
Arsenic, Total	2.1
Cadmium, Total	542
Chromium, Hexavalent	.012
Chromium, Total	2,943
Copper, Total	12,747
Cyanide	6928.72
Iron, Total	130,895
Lead, Total	4,100
Manganese, Total	1.5
Nickel, Total	7,950
Silver, Total	7,536
Zinc, Total	48,512
Aluminum, Total	5,792
Selenium, Total	14.6
Dichlorobromomethane	17.6
Chloroform	514
Phenolics, Total Recoverable	166.3
Toluene	3.9
Benzene	16
Benzene, Tolune, Xylene in Combination	8
Methylene Chloride	4,735
Tetrachlorolthylene	2.3
1, 1, 1-Trichloroethane	4.4
1, 3-Dichlorobenzene	0 *
Di-N-Octyl Phthalate	0 *
Phenol, Single Compound	0 *
Bis (2-Ethylhexyl) Phthalate	71.8
Trichloroethylene	24.9
PCB 1248	0 *
Phenols	2011
Mercury, Total	25.9
Silver, Ionic	0 *
Total Suspended Solids	26,553,912

*This substance is a permitted discharge at one or more facilities, and analysis was conducted with results below the detection limit.

Source: State Pollution Discharge Elimination System (SPDES) data. Calculations done by R. Draper using following guidelines: If 25% or greater of the reported values are quantifiable, the remaining values reported at less than minimum detection limit (MDL) would be utilized as one half (1/2) the minimum detection limit in the loadings calculation. If less than 25% of the reported values were quantifiable, the remaining values reported at less than MDL would be utilized as zero in the loadings calculation.

TABLE 5-4 ATMOSPHERIC DEPOSITION

Parameter	Deposition on Lake Ontario Lbs/yr	Dep. on Embayment Lbs/yr	Dep. on Genesee Basin Lbs/yr	Dep. on Embayment Watershed Lbs/yr
ORGANOCHLORINES				
PCBs	92.6	0.43	30	37
alpha HCH	192	0.89	63	77
gamma HCH	94.8	0.44	31	38
HCB	2.4	0.01	0.79	0.97
Dieldrin	2.98	0.01	0.97	1.20
DDT & metabolites	20.9	0.10	6.81	8.39
Heptachlor	0.82	0.00	0.27	0.33
Heptachlor Epoxide	3.90	0.02	1.27	1.57
Chlordane	7.74	0.04	2.52	3.11
Toxaphene	10.4	0.05	3.38	4.16
Endosulfans	59.5	0.28	19	23.92
Atrazine	6613	30.63	2155	2657
Alachlor	21289	98.60	6939	8553
Trifluralin	525	2.43	171	211
PAHs				
Fluorine	95	0.44	31	38.09
Phenanthrene	205	0.95	67	82.39
Fluoranthene	276	1.28	90	110.74
Pyrene	198	0.92	65	79.73
Benzanthracene	48.5	0.22	16	19.49
Chrysene	90.4	0.42	29	36.32
Benzo (k) fluoranthene	110	0.51	36	44.30
Benzo (b) fluoranthene	130	0.60	42	52.27
Benzo (a) pyrene	68.4	0.32	22	27.46
Benzo (e) pyrene	88	0.41	29	35.44
Benzo (ghi) perylene	123	0.57	40	49.61
Acenaphthene	37	0.17	12	15.06
Indeno (c.d) pyrene	119	0.55	39	47.84
Acenaphthylene	19.8	0.09	6	7.97

Surface areas: Lake Ontario 7,340 sq. mi.; Embayment 35 sq. mi.; Genesee Basin 2,463 sq. mi.; Embayment Watershed 3,000 sq. mi.

Table 5-4 Cont.

POLYCHLORINATED DIOXINS AND FURANS (wet deposition only)

Parameter	Deposition on Lake Ontario Lbs/yr	Dep. on Embayment Lbs/yr	Dep. on Genesee Basin Lbs/yr	Dep. on Embayment Watershed Lbs/yr
TCDD	0.0115	0.00005	0.0037	0.0046
PeCDD	0.0152	0.00007	0.0050	0.0060
HxCDD	0.0617	0.00029	0.0201	0.0245
HpCDD	0.9261	0.00429	0.3018	0.3676
CCDD	2.073	0.00960	0.6755	0.8228
TCDF	0.2205	0.00102	0.0719	0.0875
PeCDF	0.1147	0.00053	0.0374	0.0455
HxCDF	0.4190	0.00194	0.1365	0.1663
HePCDF	0.0926	0.00043	0.0302	0.0368
CCDF	0.0220	0.00010	0.0072	0.0088
TRACE METALS				
Mercury	1252	6	408	497
Lead	104980	486	34215	41675
Cadmium	7195	33	2345	2856
Arsenic	10099	47	3291	4009

SOURCE: Eisenreich, S. J. and Strachan, W. M. J. (1992). Estimating atmospheric deposition of toxic substances to the Great Lakes: an update. Burlington, ONT: Canada Centre for Inland Waters.

Table 5-4 Cont.

LOCAL MEASUREMENTS AT BROCKPORT, NY

Parameter	Mean Monthly Loading mg/sq meter	Dep. on Embayment Lbs/yr	Dep. on Genesee Basin Lbs/yr	Dep. on Embayment Watershed Lbs/yr
Total Phosphorus	3.45	8256	581015	707692
Cadmium	0.18	431	30314	36923
Lead	0.87	2082	146517	178461
Manganese	1.50	3590	252615	307692
Zinc	6.39	15292	1076140	1310768

SOURCE: Makarewicz, J. C., Lewis, T.W., and Brooks, A. (1990). Chemical analysis and nutrient loading of Salmon Creek, Otis Creek, Black Creek, Spencerport Sewage Treatment Plant, and precipitation falling in Western Monroe County. Brockport, NY: SUNY Brockport. P. 49.

MENDON PONDS ATMOSPHERIC DEPOSITION COLLECTOR 1990

Parameter	Mean Monthly Loading mg/sq meter	Dep. on Embayment LBS/yr	Dep. on Genesee Basin LBS/yr	Dep. on Embayment Watershed LBS/yr
Total Phosphorus	3.120	7484	526634	641455
Lead	0.455	1091	76780	93520
Zinc	1.711	4105	288875	351858

SOURCE: Monroe County Health Department, Environmental Health Laboratory, Unpublished Data.

