Michigan Department of Natural Resources

Remedial Action Plan for

CLINTON RIVER

Area of Concern

November 1988

DNR

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Michigan Department of Natural Resources
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David Kenaga
Clinton River Remedial Action Plan Coordinator
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1. EXECUTIVE SUMMARY

1.1 THE CLINTON RIVER AREA OF CONCERN

The Clinton River was listed by the Great Lakes Water Quality Board (GLWQB, 1985) as an Area of Concern (AOC) because of past reports of conventional pollutants, including high fecal coliform bacteria, high total dissolved solids (TDS), sediment contaminants including heavy metals and oil and grease, and because of impacted biota. The suspected sources of these problems were listed as municipal and industrial point sources, urban and rural nonpoint sources, combined sewer overflows (CSO), and inplace pollutants (sediment contaminants). Because the sources were not specifically defined, but investigations were underway, the Clinton River was listed as a Category 2 AOC.

The AOC boundaries were defined as the main branch of the Clinton River and spillway downstream of Red Run. The remainder of the Clinton River watershed was the Source Area of Concern (SAOC).

In the course of developing this Remedial Action Plan (RAP), most of the International Joint Commission (IJC)-identified issues, including high fecal coliform bacteria, high TDS, heavy metals, oil and grease in sediments, and degraded biota were determined to be localized problems having no impact on the Great Lakes.

In fact, the high fecal coliform issue has been resolved, and the high TDS cannot be remediated due to naturally occurring high TDS in the basin soils. The resident warmwater fishery and benthic macroinvertebrate communities remain impaired in the AOC, but their resolution is confounded by naturally occurring low velocity, a flood control spillway, undesirable physical habitat, and contaminated sediments.

The only substances of concern to the Great Lakes is PCB which ranges up to 11.4 mg/kg in the Clinton River sediments downstream of Mt. Clemens.

1.2 DESIGNATED USES, IMPAIRMENTS, AND GOALS

The Michigan Water Quality Standards (WQS) have established the following designated uses for the Clinton River:

- Agriculture
- Navigation
- Industrial water supply
- Public water supply at the point of water intake
- Warmwater (and migratory coldwater) fish
- Other indigenous aquatic life and wildlife
- Partial body contact all year
- Total body contact recreation May 1 to October 31

The designated uses presently impaired are agriculture, warmwater fish, and the benthic macroinvertebrate community.

Agricultural use of the Clinton River for irrigation is impaired because it exceeds the Michigan WQS criteria for TDS. This issue cannot be remediated because it is primarily caused by naturally occurring soil types in the Clinton River Basin.

Warmwater fish and benthic macroinvertebrate communities are impaired due to a mixture of natural and urban-related causes. These include: conventional pollutants, organic and heavy metals contaminants from historic discharges attached to the fine particles settling out in the AOC due to low velocity, high sediment oxygen demand, low river reaeration rates, watershed soil types, agricultural practices, partially blocked river flow, high Great Lakes levels, and little topographical relief resulting in river water stagnation and flow reversals.

The goals of this RAP are to summarize existing data, determine present river conditions, identify sources of pollutants, discern between local and Great Lakes impaired uses, and outline a plan to restore these uses, if possible. Action-oriented recommendations with costs and potential funding sources are identified for remediation of impaired uses.

1.3 NATURAL FEATURES, LAND USES, AND WATER USES

The Clinton River drains most of Oakland and Macomb Counties and flows 80 miles through agricultural, suburban, and densely populated areas before entering Lake St. Clair through its natural channel and an artificially constructed spillway.

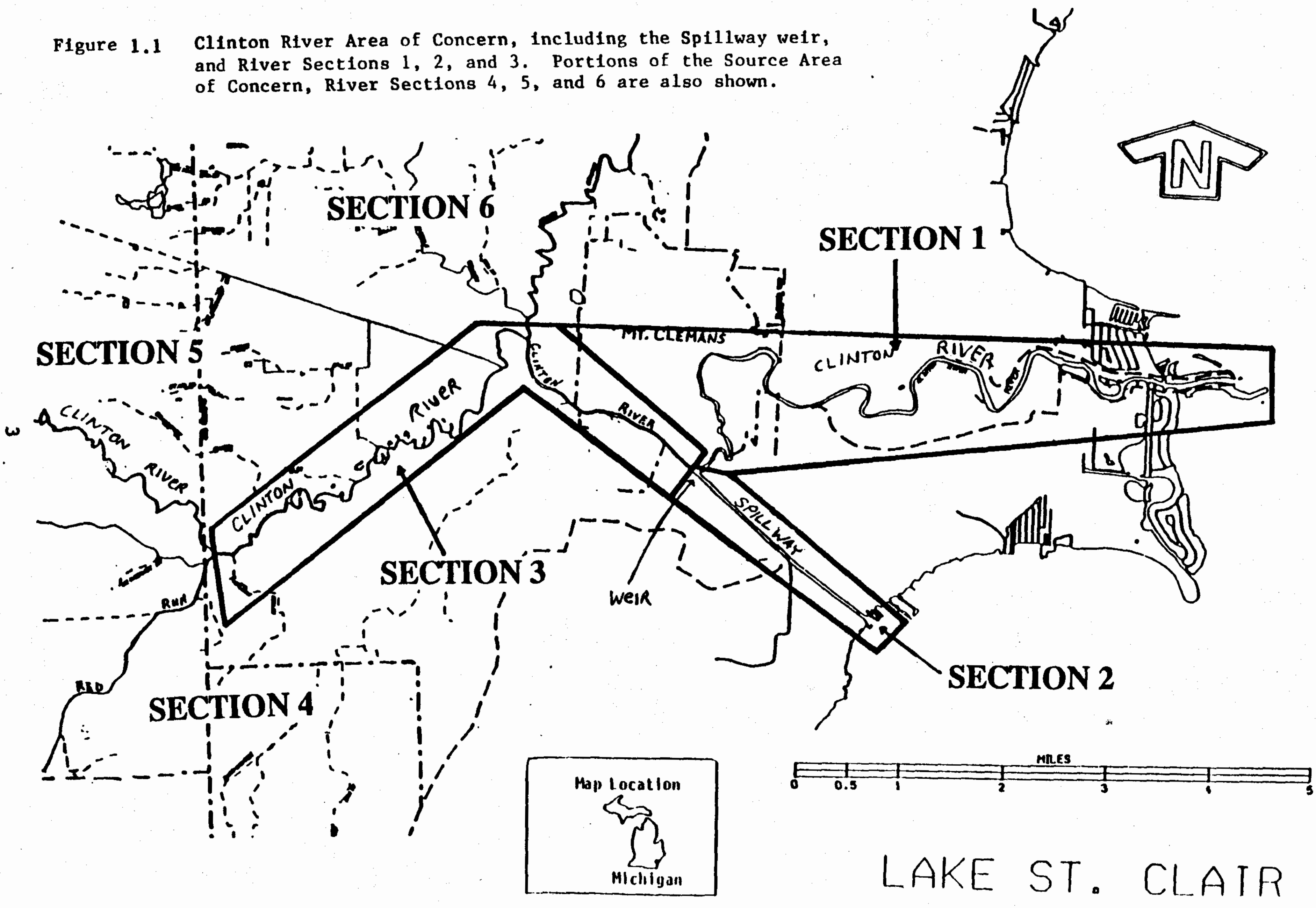
For ease of presentation, the drainage basin was divided into six sections, with an additional area (Section 7) located in Lake St. Clair. Sections 1, 2, and 3 are the AOC; Sections 4, 5, and 6 are the SAOC (Figure 1.1).

- Section 1 - Main Branch Clinton River downstream of the spillway
- Section 2 - Clinton River spillway and tributaries
- Section 3 - Main Branch Clinton River between Red Run and spillway
- Section 4 - Red Run and its tributaries
- Section 5 - Main Branch Clinton River and its tributaries upstream of Red Run
- Section 6 - North and Middle Branch Clinton River and its tributaries
- Section 7 - Nearshore Lake St. Clair between the Clinton River and spillway mouths

The watershed is mostly old glacial lake bed with gentle contours and well-stratified glacial deposits. Low soil permeability results in low 95 percent exceedence flow and rapid response to surface runoff. The August 95 percent exceedence flow through the spillway is 140 cfs. Of this, 95 cfs is treated wastewater from six of the seven municipal treatment plants in the basin.

The lower watershed has very little geographic relief and is characteristically urban with large areas of impervious surfaces. Combined sanitary and storm sewers overflow (Section 4) when overloaded with urban runoff.

Figure 1.1 Clinton River Area of Concern, including the Spillway weir, and River Sections 1, 2, and 3. Portions of the Source Area of Concern, River Sections 4, 5, and 6 are also shown.



These conditions and severe urban runoff contribute to flooding in the Clinton River downstream of Red Run.

Land use in the watershed is urban, transitional, agricultural, and recreational. The entire AOC is urbanized resulting in overtaxed storm drains, sewers, and treatment works. The main industries in the AOC are automotive related.

A major recreation area near the AOC is Metropolitan Beach, located on Lake St. Clair between the spillway and the river mouth.

Land-based wildlife habitat is limited by the urban nature of the AOC. Nearby Lake St. Clair provides excellent habitat for wintering and migratory waterfowl.

The spillway and natural channel allow passage of increasing numbers of walleye and salmon as far upstream as Yates Park Dam. Sport fishing is common in the watershed, with a resurgence of activity along the main branch. Water withdrawn from the Clinton River is used mainly for industrial and agricultural water supply, not for drinking.

1.4 POTENTIAL SOURCES OF POLLUTANTS

1.4.1 Point Sources

The seven municipal wastewater treatment plants in the Clinton River Basin with continuous discharges are listed below, along with their design flows:

Section 1:	Mt. Clemens - 6 mgd
Section 2:	None
Section 3:	None
Section 4:	Warren - 31 mgd
Section 5:	Pontiac - 15 mgd
Section 6:	Rochester - 2 mgd
	Almont - 0.32 mgd
	Armada - 0.32 mgd
	Romeo - 1.6 mgd

All WWTPs (except Almont and Armada) have industrial pretreatment programs. There is one intermittent municipal wastewater facility, the Southeastern Oakland County Sewage Disposal System Pollution Control Facility (1,852 MG/year) in Section 4. Other communities discharge to the Detroit WWTP or use on-site septic systems.

There are 22 National Pollutant Discharge Elimination System (NPDES) permitted industrial dischargers continuously discharging primarily non-contact cooling water. Some of these 22 and five other industrial facilities intermittently discharge stormwater via storm drains or sewers. The largest dischargers are the Ford Motor Sterling Axle Plant (8.5 mgd), Chrysler/Volkswagen(3.5 mgd), and the General Motors Pontiac Motor Division (4.2 mgd). The industrial sources and type of discharge are listed below by River Section.

Section 1	None
Section 2	None
Section 3	Molloy Manufacturing Co. (NCCW)
Section 4	Big Beaver Specialty Co. (NCCW) Borg Warner Corp. (SW) C.S. Ohm (NCCW) Department of the Army (NCCW) Ford Motor Co. (NCCW + SW) General Electric Carboloy (NCCW + SW) General Motors Tech Center (SW) OMI Corp. (NCCW) Schenck Treble (NCCW + cooling tower blow-down) Union Carbide (NCCW + lime slurry pond water) Chrysler/Volkswagen (NCCW, SW coal storage)
Section 5	Auburn Heights Mfg. Co. (NCCW) Buckeye Pipeline (treated groundwater) G.P. Plastics (plastics parts rinse water) Chrysler Tech Center (SW) Ford Motor Co. (NCCW + treated sanitary) General Motors Fisher Body (NCCW) General Motors Giddings Road (SW) General Motors Pontiac Motor Div. (NCCW) General Motors Truck and Bus (NCCW) Grand Trunk (SW and oil/water separator effluent) Higbie Mfg Co. (NCCW) Molmec Inc. (NCCW)
Section 6	Ford Motor Company Proving Grounds (treated sanitary wastewater proving grounds) South Macomb Disposal Authority (treated contaminated surface runoff) TRW Seatbelt Division (NCCW)

NCCW = Noncontact Cooling Water
SW = Stormwater

Point source dischargers to the river are in substantial compliance with their NPDES permits, although a few are behind in their compliance schedules.

Point sources contribute 0.4 percent of the suspended solids, 8.2 percent of the BOD_5, 16.5 percent of the total nitrogen, and 13.9 percent of the total phosphorus to the Clinton River Basin.

1.4.2 Nonpoint Sources

Major agricultural activity occurs in the North Branch watershed, accounting for 40.9 percent of the BOD_5, 28.3 percent of the suspended solids, 38.3 percent of the total phosphorus, and 59.4 percent of the total nitrogen load in the Clinton River Basin.

Urban stormwater runoff is a major nonpoint source contributor of conventional pollutants and possibly metal and organic contaminants. Urban stormwater accounts for 66.5 percent of the suspended solids, 41.3 percent of the BOD_5, 13.4 percent of the total nitrogen, and 33.5 percent of the total phosphorus to the Clinton River Basin. No stormwater data for heavy metals or organics are available for the Clinton River Basin.

Urban stormwater runoff is the greatest contributor of excess water, total phosphorus, total nitrogen, suspended solids, and BOD_5 in all river sections except Section 6 and to Red Run in Section 4.

Only one CSO is operating in the AOC. It is located directly across the river from the Mt. Clemens WWTP in Section 1. Additional CSOs in the source AOC discharge to the East Branch of Coon Creek at Armada in Section 6.

Only one open and licensed sanitary landfill is present in the AOC, the Southeast Oakland Incinerator Authority. However, numerous open, closed, or abandoned Type 2 and 3 landfills, transfer stations, and refuse processing stations exist in the basin. Additional potential groundwater contaminant sources include Act 307 sites of environmental contaminantion and active hazardous waste treatment, storage, and disposal facilities. The impact of most sites is largely undocumented. Detrimental effects from landfills on the aquatic life have not been demonstrated in two known studies done to date in the Clinton River Watershed (Kenaga, 1984 and Kenaga and Jones, 1986). Remedial investigations and planning to clean up land based contaminant sources affecting surface water quality are underway at Selfridge Air National Guard Base in the AOC and Red Run landfills, Liquid Disposal, Inc., SMDA 9 and 9A Landfills and G & H Landfill in the source AOC.

Sediments may act as a sink or source of pollutants to surface waters, depending on a variety of environmental factors. The magnitude of contaminants entering the water column from Clinton River sediments is unknown but is thought to be very small.

Little is known about atmospheric loadings of conventional pollutants in the Clinton River Basin. No heavy metals or organic loading data exist for the Clinton River Basin.

1.5 HISTORICAL OR PRESENTLY OCCURRING REMEDIAL ACTIONS

Many remedial actions have already occurred or are presently occurring in the basin.

1.5.1 Combined Sewer Overflows

In 1972, 12 to 14 southeastern Clinton River Basin communities began discharging a majority of their sewage and stormwater to the Detroit WWTP through sewage interceptors. Excess water that cannot be handled by the Dequindre Road Interceptor during high flow is given primary treatment and chlorination at the Southeast Oakland County Sewage Disposal System Pollution Control Facility (SOCSDF/PCF) prior to discharge to Red Run.

1.5.2 Stormwater

Stormwater management in the Clinton River Basin is undergoing gradual change from simple, localized provision of stormwater channels or sewers to more integrated management systems of land use regulations, on-site structural measures such as retention basins, and preservation of open spaces. Storm sewer management is still in its early stages for this AOC and, to date, little progress has been made. Limited programs have been designed to reduce runoff and conserve soils in the upper watershed. Local and regional planning and regulatory efforts have resulted in some preventive rather than remedial management strategies. Technical assistance has been provided by South East Michigan Council of Governments (SEMCOG), the Clinton River Watershed Council, and the Michigan Department of Natural Resources (MDNR). Thus far, success has been limited in the enforcement of state and local soil erosion and sedimentation regulations.

Michigan has a nonpoint source policy which requires that NPDES permits be developed for certain industrial stormwater discharges. NPDES permits have also been written for CSOs, but no effluent limits have been developed for these overflows.

Recently issued NPDES permits require approved containment facilities for accidental losses of contaminants and immediate MDNR notification.

1.5.3 Dredging and Flooding

The U.S. Army Corps of Engineers (USCOE) took measures to alleviate flooding in the lower Clinton River by enlarging natural drainage systems (Red Run) and constructing a weir and spillway to divert high river flows more quickly to Lake St. Clair. The weir and spillway dramatically reduced flooding but altered the lower river hydrology and water quality. Most of the Clinton River presently flows over the submerged weir down the spillway. The slower flowing water in the natural channel deposits its sediment load at the divergence of the natural channel resulting in shoaling or islands that divert water away from the natural channel. Periodic dredging at this juncture is required to maintain flow in the natural channel.