TABLE 5-5. AIR EMISSIONS

Parameter	Stack Emissions by County (lbs/yr)					5 County	Fugitive Losses (SARA)
	Allegany	Livingston	Genesee	Monroe	Orleans	Total	Monroe Co. (lbs/yr)
Aluminum	0	6		5788		5794	
Arsenic				12		12	
Barium	0	0				0	0
Cadmium				2		2	0
Chromium						0	500
Chromium (hexavalent)	0	0		216		216	
Cobalt				0		0	0
Copper	0			172		172	2900
Copper compounds*						0	500
Iron	480	158	2038	7042		9718	
Lead	0	32	0	2858		2890	
Manganese				6		6	0
Manganese compounds*						0	14
Mercury (organic)				0		0	
Molybdenum				6		6	
Nickel (metal)				116		116	500
Nickel compounds*						0	96
Selenium				280		280	0
Silver				29338		29338	
Zinc				11002		11002	68
Zinc compounds*						0	720
Acetone	12	22	1316	3630950	2020	3634320	450000
Benzene	754			3846	40	4640	
Dioctyl phthalate		0		2662	7998	10660	
Carbon tetrachloride				8832		8832	6700
Chloroform				7336		7336	
O-dichlorobenzene				110	0	110	
M-dichlorobenzene				4		4	
Methyl amyl alcohol				24560		24560	
Hexane	2	1926		76148		78076	
Methylene chloride		98		8295278	338	8295714	840000
Methyl ethyl ketone		24620	3532	545852	2134	576138	42000
Phenol	952	6		190		1148	82
Phosphoric Acid (PO4)*						0	18000
PCB				0		0	
Tetrachloroethylene			16	13972		13988	
Tetrahydrofuran				188236		188236	
Toluene	96030	4058	5332	4757570	504	4863494	150000
124 trichlorobenzene				0		0	
Methyl chloroform	3420	4262	69838	4022532	69838	4169890	
Trichloroethylene		82	39532	383056		422670	24000

* Recorded only for fugitive emissions.

Table 5-6
KODAK AMBIENT AIR MONITORING STATISTICAL RESULTS [ppbv]
Fourth Quarter 1991
Dichloromethane
MDL : 0.13 [ppbv] (0.45 ug/m3)

Location	Number of Samples	Arithmetic Mean	Median	Running*** Annual Average
School 41	15	2.0	0.78	3.5
Rand Street	15	2.1	1.5	7.8
Koda Vista	15	20	6.7	17
Merrill Street**	15	39	49	21
Irondequoit	15	3.3	3.3	4.3
Ridgeway Ave.	14	0.18	ND	0.23
Hanford Landing Road	15	17	13	20
Trip Blank	7	0.43	ND	0.31

Notes: ppbv - Parts per billion by volume.
ug/m3 - Micrograms per cubic meter.
MDL - Method detection limit, based on standard sample dilution. The minimum concentration that can be measured and reported with 99 percent confidence to be greater than zero, assuming a baseline level of zero.
ND - Not detected.
* - Result is below MDL.
** - Merrill Street statistics calculated from data presented in Table A - 4.
*** - Running Annual Averages were calculated for the time period January 1, 1991 - December 31, 1991.

1. In cases where the compound was not detected in one of the samples, one-half of the MDL was used for all calculations.

2. Trip blank canisters collected before 12/20/91 were diluted with ultra high purity air by a factor of approximately 2.3 prior to analysis. The trip blank results presented in this report have not been dilution corrected. Trip blanks are evacuated, certified canisters which are never opened in the field. They accompany field samples to help determine if systematic field sample contamination is occurring during transport. Once returned to the laboratory, the trip blanks were analyzed using the same methods as for field samples.

Source: Eastman Kodak Company. Quarterly Report for the Kodak Park Ambient Air Monitoring Program, October 1-December 1, 1991. Page 4-8 and page 2-5.

TABLE 5-7
XEROX AMBIENT AIR MONITORING PILOT PROGRAM
SUMMARY OF ARITHMETIC MEANS (ppbv)
OVERALL SUMMARY: VOLATILES

	Site #1	Site #2	Site #3	Site #4	Site #5	Site #6	Agency Guideline[a]	National UATMP[b]
1,3-butadiene	0.053*	0.055*	0.055*	0.055*	0.055*	0.059*	33	0.21
dichloromethane	5.0	2.7	2.6	8.7(4.2)[c]	4.2	3.5	7.8[d]	0.60
methyl ethyl ketone	1.7*	3.0	1.6*	3.0	2.0	2.0	670	NA
styrene	0.31*	0.26*	0.26*	2.1	0.25*	0.30*	170	1.1
toluene	2.1	2.4	1.4	13	6.5	3.4	2600	4.6
1,1,1-trichloroethane	0.50	0.59	0.70	0.62	0.43	0.43	7100	NA

* Result is below the Method Detection Limit.

a Ambient Guideline Concentrations from NYSDEC, for acceptable annual average (NYS Air Guide - 1, September 1989).

b Data from USEPA Urban Air Toxics Monitoring Program (UATMP), 1989.

c Value in parentheses excludes 58 ppbv value of 7/28/90. Median concentration, including 58 ppbv result, is 2.5 ppbv.

d The current AGC value for DCM is 340 ppbv; however, the proposed value (7.8 ppbv) has been intensively reviewed and is frequently regarded as the adopted value.

Source: Radian Corporation, prepared for Xerox Corporation. Xerox Ambient Air Monitoring Pilot Program Final Report November, 1990.

tablela.es
xeroxea

TABLE 5-8. INACTIVE HAZARDOUS WASTE SITES IN ROCHESTER EMBAYMENT DRAINAGE BASIN
Containing AOC Priority Chemicals

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
MONROE COUNTY (based on registry, Phase II investigations and other analytical data)				
A. C. Rochester 1000 Lexington Ave. Rochester	828064 2	Genesee River	Benzene Tetrachloroethene 1,1,1-Trichloroethane Trichloroethene	Toluene
Autohaus of Rochester 99 Marsh Rd. Perinton	828084 2	Irondequoit Creek (Central basin)	Acetone Benzene Methyl ethyl ketone	Methylene chloride Tetrachloroethylene 1,1,1-trichloroethane Trichloroethene
Bausch & Lomb Frame Center 465 St. Paul Rd. Chili	828061 2	Black Creek (Genesee Basin)	Benzene Toluene 1,1,1-trichloroethane Trichloroethene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Chrysene Fluoranthene Pyrene	Cadmium Chromium Lead Mercury Nickel Silver Vanadium Zinc
Formerly Black & Decker Also formerly General Electric Currently Kleenbrite 200 State St. Brockport	828003 2	Brockport Creek (West Basin)	Trichloroethene Chromium Iron Nickel	
Brighton Town Landfill Browncroft Blvd. Brighton	828031 2a	Irondequoit Creek (Central Basin)	4,4'-DDD Acetone Benzo(k)fluoranthene Bis(2 ethylhexyl)phthalate Chrysene Di-n-octyl phthalate	Barium Chromium Copper Lead Zinc
Brockport Landfill Canal Rd. Sweden	828038 2	Brockport Creek (W. Basin)	Acetone Benzene Di-n-octyl phthalate Trichloroethene Toluene Aluminum Arsenic Barium	Cadmium Cobalt Copper Iron Lead Manganese Vanadium Zinc