1.5.4 Capital Improvements through Local, State, and Federal Funding

Water quality in the AOC has improved due to the near elimination of untreated sewage, the construction of new wastewater treatment plant interceptors, pump stations, and sewer service systems, reduction in the loadings from industrial point sources, and industrial pretreatment. Costs of capital improvments through federal, state, and local funds between 1972 and 1987 totaled $378.4 million. Of this, federal grants paid $230 million, the state paid $50 million, and local governments paid $100 million.

1.5.5 Point Source Controls

In 1974, the State of Michigan began to issue NPDES permits. These permits are issued to all municipal and industrial facilities discharging to surface waters, and are reviewed every five years on a watershed basis. The Clinton River permits were last reviewed in 1985. This system is largely responsible for the tremendous improvement in Clinton River quality since the 1970's.

1.6 IMPROVEMENTS IN STREAM QUALITY

There has been a demonstrable improvement in Clinton River stream quality since 1970, as evidenced by the following list of changes:

Water

- Decreased total phosphorus concentration
- Decreased BOD_5 concentration
- Decreased metals concentrations
- Decreased pesticide and PCB concentrations
- Decreased ammonia concentrations
- Decreased fecal coliform bacteria concentration
- No beach closings since 1983
- Decreased suspended solids in Sections 3, 4, and 5
- Improved dissolved oxygen concentrations in Sections 5 and 6
- Decreased levels of chlorophyll a in Section 5 and 3
- No recent exceedences of Rule 57(2) allowable levels for metals.

Sediments

- Decreased sediment metals in Section 5
- Decreased sediment organics in Section 5

Benthic Macroinvertebrate Community

- Significantly improved benthic macroinvertebrate community between Pontiac and Red Run (Section 5)

Fish

- Improved resident fish community in Sections 1 and 6
- Improved fishery in Paint and Stony Creek watersheds
- Recovering resident fish community in Section 5
- Improved walleye and chinook fishery in Sections 1, 2, 3 and part of Section 5

1.7 Recommended Actions

Table 1.1 lists the local and Great Lakes impaired uses, causes, recommended actions, estimated costs, and potential funding sources. These actions are the next steps needed to restore all beneficial uses.

Table 1.1 Impaired uses, problems, recommendations, cost estimates for proposed actions and possible funding sources, October, 1988.

Local Issues

Impaired Use	Problem	Recommendation	Cost	Funding Source
Warmwater fish	Low D. O. Degraded community	Survey to determine extent of problem	30,000	S
	Low D. O. Degraded community toxicity	Do caged fish study	47,000	S
Benthic macroinvertebrate community degradation	Sediment toxicants	Do sediment bioassays	70,000	S
	Sediment toxicants Poor habitat	Support USCOE dredging	3,000,000	F
	Locally degraded community	Survey to document extent of problem	$ 65,000	S/O
Local fish and benthic macroinvertebrate community degradation	Locally degraded community	Survey to determine sources of oxygen consuming substances for waste load allocation	85,000	S/O
	Low D. O. Poor physical habitat Poor flow regime	Waste load allocation for Clinton River point source dischargers	$ 25,000	S/F
		Complete upgrading of Mt. Clemens and Armada WWTPs	$23,900,000	S/F/L
		Reduce frequency or eliminate overflow to Red Run from SOCSDS/PCF	Unknown	S/F/L
	Low D. O. Poor physical habitat Toxicants	Do smoke and dye studies for illegal hook-ups	195,000	U
	Low D. O. Poor physical habitat Toxicants	Enforce Best Management Practices for nonpoint sources	15,000,000	U

Local Issues (continued)

Impaired Use	Problem	Recommendation	Cost	Funding Source
Local fish and benthic macroinvertebrate community degradation	Low D. O. Low Flow	Determine effect of weir modification	200,000	S/L/O
	Diffuse toxicant loadings	Increase air quality monitoring	405,000	S/F
	Local toxicant loadings	Continue and expand 307 and superfund studies	9,000,000	S/F
Potential local & Great Lakes PCB contamination of fish	PCB in sediments	Verify presence or absence in previously reported areas	20,000	S/O
	PCB and other organics in surface water	Monitor water for organic contaminants by river section	22,000 annually	S
	PCB in aquatic environment	Expand fish contaminant monitoring	97,000	S
Sediments block river flow	Low flow Low D. O.	Define source of sediments	400,000	S/O
	Low flow Low D. O.	Remove sediments at Shadyside Park	200,000	L
Clinton River ecosystem	Disjointed watershed approach	Establish a watershed funded clearinghouse for studies, information, and issues	200,000 annually	L
Great Lakes Issues				
Potential fish consumption advisories	PCB in fish	Do caged fish studies to determine local PCB sources	47,000	S
PCB in aquatic life derived from sediments or water	PCB in sediments	Sample sediments for PCB concentrations	20,000	S
	PCB in water	Sample water for PCB concentrations	22,000 annually	S/F

F = Federal; S = State; L = Local; O = Other; U = Uncertain

2. INTRODUCTION

The Great Lakes have received nutrients and contaminants from numerous sources resulting in a variety of impairments to the aquatic ecosystem, including eutrophication, localized bottom dwelling aquatic life impairments, and widespread fisheries impairments. Many of the impairments from conventional pollutants, including nutrients, have been largely resolved, thanks to a considerable commitment of funds and technology. However, persistent organics and some metal continue to cause fisheries impairments such as fish consumption advisories, which remain in effect in all the Great Lakes.

To restore the beneficial uses to the Great Lakes, the GLWQB of the IJC encouraged the Great Lakes states and provinces to identify areas where particularly difficult problems were still thought to exist. These locations eventually became known as AOCs and were viewed as significant sources of contaminants to the Great Lakes. For some areas updated information was unavailable or left unreported leaving the GLWQB uninformed as to the progress or present condition of these areas. Although all of the impaired uses in these AOCs were originally thought to extend into the Great Lakes, upon examination of the data, it became apparent that many issues were clearly only local problems which caused no use impairments in the Great Lakes.

In many AOCs, sediment contaminants were considered a potential source of impairment to the Great Lakes. Because removal of the contaminated sediments without stopping or significantly reducing the sources would only temporarily improve the AOC, all sources of contaminants need to be considered. Thus, the remainder of the watersheds upstream of the AOC boundaries were defined as source AOCs if they contributed materials resulting in impaired uses within the AOC. The consideration of upstream contaminants was not limited to sediment contaminants but included all factors that contribute to local and Great Lakes use impairments.

2.1 PURPOSE AND OBJECTIVES

The purpose of this RAP is to gather and analyze existing data to determine present river conditions, identify and distinguish between local and Great Lakes impaired uses, identify sources causing the impaired uses, develop a plan for gathering additional data required for decision making, and list proposed methods for restoration of impaired uses in the AOC.

Most of the problems and impaired uses identified by the GLWQB in the Clinton River were local impairments with no impact on the Great Lakes. However, all of the problems identified by the GLWQB are discussed in this RAP to provide a comprehensive list of problems in the AOC. Inclusion of all of the listed problems in the RAP makes sense from an ecosystem management perspective since it includes perceived as well as documented problems. The objective is to develop clear recommendations for specific private and/or public actions that will guide the restoration of beneficial uses. The RAP process will be ongoing in a step-wise fashion until the uses that can be restored are restored.

2.2 BACKGROUND

The MDNR defined the Clinton River AOC as the main branch of the Clinton River and the spillway downstream of Red Run. The remainder of the watershed is the SAOC. The Clinton River watershed is located in Southeastern Lower Michigan, primarily in Oakland and Macomb Counties, on the northwestern edge of Lake St. Clair.

The GLWQB listed the problems identified by the State of Michigan AOC as:

(1) High fecal coliform bacteria
(2) High TDS concentrations
(3) Contaminated sediments
(4) Impacted biota

The contaminants sources were listed as:

(1) Nonpoint urban and rural runoff
(2) Combined sewer overflows
(3) Municipal and industrial point source discharges
(4) Contaminated sediments

Of the listed problems, only PCB-contaminated sediments could be considered as a contributor to Great Lakes impairment. High fecal coliform bacteria is no longer a problem, and impacted biota is a local issue that does not impact the Great Lakes. High TDS concentrations is a local problem that cannot be abated due to soil types in the watershed.

An additional problem, not listed by the IJC but which continues to plague the Clinton River AOC, is low dissolved oxygen. This localized issue does not impact the Great Lakes, but does result in local impairment of the fish and benthic macroinvertebrate communities in the AOC.

The GLWQB reports water quality research activities and the Great Lakes environmental conditions to the IJC. The GLWQB has adopted a category system to track and measure progress in restoring impaired uses in the 42 AOCs. The categories identify the status of the information base, programs which are underway to fill the information gaps, and the status of remedial efforts. According to the GLWQB (1985), removal from the AOC list occurs when evidence is presented verifying that all impaired uses have been restored. The categories are described below.

Category	Explanation
1	Causative factors are unknown and there is no investigative program to identify causes
2	Causative factors are unknown; however, an investigative program is underway to identify causes.

Category	Explanation
3	Causative factors are known, but a Remedial Action Plan has not been developed and remedial measures are not fully implemented.
4	Causative factors are known and a Remedial Action Plan has been developed, however, remedial measures are not fully implemented.
5	Causative factors are known, a Remedial Action Plan has been developed, and all remedial measures identified in the Plan have been implemented.
6	Confirmation that uses have been restored and deletion as an Area of Concern in the next report on Great Lakes Water Quality.

The State of Michigan has listed the Clinton River as a Category 2.

Clinton River stream quality has improved in recent years. Improved waste collection and treatment systems have drastically reduced nutrient and fecal coliform bacteria loadings. Industrial pretreatment programs have resulted in significant reductions in metals loadings to water and sediments.

The magnitude of change can be indicated by comparing the past and present community structures and health of the organisms which are continuously and totally immersed in the aquatic environment. Natural reproduction of chinook salmon has been documented since 1983, with the discovery of live eggs and, later, fingerlings in the vicinity of Dequindre Road bridge. No chinook salmon were stocked, yet a sizable and popular fishery occurs in the river each fall (Personal Communications, Ron Spitler, 1987). There are also winter-long steelhead and year-round brown trout populations. Survival of planted brown trout and steelhead has been documented by surveys and anglers from Crooks Road to Ryan Road.

In the upper river, the benthic macroinvertebrate community has shown excellent improvement, although not complete recovery. The poor benthic macroinvertebrate community in the natural channel downstream of the weir reflects the combination of: (a) the absence of good benthic macroinvertebrate substrate; (b) the contaminated sediment substrate; and (c) low dissolved oxygen in the overlying river water. Apparently, heavy algal growths and high turbidity historically plagued the area, due to point source nutrient enrichment and stagnant river conditions.

3. ENVIRONMENTAL SETTING

3.1 LOCATION

The Clinton River drainage basin is located just north of Detroit, primarily in Oakland and Macomb Counties in the southeastern corner of Michigan's lower peninsula (Figure 3.1). It is bordered to the north by the Shiawassee, Flint and Belle Rivers and to the south and west by the Huron and Rouge Rivers. It flows eighty miles through 26 townships, 25 cities, and nine villages prior to discharging to Lake St. Clair primarily through an artificially constructed spillway near Mt. Clemens and its natural channel. The spillway, created in 1952 by the USCOE, was designed to relieve flooding.

The AOC is defined as the main branch of the Clinton River and the spillway downstream of Red Run (Figure 3.2). The remainder of the watershed is the SAOC which may contribute to the problems that cause impaired uses in the AOC.

For ease of data presentation, the Clinton River basin was divided into six river sections described below (Figure 3.3). The AOC includes Sections 1, 2, and 3. Sections 4, 5, and 6 are the SOAC. The Clinton River flows into Lake St. Clair which is classified as Section 7. Lake St. Clair is not included in the AOC.

3.1.1 AOC Sections

Section 1	The natural channel of the main branch of the Clinton River downstream of the spillway weir
Section 2	The Clinton River spillway
Section 3	The main branch of the Clinton River between Red Run and the spillway weir

3.1.2 SOAC Sections

Section 4	Red Run and its tributaries
Section 5	The main branch of the Clinton River upstream of Red Run and its tributaries
Section 6	The Middle and North Branches of the Clinton River and their tributaries

3.1.3 Downstream of Clinton River Basin Section

Section 7	Nearshore waters of Lake St. Clair between the mouth of the Natural Channel and the spillway

Figure 3.1. CLINTON RIVER DRAINAGE BASIN
DRAINAGE AREA 760 SQ. MI.

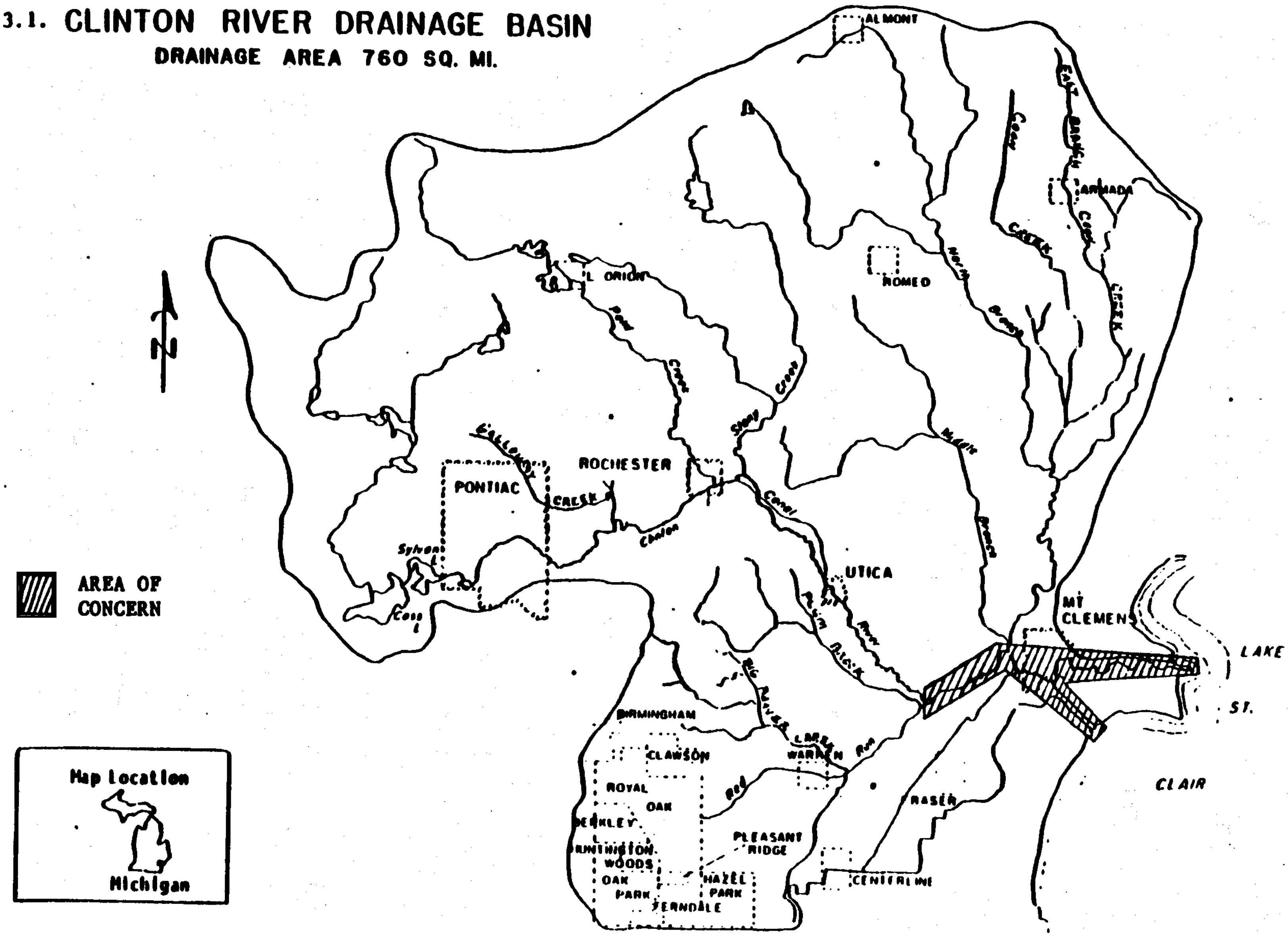
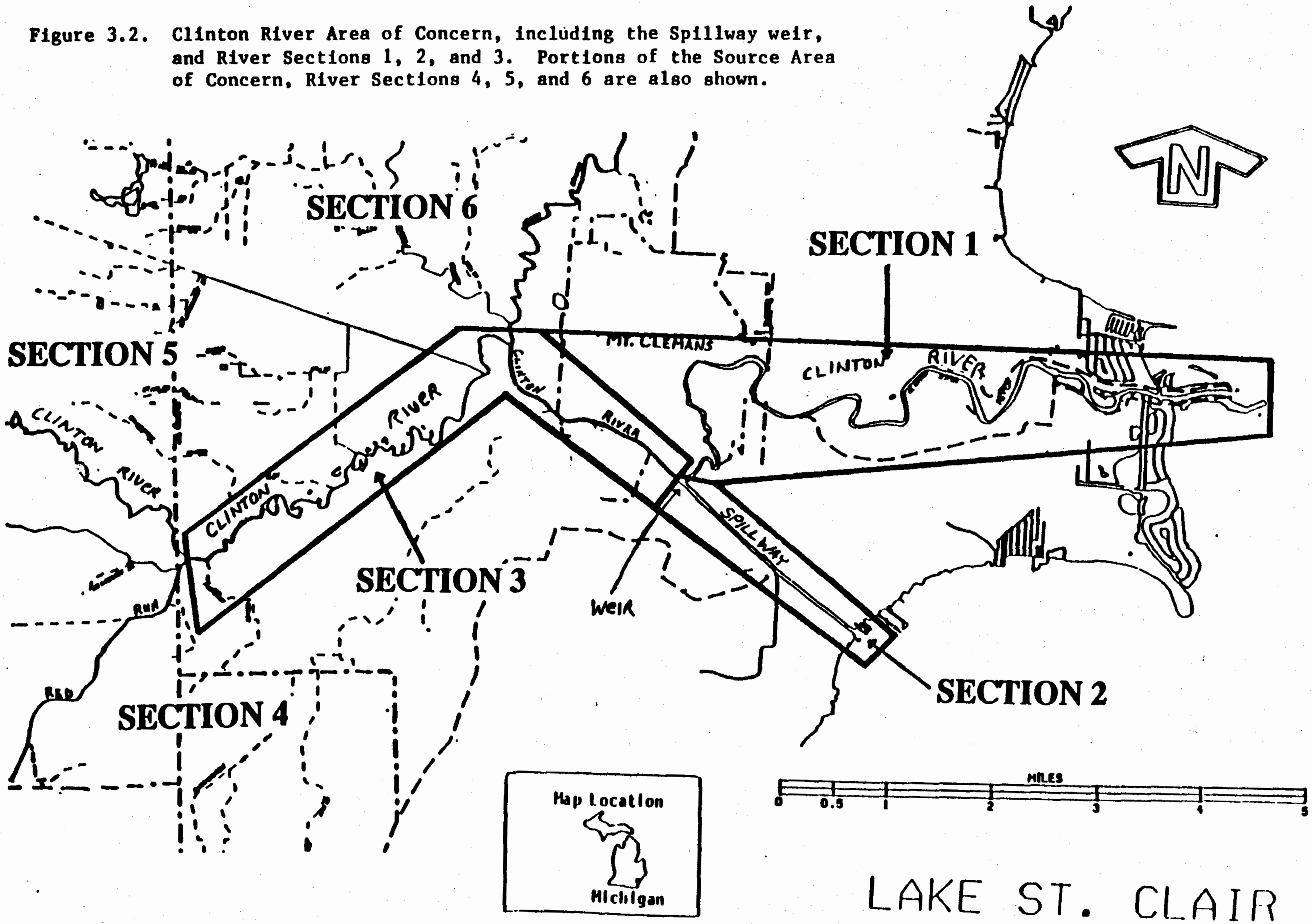