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Burroughs/Unisys Site 1225 Ridgeway Ave. Rochester	828075 2	Trib. of Genesee River	Acetone Methyl ethyl ketone	
Carter St. SW corner Carter St. & Ridge Rd. Rochester	828051 Delisted	Storm sewers (W. Basin)	Lead	
Chemical Sales Corp. 150 Lee Rd. Gates	828086 2	Erie Canal	Acetone Hexane Methylene chloride Methyl ethyl ketone	Tetrachloroethylene Toluene 1,1,1-trichloroethane Trichloroethene
Clarkson Landfill Redman Rd. Clarkson	828036 Delisted	Moorman Creek (trib. of West Ck) West Basin	4,4'-DDD 4,4'-DDT Benzene Bis(2 ethylhexyl)phthalate Methylene chloride	Aluminum Barium Lead Manganese Mercury
Davis Howland Oil Corp. 200 Anderson Ave. Rochester	828088 2a	Genesee Basin	Acetone Methylene chloride Methyl ethyl ketone	Toluene 1,1,1-trichloroethane Cadmium Lead
Dearcop Farm Dearcop Dr./Varian Lane Gates	828016 2	Erie Canal	Benzene Trichloroethene Aluminum Arsenic Cadmium	Lead Manganese Silver
Former Dollinger Corp. Currently American Filtrona Corp. 1 Townline Circle Brighton	828078 2	Red Creek (GenBasin)	Trichloroethene	
Eastman Kodak Co., Kodak Park East 1669 Lake Ave. Rochester	828071 2	Genesee River	Acetone Benzene Methylene chloride	
Eastman Kodak Co., KPM 1669 Lake Ave. Rochester	828082 2	Paddy Hill Creek (W. Basin)	Acetone Methylene chloride Methyl ethyl ketone Toluene	

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Eastman Kodak Co., KPW 1669 Lake Ave. Rochester	828074 2	Genesee River	Acetone Benzene Chloroform Hexane	Methylene chloride Methyl ethyl ketone Toluene Silver
Emerson St. Landfill Emerson St. Rochester	828023 3	Erie Canal Storm sewers (W. Basin)	Chlordane 4,4'-DDT Acetone Benzene Bis(2 ethylhexyl)phthalate Di-n-octyl phthalate Toluene	Trichloroethene Aluminum Chromium Iron Lead Manganese Zinc
Erdle Perforating 100 Pixley Industrial Pkwy. Gates	828072 2	Little Black Creek (G. Basin)	Trichloroethene Tetrachloroethylene	
Flynn Road Landfill Flynn Road Greece	828029 2a	Northrup Creek (W. Basin)	4,4-DDT Acetone Benzene Toluene Benzo(a)pyrene Fluoranthene	Pyrene Arsenic Cadmium Lead Mercury
Gates Dump - Hinchey Rd. Hinchey Rd. Gates	828047 Delisted	Erie Canal	Aldrin Endosulfan Methoxychlor Cyanide Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene	Chrysene Pyrene Cadmium Chromium Copper Lead Mercury Zinc
General Circuits 95 Mt. Read Blvd. Rochester	828085 2	Genesee River	Acetone Tetrachloroethylene Trichloroethene Toluene	
Genesee Gorge Upper Falls to Lower Falls	828044 Delisted	Genesee River	Benzene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Bis(2-ethylhexyl)phthalate Dibenzofuran Fluoranthene Hexachlorobutadiene	Tetrachloroethene Trichloroethene Toluene Arsenic Barium Cadmium Chromium Lead Mercury Zinc

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Genesee Scrap & Tin 80 State St. Rochester	828081 2	Genesee River	PCBs	
Golden Rd. Disposal Site Golden Road Chili	828021 2	Little Black Creek (G. Basin)	Benzene 1,1,1-trichloroethane Tetrachloroethylene Toluene	Arsenic Barium Chromium Lead Manganese Zinc
High Acres Landfill Perinton Pkwy. Perinton	828014 3	Thomas Creek (Central Basin)	Acetone Benzene Phenol Toluene	Cyanide
Former Jarl Extrusions, Inc. (Alcan Aluminum Corp.) 860 Linden Ave. Pittsford	828005 2	Irondequoit Creek (Central Basin)	Aluminum Chromium Copper Iron	Lead Nickel Zinc
Little League Lynden Road Perinton	828026 3	Thomas Creek (C. Basin)	Cyanide Acetone Chloroform PCBs	Aluminum Cadmium Copper Iron Lead Zinc
Monarch Sand and Gravel Ridge Road Parma	828019 2a	Buttonwood Creek (W. Basin)	Dieldrin DDT DDE DDD Bis(2 ethylhexyl)phthalate Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Fluoranthene Pyrene	Aluminum Arsenic Cadmium Copper Iron Lead Manganese Vanadium Zinc
NYSDOT Pittsford Monroe Ave. Pittsford	828056 Delisted	West Brook (C. Basin)	Pyrene Toluene	
NYSDOT Pittsford Linden Ave. Pittsford	828045 2a	Irondequoit Creek (C. Basin)	Endosulfan Acetone Benzene Methylene chloride Toluene Fluoranthene	Phenanthrene Pyrene Chromium Iron Lead Manganese