Figure 3.2. Clinton River Area of Concern, including the Spillway weir, and River Sections 1, 2, and 3. Portions of the Source Area of Concern, River Sections 4, 5, and 6 are also shown.



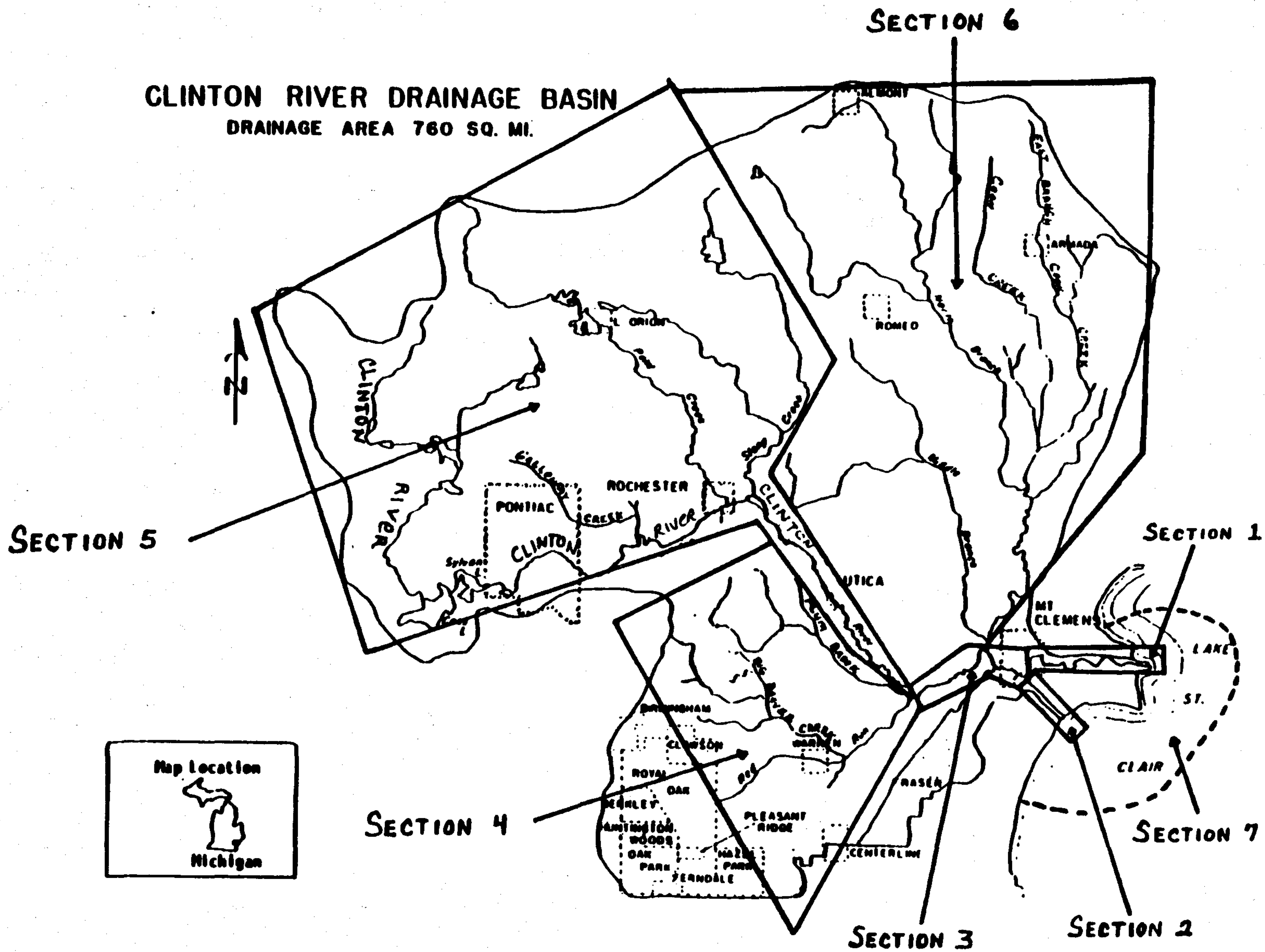


Figure 3.3. Clinton River Watershed, showing the six River Sections. Sections 1, 2, and 3 are the Area of Concern. Sections 4, 5, and 6 are the Source Area of Concern.

3.2 NATURAL FEATURES

3.2.1 Drainage

The Clinton River basin encompasses 1,968 km^2 (760 mi^2). The Clinton River is a fifth order stream at its mouth, although the majority of the Clinton River presently flows down the spillway (Figure 3.4). The Middle Branch, a third order stream, joins the North Branch, just prior to where the North Branch, a fourth order stream, joins the Main Branch two miles upstream of Mt. Clemens in an area known as "The Forks". Red Run, Stony, Galloway, Paint, and Sashabaw Creeks are second and third order streams feeding the Main Branch (Appendix 3.1).

3.2.2 Topography

Topography is a major factor contributing to the problems identified in the Clinton River basin. The topography determines the river slope (Figure 3.5), which influences the river velocity. When a large slope exists, the result will generally be a healthy velocity and good aquatic substrates (rocks, cobble, and gravel) which leads to well-oxygenated water. When the slope is very small, low velocity results causing suspended particulate matter to settle from the water column in depositional zones containing fine sand, clay, and silt that are poor aquatic life substrates. Low flow areas do not have good reaeration and often have high sediment oxygen demand due to high concentrations of oxygen consuming organic material.

Upstream of Pontiac is a relatively flat plateau dominated by numerous small lakes, with little slope (1.3 ft/mi) and a very low, 95 percent exceedence flow (2.5 cfs). Downstream of Pontiac to Honeywell Drain there is a healthy slope averaging 12 ft/mi (Nowlin, undated). Between Honeywell drain and Utica, the slope is approximately 8 ft/mi which is still healthy. Between Utica and Red Run the slope is to 3.6 ft/mi and becomes problematic. Between Red Run and the North Branch, the slope is 1.5 ft/mi and downstream of the North Branch, the slope is less than 0.1 ft/mi resulting in slow-moving to stagnant water (Figure 3.6).

The major tributaries to the Main Branch, including Stony, Paint, and Galloway Creeks, and the upper reaches of the tributaries to the Middle and North Branch have slopes exceeding 8 ft/mi resulting in good to high quality streams (Appendix 3.2). The upper reaches of Plum Brook, tributary to Red Run, have similar slopes. However, the lower reaches of the North and Middle Branches, and most of Red Run, have slopes near 2 ft/mi, resulting in systems with naturally limited quality aquatic life.

Much of the lower watershed from Utica to the Mouth (sections 1, 2, 3 and about 8 miles of section 5), including most of the North and Middle Branches (section 6) are old glacial lake beds with gently sloping contours and well stratified glacial deposits (USDA, 1982). This area rarely exceeds 650 feet above sea level. The northwest portion (most of Section 5) consists of rolling moraines separated by narrow sand and gravel plains (USDA, 1971).

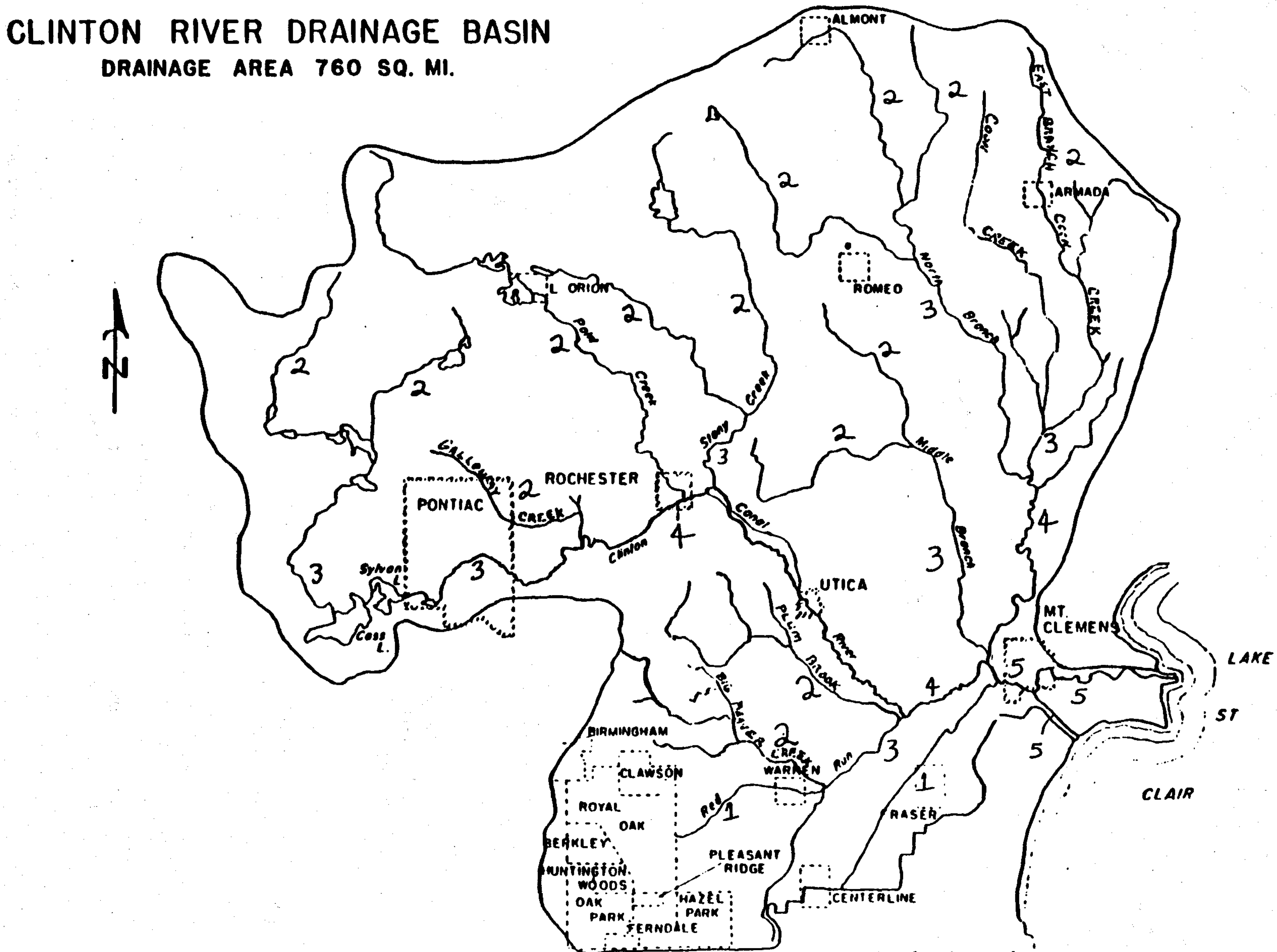


Figure 3.4. Clinton River and its tributaries, showing stream order. The higher the number, the larger the stream.