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Ogden Landfill Lyell St. Ogden	828039 Delisted	Erie Canal	Iron Manganese	
Old Rochester City Landfill Pattonwood Dr. Irondequoit	828009 2a	Genesee River	Benzene PCBs Toluene Lead	
Olin Chemicals McKee Road Rochester	828018A	Erie Canal	Benzene Carbon tetrachloride Chloroform Dibromochloromethane 1,2 dichlorobenzene 1,3 dichlorobenzene	1,4 dichlorobenzene Methylene chloride Tetrachloroethylene Toluene 1,1,1-trichloroethane
Parma 6 Ridge Rd. at Manitou Rd. Parma	828050 Delisted	Smith Creek (W. Basin)	Toluene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene	Pyrene Arsenic Selenium
Tom Paxton Chevrolet 3722 Scottsville Rd. Wheatland	828073 2a	Genesee River	Acetone Benzene Toluene	
Pittsford Town Dump Marsh Road Pittsford	828048 Delisted	Erie Canal, Irondequoit Creek (C. Basin)	Cyanide Arsenic Barium	Lead Manganese Zinc
Railroad Car Shops Despatch Drive East Rochester	828046 2a	Irondequoit Creek (C. Basin)	Bis(2 ethylhexyl)phthalate Methylene chloride Aluminum Barium Chromium Iron	Lead Mercury Nickel Vanadium Zinc
R. D. Specialties Salt Road Webster	828062 2	Four Mile Creek (C. Basin)	Chromium	
George A. Robinson & Co., Inc. 477 Whitney Rd. Perinton	828065 2	Trib. of Irondequoit Creek (C. Basin)	Trichloroethene	

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Rochester Fire Academy 1190 Scottsville Rd. Chili	828015 2	Genesee River	Benzene Bis(2 ethylhexyl)phthalate Chloroform Methyl ethyl ketone PCBs Tetrachloroethylene Toluene Benzo(a)pyrene Benzo(b)fluoranthene	Benzo(k)fluoranthene Chrysene Pyrene Cadmium Copper Lead Silver Zinc
Roehlen Engraving 701 Jefferson Rd. Henrietta	828077 2	Red Creek (G. Basin)	Methylene chloride Trichloroethene	Chromium Lead
Rush Landfill Route 251 Rush	(Not an active haz. waste site)	Genesee River	Benzene PCBs Phenol Toluene Cyanide	Aluminum Chromium Iron Lead Manganese Vanadium Zinc
Scobell Chemical 1 Rockwood Place Brighton	828076 2	Grass Ck. (trib. of Irondequoit Bay) C. Basin	Tetrachloroethylene Toluene	
Scottsville Rd. - Chili 2 Scottsville Road Chili	828022 2a	Genesee River	Acetone Barium Chromium Copper Iron	Manganese Mercury Nickel Silver Zinc
Sigismondi Landfill Linden Ave. Pittsford	828011 2a	Irondequoit Creek (C. Basin)	1,1,1-trichloroethane Chromium Lead	
Stuart-Oliver-Holtz 39 Commerce Dr. Henrietta	828079 2	Red Creek (G. Basin)	Methylene chloride Tetrachloroethylene 1,1,1-trichloroethane	Trichloroethene
Sweden-3 Chapman Beadle Rd. Sweden	828040 2	Black Creek (W. Basin)	4,4'-DDT Acetone Benzene Bis(2 ethylhexyl)phthalate Methylene chloride Tetrachloroethylene Trichloroethene	Toluene Cyanide Cadmium Chromium Lead Mercury

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Taylor Instruments 95 Ames St. Rochester	828028A 4	Genesee River	Mercury	
Former 3M/Dynacolor Currently Brockport Cold Storage 98 Spring St. Brockport	828066 2a	Brockport Creek (W. Basin)	Cyanide Cadmium Silver Zinc	
Trimmer Rd. Landfill Trimmer Road Parma	828012 Delisted	Buttonwood Creek (W. Basin)	Acetone Benzene Bis(2 ethylhexyl)phthalate Chloroform	Arsenic Barium Iron Manganese
Village of Spencerport Dump Trimmer Rd. Ogden	828025 3	ButtonwoodC reek (W. Basin)	Beta BHC Iron Manganese	
Xerox Landfill 800 Phillips Rd. Webster	828013 4	Four Mile Creek (C. Basin)	Acetone Chloroform Carbon tetrachloride Tetrachloroethylene	1,1,1-trichloroethane Toluene Arsenic Selenium
Xerox - Salt Rd. 800 Phillips Road Webster	828067 2	Four Mile Creek (C. Basin)	Tetrachloroethylene Trichloroethene Toluene	
Xerox - Bldg. 201 800 Phillips Rd. Webster	828080 2	Mill Creek (C. Basin)	Tetrachloroethylene 1,1,1-trichloroethane Trichloroethene Arsenic	Chromium Nickel Selenium
Xerox - Henrietta 1350 Jefferson Rd. Henrietta	828069 2	Allen Creek (C. Basin)	Methylene chloride Tetrachloroethylene 1,1,1-trichloroethane	
Xerox - Nursery Area San Jose Blvd. Webster	828083 2	Four Mile Creek (C. Basin)	Tetrachloroethylene Trichloroethene 1,1,1-trichloroethane Toluene	
Xerox - Bldg. 209 800 Phillips Rd. Webster	828068 2	Four Mile Creek (C. Basin)	Tetrachloroethene Trichloroethene 1,1,1-trichloroethane	
ORLEANS COUNTY (based on registry only) All in West Basin.				

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Haight Farm 4899 Upper Holley Rd. Clarendon	837006 2	Sandy Creek	Trichloroethene Other solvents	
FMC Corp. Dublin Rd. Shelby	837001 2	Erie Canal	DDT Arsenic Mercury Lead	Other pesticides
McKenna Landfill N. of Yeager Rd. Albion	837003 2	Erie Canal	Benzene Barium Manganese	Cleaning solvents Other industrial waste
GENESEE COUNTY (based on registry only) All in Genesee Basin				
Lehigh Valley RR Derailment Gulf Rd. & Lehigh Valley RR crossing LeRoy	819014 2	Oatka Creek	Trichloroethene Cyanide	
Route 19 Drum Disposal (McGinnis) Route 19 LeRoy	819009 2a	Oatka Creek	Solvents	
WYOMING COUNTY (based on registry only) All in Genesee Basin				
ETE Sanitation and Landfill Broughton Rd. Gainesville	961005 2a	Cotton Creek (trib. of Oatka)	Carbon tetrachloride Lead	
Warsaw Village Landfill Industrial St. Warsaw	961006 2a	Oatka Creek	Toluene Lead Plating wastes	
Robeson Industries, Inc. Buffalo Rd. Castile	961008 2	Oatka Creek	1,1,1-trichloroethane	
LIVINGSTON COUNTY (based on registry only) All in Genesee Basin				
Atochem N. America Formerly Lucidol Route 63 Piffard	826006 2a	Genesee River	Ash Sludges Chloroformates	