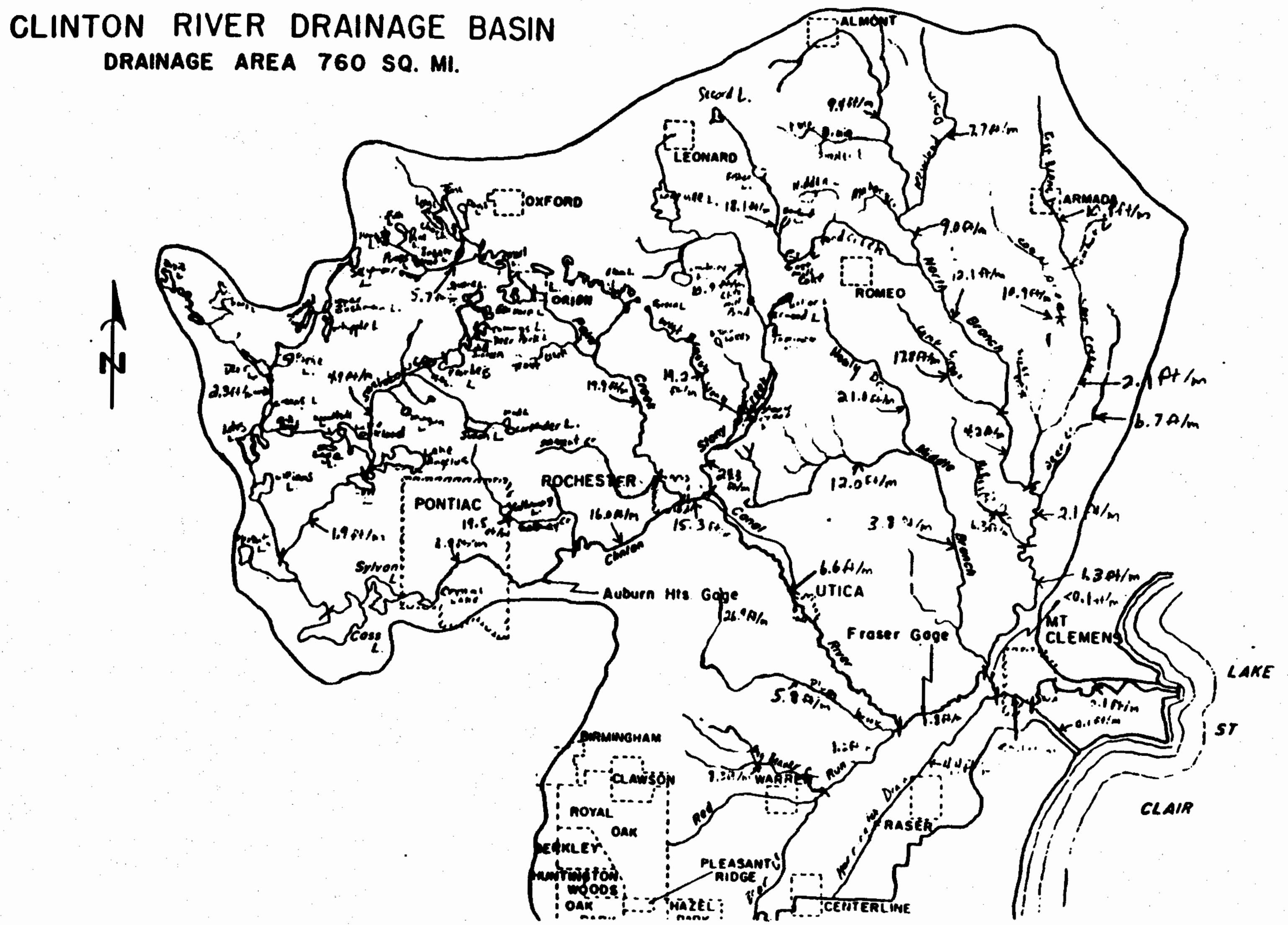
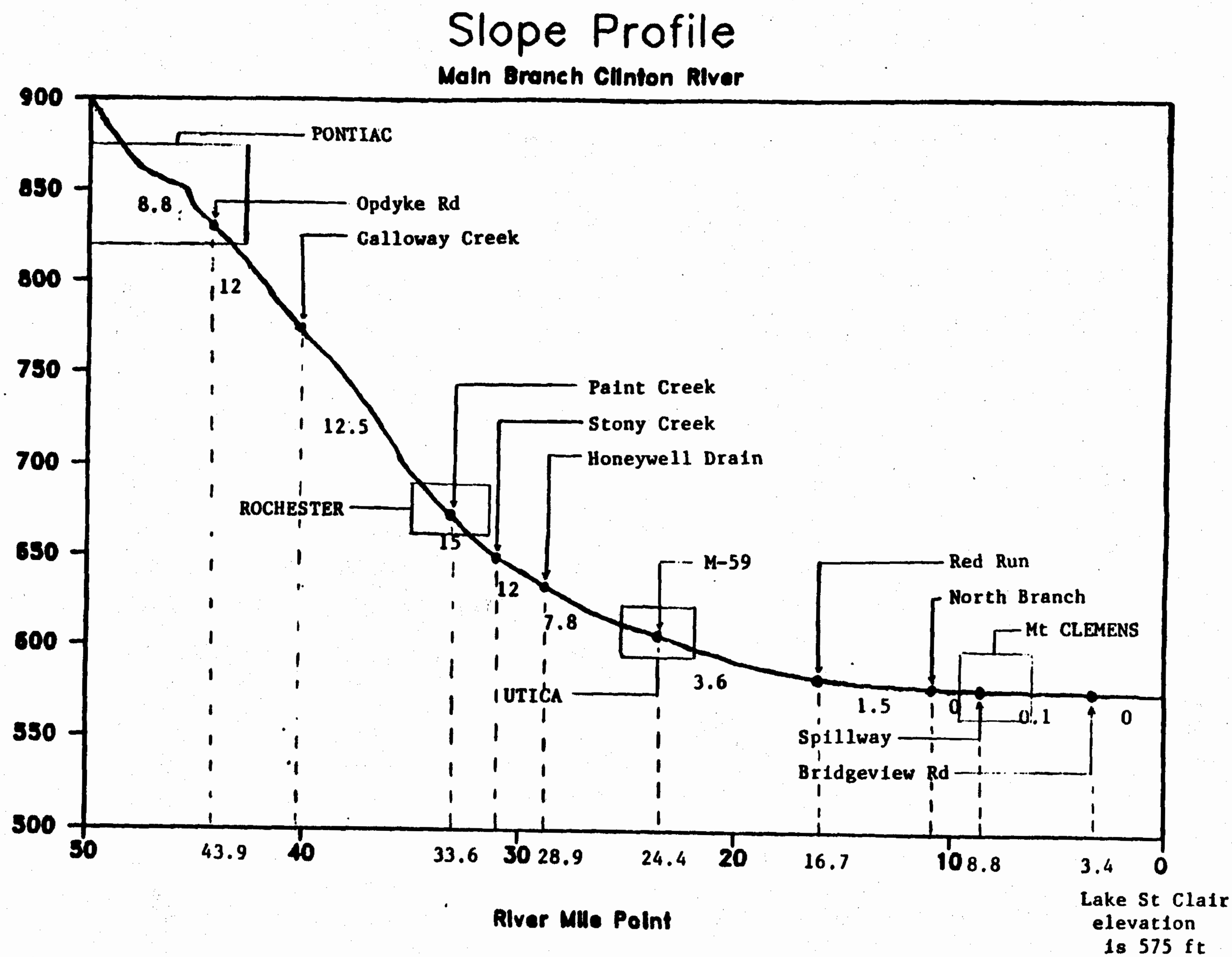


Figure 3.5. Clinton River Drainage Basin showing average slope in feet per mile.



Distance between points is the slope in feet/mile. i.e. between Opdyke Rd and Galloway Creek the slope falls an average of 12 ft per mile.

Figure 3.6. Slope of the Main Branch Cli[illegible] River from Pontiac to Lake St Clair in feet per [illegible]e.

3.2.3 Hydrology, Flooding, and Stream Modifications

Water sources making up the Clinton River include direct precipitation, runoff from land during and after precipitation, groundwater, other tributaries, and discharges from municipal and industrial facilities. Groundwater and tributaries comprise 15.1 percent of the total flow shown in Table 3.1 (Figure 3.7). Municipal WWTP discharges comprise 63.8 percent, and industrial dischargers, primarily noncontact cooling water, contribute 21.1 percent of the total 95 percent exceedence flow. The Clinton River is clearly an effluent-dominated stream at 95 percent exceedence flow, the flow used for all NPDES permit development by the MDNR.

The 95 percent exceedence flow at Pontiac is very small (2.5 cfs) even though the area drained is approximately 120 square miles. The soils in this vicinity are relatively porous allowing groundwater to percolate horizontally into the deeper aquifer rather than the river-based aquifer. This condition is quite different downstream of Pontiac where the soils are not very permeable. This condition, known as "tight soils", generally produces low volumes of water when wells are drilled. Table 3.1 indicates that if there were only groundwater and tributary inputs, the Clinton River 95 percent exceedence flow at the mouth would be 22.5 cfs. The remainder of the flow is imported from outside the watershed through the Detroit Water and Sewer System from Lake Huron and the Detroit River. This "imported" water is used and then discharged from industrial and municipal treatment plants.

Upstream of Red Run minor flows (18.1 cfs) are contributed by Paint and Stony Creeks and some from the Rochester WWTP. Red Run (76.5 cfs), which is nearly 100 percent treated wastewater and industrial noncontact cooling water, more than doubles the 95 percent exceedence flow of the Clinton River. A few miles downstream of Red Run, the North Branch, Romeo, Armada, and Almont WWTPs, and small industrial flows contribute 7.6 cfs which at 95 percent exceedence flow is 50 percent treated municipal effluent. Two miles downstream of the confluence of the North and Main Branches, the river is split by a weir into the natural channel to which the Mt. Clemens WWTP discharges (9.3 cfs) several miles upstream of Lake St. Clair and the Clinton River spillway which conveys the majority of the Clinton River flow rapidly to Lake St. Clair.

Tight soils in the lower Clinton River watershed result in large amounts of surface runoff to the natural streams, the artificially modified streams which have been straightened and deepened to become open drains, underground storm sewers, and combined storm and sanitary sewers which rapidly reach the Clinton River. Stream channelization is extensive in the lower Clinton River where the land use is primarily urban. Because the surrounding land in the lower reach is a very flat, old glacial lake bed, a small rise in the water level results in wide-scale flooding.

Approximately 81 percent of the flood damages in southeastern Michigan occur in the Clinton River Basin (CRWC, 1981). In 1976 and 1977, the annual flood damage to industrial and residential properties was $9.7 million (USCOE, 1979). To help alleviate the flooding problem, the straightening and widening of Red Run and the Clinton River weir and spillway projects were built by the USCOE.