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Enarc-O Machine Products 1175 Bragg St. Lima	826011 2	Honeoye Creek	1,1,1-trichloroethane Trichloroethene Other solvents	
Foster-Wheeler Corp. RD #3 N. Dansville	826001 2a	Cana-seraga Creek	Chloroform Methylene chloride Bis(2 ethylhexyl)phthalate	PCBs Waste paint
Jones Chemical 100 Sunny Sol Blvd. Caledonia	826003 2	Spring Creek	Methylene chloride Tetrachloroethylene	1,1,1-trichloroethane Trichloroethene
Tenessee Gas Pipeline Station 233 Dow Rd. & Federal Rd. York	826014 2a	Bidwells Creek	PCBs	
ONTARIO COUNTY (based on registry only) All in Central Basin				
Genesee Sand & Gravel 748 Phillips Rd. Victor	835005 2a	Trib. of Irondequoit Creek	Phenols Volatile organics Heavy metals	Waste paint Flammable liquids
ALLEGANY COUNTY (based on registry only) All in Genesee Basin				
Sinclair Refinery Brooklyn Ave. Wellsville	902003 2	Genesee River	PCBs Lead Nickel	Pesticides Petroleum
Wellsville-Andover Landfill Snyder Hill Rd. Wellsville and Andover	902004 2	Dutty Hollow Ck. (trib. of Chenunda)	Cyanide Methylene chloride Chromium Zinc	VOCs SVOCs Metals Resins, solvents
Deming Electroplating Route 305 New Hudson	902007 2a	Black Creek	Cadmium Lead	Heavy metal sludges
W. Almond Pesticide Storage Site N. of County Rt. 2A W. Almond	902010 2	Angelica Creek	DDT Dieldrin Chlordane Cyanide	Arsenic Mercury Lead

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Cuba Municipal Waste Disposal Jackson Hill Rd. Cuba	902012 2a	Black / Van Campen Creeks	Cyanide PCBs	Chlorinated solvents Paint sludges
Friendship Foundries 10 Howard St. Friendship	902015 2	Van Campen Creek	PCBs	Ignitable liquid waste solvents

Site Classification:

2 = Significant threat to public health or environment; action needed.
2a = Temporary classification assigned to sites that have inadequate and/or insufficient data for inclusion in any of the other classifications.
3 = Does not present a significant threat to the public health or the environment; action may be deferred.
4 = Site is properly closed; requires continued management.

Sources:

New York State Depts. of Environmental Conservation and Health. (1992, April). Inactive hazardous waste disposal sites in New York State. Volumes 8 and 9. Albany, NY.

Phase II investigations and other data for individual waste sites in Monroe County.

TABLE 5-9. CALCULATED NONPOINT SOURCE RUNOFF

Parameter	Loading (tons/yr)			
	West Sub-basin	Lower Genesee Basin[1]	Central Sub-basin[2]	Upper Genesee Basin
Total susp. solids	25,000	81,000	20,000	no estimates
Total phosphorus	28	86	24	
Total lead	3.5	8.6	4.3	
Total zinc	119	391	116	

1 From Geneseo to river mouth. (Includes runoff from small area between Charlotte Docks and river mouth not included on Table 5-16).

2 A large part of this sub-basin is the Irondequiot Bay watershed. Estimated loading from the NURP study (Kappel *et al*, p. 26) was used for the Irondequoit Bay watershed. Runoff from the Durand area and the Mill Creek/Four-mile Creek area of this sub-basin was calculated.

See chapter appendix for discussion of methods.

Table 5-10 MONROE COUNTY REPORTED SPILL RECORDS
For the Period 10/1/89 through 7/17/91

Substance Spilled	# of spills	total gallons/lbs. spilled	# of spills w/ known quantity
Oil	27	26	1
Motor Oil	11	21	3
Hydraulic Oil	20	27	15
Hydraulic Fluid	16	unknown	
Home Heating Oil	11	154	4
Fuel Oil	22	unknown	
Diesel Oil	54	1233	not counted
Waste Oil	16	230	12
Waste Motor Oil	4	145	3
Used Motor Oil	13	unknown	
Transformer oil	3	8	1
PCB Oil	1	unknown	
Cutting Oil	9	473	6
#6 fuel oil	4	4	1
#2 fuel oil	32	4033	22
Machine lub oil	6	33	4
Kerosene	3	unknown	
Jet Fuel	7	60	2
Gasoline	166	357	not counted
Petroleum Products	241	4236	not counted
N-Butyl Alcohol	1	1700	1
Methyl ethyl ketone	2	1	1
Ethylene glycol	7	111	not counted
Acetone	5	220	not counted
Nitrogen compounds	7	1	1
Mercury	1	unknown	
Fertilizer	2	400	1
Zinc Dust	3	21.6	2
Suspect Phosphorus	1	1	1
Silver Rich Water	2	5	1
Silver Recovery Matls.	5	24	4
Photo Finish Proc.	3	38	2
Barium Chloride	5	unknown	
Methylene Chloride	10	2127	7
Hexane	3	595	2
Heptane	2	625	2
Dieldrin	2	5	1
Dichloromethane	1	2222	1
Xylene	5	75	2
Vinylidine Chloride	2	38	2
Turpentine	2	unknown	
Trichloroethylene	4	50	1
Trichlorethane	2	25	1
Transmission fluid/oil	5	13	2
Toluene	5	76	4
Tetrachloroethylene	1	25	1
Pesticide	2	45	2
Atrazine	2	unknown	
111 Trichloroethane	3	1000	1
Solvents	26	15444	15

Source: Database computer file provided by Monroe County Office of Emergency Preparedness.

TABLE 5-11. GENESEE RIVER LOADING ESTIMATES
October 1989 - September 1990
(See Appendix E for Loading Estimate Methodology)

Parameter	At Geneseo tons/yr (upper basin)	At Rochester tons/yr (entire basin)	Geneseo to Rochester tons/yr (lower basin)	Load per sq. mi. per yr (upper basin)	Load per sq. mi. per yr (lower basin)	% from upper basin
Arsenic (dissolved)	NA	2.7	- -	--	2 lbs (entire basin)	- -
Barium (dissolved)	NA	116	- -	--	94 lbs (entire basin)	- -
Cadmium (tot. recov.)	Mostly ND	2.6	- -	--	2 lbs (entire basin)	- -
Copper (tot. recov.)	20	30	10	28 lbs	19 lbs	67
Lead (tot. recov.)	12	20	8	17 lbs	15 lbs	60
Manganese (tot. recov.)	300	400	100	420 lbs	190 lbs	75
Mercury (tot. recov.)	Mostly ND	492	- -	--	400 lbs (entire basin)	- -
Nickel (tot. recov.)	14	24	10	20 lbs	19 lbs	58
Zinc (tot. recov.)	56	111	55	79 lbs	105 lbs	50
Total suspended solids	338,000	626,000	288,000	240 tons	280 tons	54
Total Phosphorus	NA	368	- -	--	300 lbs (entire basin)	- -

NA = not analyzed. ND = not detected.

Area of basin above Geneseo (including Canaseraga basin): 1424 sq. mi. Area of entire Genesee basin: 2464 sq. mi. Area of basin below Geneseo: 1043 sq. mi. Area of upper basin is 58% of entire basin. **Sources**: USGS Water Resources Data Reports. Loadings were correlated with flow, then calculated based on daily flows for the water year 1990.

RIVLOAD

TABLE 5-12
POLLUTANT LOADINGS FROM DREDGING

Parameter	River Loading tons/yr	Dredge Loading tons/yr
Arsenic	2.7	1.5
Barium	116	11
Cadmium	2.6	0.13
Chromium	Mostly ND	1.7
Copper	30	4
Cyanide	NA	0.13
Manganese	400	100
Mercury	0.25	0.015
Lead	20.2	2.2
Nickel	23.5	3.4
Silver	ND	1.1
Zinc	111	13
Total susp. solids	626,000	Total solids 23,000
Total phosphorus	368	132

NA = not analyzed. ND = not detected.

Notes:

Values for most metals in the river are "total recoverable" values. This includes most pollutants that are dissolved and that are attached to suspended sediments. Arsenic, barium, chromium and silver are only measured in the dissolved form. No dissolved silver has been detected since 1987.

Values for metals and cyanide in sediment are "total" values.

Sources:

USGS Water Resources Data Reports.

US Army Corps of Engineers dredging data.

Aqua Tech Environmental Consultants, Inc. (1990). Sediment analysis: Rochester harbor, Irondequoit Bay, New York. Prepared for U.S. Army Engineer District, Buffalo, NY.

Methods:

River loadings. Loadings were correlated with flow using data from 1986-90 or 1988-90 to generate regression equations. Loadings for water year 1990 were then calculated based on daily flows.

Dredge loadings. Loadings were determined as follows:

```
mg pollutant/kg dry solids x kg dry solids/100 kg wet sample
     (concentration)       x        (% solids)

x kg wet sample/kg H2O x 1000 kg H2O/M3 x .765 M3/CY x 2.205 lb/kg
x  (specific gravity)  x             (conversion factors)

x .0005 tons/lb x CY dredged = tons pollutant
              (volume dredged)
```

Concentrations used were averages for 11 samples. Results were halved because the harbor was not dredged in 1989; therefore the amount dredged in 1990 was assumed to be two years' deposition.

DREDLOAD

TABLE 5-13
ESTIMATED SOURCES OF LOADINGS TO ROCHESTER EMBAYMENT
FROM GENESEE BASIN
October 1989 - September 1990

Parameter	SPDES Wastewater Discharges tons/yr	Other Sources	Dredge Spoil tons/yr
Arsenic	0	2.7[2]	1.5
Cadmium	0.25	2.34	0.13[3]
Copper	2	28	4
Lead	1.4	18.8	2.2
Manganese	0.05	400	100
Mercury	0.013	0.24[4]	0.015
Nickel	1.1	22.9	3.4
Silver	3.3	--[2]	2.2
Zinc	16	95	13
Total suspended solids	13,277	626,000	Total solids 23,000
Total phosphorus	44	328	132

[1] Other sources were determined by subracting SPDES discharges from total calculated river discharge.

[2] Arsenic and silver in water are measured only in the dissolved form. Other metals on this table are measured as "total recoverable." No dissolved silver has been detected since 1987.

[3] Cadmium was only detected at one of the ten sample points. Two samples were taken at this point and both showed cadmium at 0.5 mg/kg. The loading value of 0.13 tons/yr assumes that cadmium was present at half the detection limit at sites where it was not detected.

[4] This value assumes that mercury was present at half the detection limit at those sites where it was not detected.

GENSOURC

TABLE 5-14.
COMPARISON OF POLLUTANT LOADINGS FROM WASTEWATER TREATMENT PLANTS DISCHARGING TO LAKE ONTARIO AND LOADINGS FROM GENESEE RIVER

Parameter	Genesee River Discharge tons/yr	WWTP Discharge tons/yr
Arsenic	2.7	ND
Cadmium	2.6	0.02
Chromium	Mostly ND	0.32
Copper	30	4.4
Manganese	400	ND
Mercury	0.25	ND
Lead	20.2	0.61
Nickel	23.5	2.9
Silver	ND	0.5
Zinc	111	7.9
Total susp. solids	626,000	?
Total phosphorus	368	153

Notes:

The treatment plants included are the Walter W. Bradley plant in Webster, the Frank E. Van Lare plant in Irondequoit, and the Northwest Quadrant plant in Greece.

Values for most metals in the river are "total recoverable" values. This includes most pollutants that are dissolved and that are attached to suspended sediments. Arsenic, chromium and silver are only measured in the dissolved form. No dissolved silver has been detected since 1987.

Values for metals in WWTP effluent are "total" values.

Sources:

USGS Water Resources Data Reports.
SPDES permit compliance data.

STPLOAD

TABLE 5-15
NONPOINT SOURCE LOADINGS TO EMBAYMENT FROM GENESEE BASIN
BETWEEN GENESEO AND CHARLOTTE DOCKS

	Estimate of Nonpoint Sources Using Calculated River Loadings Minus SPDES Discharges	Estimate of Runoff Using NURP Data
Total Suspended Solids (tons/yr)	>280,000	79,000
Total Phosphorus (tons/yr)	112.(est.)[1]	82
Lead (tons/yr)	6.6	7.2
Zinc (tons/yr)	39	385

1 Phosphorus loadings for the basin below Geneseo cannot be calculated because phosphorus is not measured at Geneseo. This value assumes that phosphorus loadings per acre are the same in the upper and lower basins.

NPGEN

TABLE 5-16
AREAL LOADINGS

Parameter	Loading by Basin (lbs/mi^2 per yr)				
	Salmon Creek	Otis Creek	Thornell Subbasin	Irondequoit Creek	Genesee River
Cadmium	3	11	14	16	2
Lead	13	24	12	40	15
Zinc	61	135	698	962	105
Total Suspended Solids	118,000	198,000	161,000	231,000	560,000
Tot. Phosphorus	209	319	158	235	300

Notes:

Salmon Creek is a rural watershed in the West Basin and was sampled upstream of its confluence with Otis and Brockport Creeks.

Otis Creek is a small watershed in the West Basin which includes the Village of Brockport. The sampling station on Otis Creek is upstream of its confluence with Brockport Creek.

The Thornell watershed is part of the rural, upper Irondequoit Basin.

Irondequoit Creek watershed refers to the area upstream of Blossom Rd., a mixed-use suburban area.

The U.S. Geological Survey (USGS), in a report entitled Quantity and Quality of Urban Storm Runoff in the Irondequoit Creek Basin near Rochester, New York, (1986) recognized that the average mean storm concentrations of total zinc were high in the Irondequoit Creek basin compared with published values for storm runoff. The USGS suggests that a possible source of the zinc in the Irondequoit Basin may be the mineral spalerite (zinc sulfide), which occurs in the Silurian Lockport Dolomite that underlies the central part of the basin and is also within the drift and soils derived from it.

AREALOAD

TABLE 5-17.
ESTIMATED ATMOSPHERIC INPUT AND RIVER OUTFLOW OF SELECTED POLLUTANTS

Genesee River[1]

Parameter	Atmospheric Input to Genesee Basin (tons/yr)	Outflow from Genesee River (tons/yr)	Input/Outflow (1980-81) %
Arsenic	1.7	2.7	63%
Cadmium	1.2	2.6	46%
Lead	17.2	20.2	85%
Mercury	0.21	0.25	84%

Salmon, Otis and Irondequoit Creeks[2]

Parameter	Input/Outflow Salmon Creek (1989-90)	Input/Outflow Otis Creek (1989-90)	Input/Outflow Irondequoit Ck. (1980-81)
Lead	31%	95%	647%
Total Kjeldahl Nitrogen	260%	83%	135%
Total Phosphorus	110%	36%	65%

[1]Atmospheric deposition estimate calculated using Eisenreich/Strachan data.
[2]Atmospheric deposition and water quality data from Makarewicz data.

Sources:

Eisenreich, S. J. and Strachan, W. M. J. (1992). Estimating atmospheric deposition of toxic substances to the Great Lakes: an update. Burlington, ONT: Canada Centre for Inland Waters.

Kappel, W. M., Yager, R. M., and Zarriello, P. J. (1986). Quantity and quality of urban storm runoff in the Irondequoit Creek Basin near Rochester, New York. (USGS Water-Resources Investigations Report 85-4113). Ithaca, NY: U.S. Geological Survey.

Makarewicz, J. C., Lewis, T. W., Brooks, A., and Burton, R. (1990). Chemical analysis and nutrient loadings of: Salmon Creek, Otis Creek, Black Creek, Spencerport Sewage Treatment Plant, and precipitation falling in western Monroe County. Brockport, NY: SUNY Brockport Dept. of Biological Sciences.

ATMOS

Table 5-18

PCB Equipment Inventory Summary for the New York State Electric Utilities

(equip in svce as of 6/30/92 – 14th filing)

		NUMBER of CAPACITORS			NUMBER of TRANSFORMERS		
Company	Reporting Date	Distribution	Station	*Total*	Askarel	Oil>500	*Total*
RG&E	*Begin Phaseout*	5000	1483	6483	130	33	163
	12/31/85	634	1483	2117	76	33	109
	6/30/86	428	1456	1884	67	33	100
	12/31/86	176	1456	1632	62	27	89
	6/30/87	35	1420	1455	49	27	76
	12/31/87	0	1198	1198	44	17	61
	6/30/88	0	1198	1198	30	14	44
	12/31/88	0	1198	1198	23	13	36
	6/30/89	0	1198	1198	21	11	32
	12/31/89	0	1198	1198	18	7	25
	6/30/90	0	1132	1132	16	4	20
	12/31/90	0	1077	1077	12	5	17
	6/30/91	0	1077	1077	12	4	16
	12/31/91	0	1104	1104	8	5	13
	6/30/92	0	1034	1034	4	3	7
	removed this period	0	70	70	4	2	6
NMPC	*Begin Phaseout*	16734	10411	27145	515	433	948
	12/31/85	5393	10411	15804	389	433	822
	6/30/86	4665	10411	15076	389	266	655
	12/31/86	4165	10153	14318	360	252	612
	6/30/87	2424	9885	12309	297	225	522
	12/31/87	1185	9763	10948	261	192	453
	6/30/88	192	9568	9760	232	163	395
	12/31/88	0	9415	9415	218	156	374
	6/30/89	0	9261	9261	194	138	332
	12/31/89	0	8249	8249	146	122	268
	6/30/90	0	7956	7956	127	112	239
	12/31/90	0	6773	6773	118	96	214
	6/30/91	0	6449	6449	122	70	192
	12/31/91	0	5568	5568	72	62	134
	6/30/92	0	4915	4915	52	47	99
	removed this period	0	653	653	20	15	35

18–Mar–93

Table 5-18 (continued)

PCB Equipment Inventory Summary for the New York State Electric Utilities

(equip in svce as of 6/30/92 – 14th filing)

Company	Reporting Date	NUMBER of CAPACITORS Distribution	Station	Total	NUMBER of TRANSFORMERS Askarel	Oil>500	Total
NYSEG	Begin Phaseout	9000	4000	13000	8	114	122
	12/31/85	62	2392	2454	2	114	116
	6/30/86	0	2351	2351	1	114	115
	12/31/86	0	1506	1506	0	68	68
	6/30/87	0	837	837	0	51	51
	12/31/87	0	468	468	0	33	33
	6/30/88	0	274	274	0	22	22
	12/31/88	0	144	144	0	19	19
	6/30/89	0	69	69	0	19	19
	12/31/89	0	27	27	0	12	12
	6/30/90	0	27	27	0	11	11
	12/31/90	0	0	0	0	9	9
	6/30/91	0	0	0	0	7	7
	12/31/91	0	0	0	0	10	10
	6/30/92	0	0	0	0	1	1
	removed this period	0	0	0	0	9	9

TABLE 5-19. ESTIMATED 1974 SEDIMENT LOAD FROM GENESEE BASIN

Watershed	Tons/yr from Streambank Erosion	Tons/yr from Cropland	Tons/acre from Cropland	Total Tons/yr
Lower Genesee (north of Scottsville)	**25,270**	14,250	8.39	39,520
Red Creek	17,080	**17,120**	8.39	34,200
Black Creek (Genesee County)	81,361	**224,176**	7.88	305,537
Lower Honeoye	12,852	**89,504**	7.68	102,356
Middle Genesee (Mt. Morris to Scottsville)	58,808	**205,406**	6.97	264,214
Conesus Lake	31,934	**104,995**	6.73	136,929
Honeoye	26,387	**98,640**	9.56	125,027
Upper Honeoye	4,587	**21,083**	13.19	25,670
Oatka Creek	63,771	**219,261**	7.21	283,032
Little Beard Creek	14,450	**72,064**	6.63	86,514
Silver Lake-Genesee River	**35,119**	12,516	6.58	47,635
E. Koy and Wiscoy Creeks	30,450	**97,435**	6.56	127,885
Canaseraga Creek	143,882	**301,106**	7.00	444,988
Sixtown and Rush Creeks	**108,547**	17,752	5.62	126,299
Canadea Creek	**49,027**	4,958	6.00	53,985
Black Creek (Allegany County)	**78,728**	4,062	4.46	82,790
Angelica Creek	**75,275**	2,494	4.46	77,769
Baker Valley	1,262	-	-	1,262
Van Campen Creek	**52,486**	2,280	4.46	54,766
Vandermark and Knight Creeks	**129,142**	5,445	4.46	134,587
Dyke Creek	**57,644**	20,768	7.30	78,412
Chenunda Creek	**66,299**	3,171	4.46	69,470
Cryder River	22,851	**27,896**	7.75	50,747
TOTAL	1,187,212	1,566,382		

Note: The larger erosion source for each watershed is in **bold**.

Source: U. S. Department of Agriculture, Soil Conservation Service. (1974). Erosion and Sediment Inventory -- New York. Washington, DC.

EASI

TABLE 5-20

Comparison of phosphorus loading in subbasins of the Irondequoit Bay watershed to phosphorus loadings from Otis and Salmon Creeks. Irondequoit Basin data is from Bannister and Burton (1979) and Peet, Burton, Baker et al. (1985). Other data is from Makarewicz (1989) and this study.

Subbasin or Creek	Total Areal Phosphorus Loading (g P/ha/d)
Irondequoit Creek	
[a]1975-77 (pre-diversion)	5.6
[a]1978-79 (post-diversion)	2.0
[b]1979	2.3
[b]1980	2.2
[b]1989-85	0.88
Larkin Creek (1988-89)	0.70
Buttonwood Creek (1988-89)	1.58
Lower Northrup (1988-89)	4.24
Upper Northrup (1988-89)	3.23
Black Creek (1988-89)	0.60
Otis Creek (1989-90)	1.56
Salmon Creek (1989-90)	1.00

[a]At Browncroft Blvd.
[b]At Blossom Road

Note: Diversion refers to diversion of wastewater treatment plan effluent from streams in the Irondequoit Basin.

Source: Makarewicz, J. C., Lewis, T. W., Brooks, A and Burton, R. (1990). Chemical analysis and nutrient loading of Salmon Creek, Otis Creek, Black Creek, Spencerport Sewage Treatment Plant, and precipitation falling in Western Monroe County. Brockport, NY: SUNY Brockport. P.24.

TABLE 5-21. BENZENE, TOLUENE AND XYLENE SEEPS AT LOWER FALLS

Compound	Concentration at Four Sample Points (ppm) B1	B2	B3	B4
Benzene	5.80	6.00	5.60	0.70
Toluene	4.80	5.00	5.50	0.68
meta-Xylene	1.70	0.87	1.60	0.30
ortho-Xylene	1.70	1.40	1.50	0.28
para-Xylene	0.73	0.75	0.79	0.14

TABLE 5-22. POOL AT BASE OF FALLS

Compound	Concentration (ppm)
Benzene	ND
Toluene	ND
Xylenes	ND
Chloroform	ND
Other volatiles	ND
Naphthalene	0.20
Acenaphthylene	1.30
Fluorene	0.77
Phenanthrene	2.30
Anthracene	0.68
Fluoranthene	0.98
Pyrene	1.70
Benzo(a)anthracene	1.60
Benzo(b)fluoranthene	0.73
Benzo(a)pyrene	1.00
Iodeno(1,2,3-cd)pyrene	ND
Benzo(g,h,i)perylene	ND
Di-n-butyl phthalate	0.78
Other Base/Neutrals	ND
Acid Extractables	ND

ND = not detected

Sources:

Monroe Co. Dept. of Health. (1986). Genesee River sediment toxics survey (205j). (Final report). Rochester, NY. Page B1.

RECRA Environmental, Inc. (1988). Expanded phase I investigation: Genesee River Gorge (Lower Falls). Site I.D. #828044. Albany, NY: NYSDEC. Table 4.3-12.

SEEPS

Table 5-23. NONPOINT SOURCE LOADINGS TO EMBAYMENT

WATERSHED	Watershed Total Area sq mi	Total C1 sq mi	Total H2 sq mi	Total M3 sq mi	Total L4 sq mi	Total Imperv. Area sq mi	Total % Imperv. Area	TSS load tons/yr	Total P load tons/yr	Lead load tons/yr	Zinc load tons/yr
WEST BASIN											
Round Pond/Slater	27.99	5.16	1.46	11.49	9.88	5.98	21.37	2775	6.23	1.79	22
Remainder West Basin (using Thornell)	280.54							22613	22.15	1.70	98
Total West Basin	308.53							25388	28.38	3.49	119
GENESEE BASIN											
Lower Genesee Urbanized area (Monroe Co.)	94.38	8.96	4.31	11.7	69.41	12.01	12.72	2886	7.51	1.44	54
Lower Genesee Geneseo to Charlotte minus urbanized area (using Thornell)	949							76496	74.92	5.76	331
Total Geneseo to Charlotte	1043							79382	82	7.19	385
Genesee Mouth below Charlotte docks	5.44	1.49	2.77	0.54	0.64	1.63	29.93	1727	3.35	1.44	5.65
Total Geneseo to mouth	1049							81109	85.79	8.63	390.59
CENTRAL BASIN											
Irondequoit Basin (NURP est.-see p.26)	175							19030	20.24	3.58	88
Mill/4-mile/ Shipbuilders Creeks	44.53	3.65	0	2.167	38.713	4.32	9.71	904	2.48	0.41	22.81
Durand area	7.64	0.33	0.95	3.26	3.1	1.43	18.68	525	1.24	0.31	5.36
Total Central Basin	227.17							20459	23.95	4.30	116

C1 = Commercial/industrial/multifamily land use, assumed to be 40% impervious
H2 = High density residential land use, assumed to be 31% impervious
M3 = Medium density residential land use, assumed to be 25% impervious
L4 = Low density/rural land use, assumed to be 6% impervious