Table 3.1 Drought Flow of Main Branch Clinton River by River Mile With Additions From Tributaries, Municipalities, and Industries

Location	Clinton River Flow (cfs)	Tributary Flow (cfs)	WWTP Flow (cfs)	Industrial Flow (cfs)	River Mile Point
Upstream of Pontiac WWTP	2.5	2.5			50.0
At Pontiac WWTP	25.7		23.2		45.0
Industries between the Pontiac area & Paint Crk	35.9			10.2	[illegible].0-45.0
Paint Creek and Galloway Creek	46.9	11.0			35.0
At Rochester WWTP	50.0		3.1		33.0
At the mouth of Stony Creek	54.0	4.0			32.5
At the mouth of Red Run	130.5	0.4	55.7	20.4	17.0
At the mouth of the North Branch Clinton R.	138.1	3.6	3.5	0.5	11.5
At Harrington Drain	139.4	1.0		0.3	10.0
Mt. Clemens WWTP	148.7		9.3		6.5
Totals	148.7	22.5	94.8	31.4	0.0
Percent of Flow	100.0	15.1	63.8	21.1	

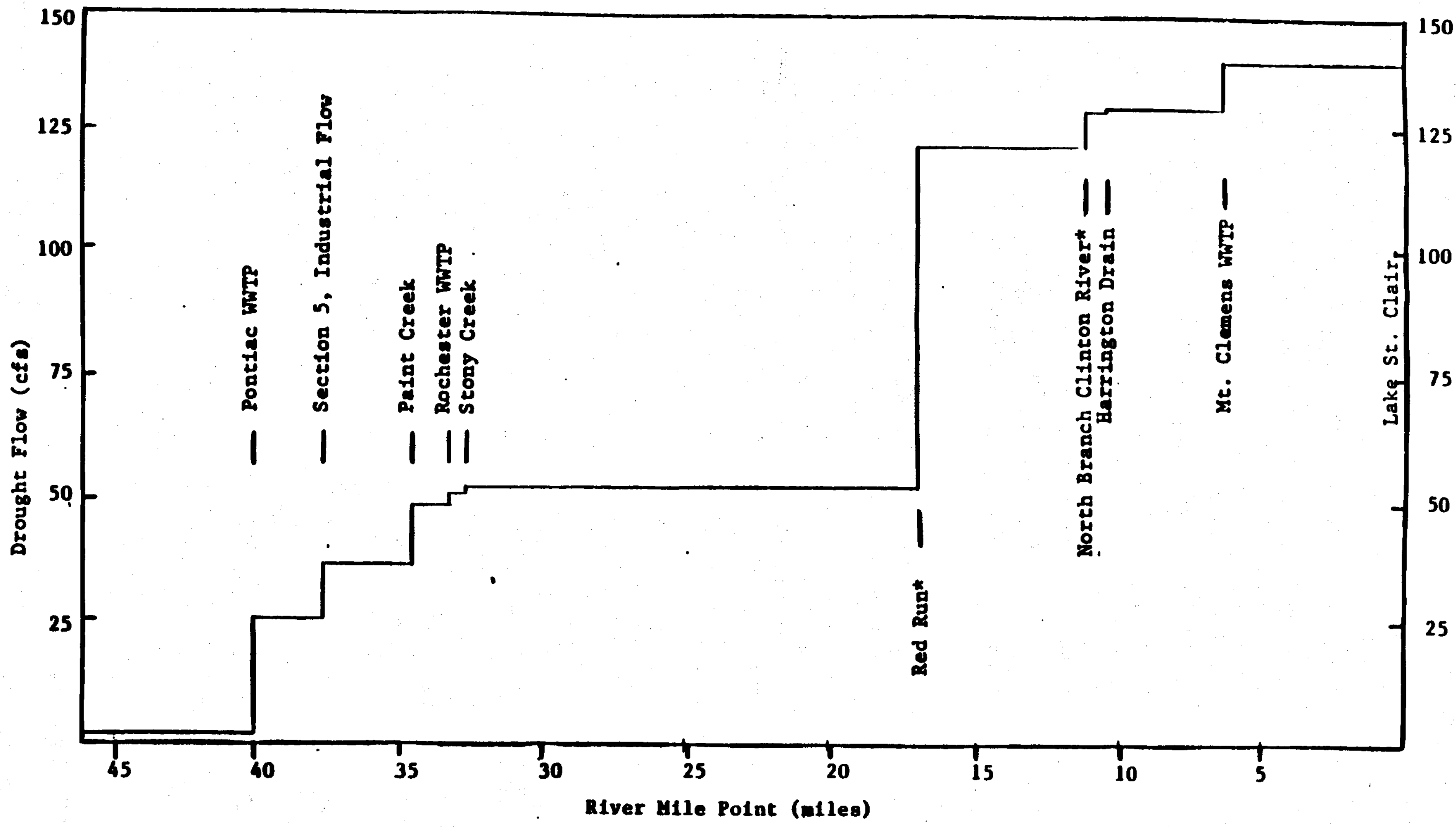


Figure 3.7
Clinton River drought flow plus industrial and municipal flow versus river mile point.

*** includes tributary flow, WWTP flow, and industrial flow**

The Red Run project will be detailed in Chapter 5. Basically, Red Run was a natural tributary receiving storm and sanitary wastes from the Royal Oak area. As urban development exceeded its capacity, large-scale flooding occurred until 1948, when it was greatly enlarged and straightened to carry the combined wastewater from 12 towns in the Royal Oak area to the Clinton River. Later (1965), the Twelve Towns Drainage System was constructed which further expanded Red Run.

In 1973, the Southeastern Oakland County Sewage Disposal System Pollution Control Facility (SOCSDSPCF) was constructed to treat the combined sanitary and stormwater that exceeded the maximum flow of 21 million ft^3/day that the Dequindre Road Interceptor could deliver to the Detroit Wastewater Treatment Plant. The SOCSDSPCF continues to provide primary treatment and chlorination for this periodically large combined sewer overflow discharge to Red Run.

The Clinton River Spillway was authorized in 1946 and constructed in 1952 by the USCOE (1979). It runs from the weir at river mile 9.5 where the natural channel turns north toward Mt. Clemens 8.8 miles to Lake St. Clair and provides a shorter, straighter path for river flow than the natural channel. It was designed to direct a major portion of the high flows while restricting flows less than 600 cfs to the natural channel. When the Lake St. Clair water level exceeds 573.2 - International Great Lakes Datum (IGLD), the spillway weir becomes submerged and flows are directed primarily down the spillway.

When this occurs, water quality in the lower reach of the natural channel is significantly affected by stagnant conditions (see also Section 4.2) (MDNR, 1981a). The weir has been submerged most of the time during the summer months, even when flow is below 600 cfs. The portion of the Clinton River water that does not flow down the spillway loses its velocity as it flows north causing sediment accumulations in the natural channel, partially blocking normal flow into the natural channel. Periodic dredging is necessary to remove these shoals to encourage flow down the natural channel.

The first dredging at this site was done in 1962 by the City of Mt. Clemens. Dredging took place again in 1971 and was financed through the Clinton River Spillway Drainage Board, which includes Lapeer, St. Clair, Oakland, and Macomb Counties, and totalled approximately 13,000 cubic yards. A small amount of material was removed in the spring of 1988 without a permit. A permit to dredge more sediment from this site was applied for in August, 1988.

In 1979, the Corp of Engineers proposed an inflatable weir and an increased spillway width with the final 3,000 feet of the canal widened to 210 feet with an earthen bottom and concrete sides. A boat launching facility near the lower end of the spillway was also proposed. This project was deauthorized by the Water Resource Development Act of 1986, Public Law 99-662, and the spillway remains unaltered.

As previously described, the Clinton River is a flashy river system because of its geography and soil types. The average annual, monthly, and daily flows for the water year 1980 measured at Mt. Clemens are shown in Figure 3.8 (USGS, 1981). Appendix 4.8 shows additional river hydrographs. A summary of Clinton River hydrologic characteristics at various U.S. Geological Gaging Stations (USGS) is presented in Table 3.2 whose station locations are shown in Figure 3.9. Highly variable streamflow and low groundwater yield are typical for urban areas and for these soil types. Stations in areas of impervious surfaces show 20 to 150 times greater maximum discharge and minimum discharges of 60 to 500 times less than stations on the lesser urbanized morainal areas (SEMCOG, 1978a). Each year the USGS summarizes the data gathered at USGS gaging stations. The most recent data available for water year 1987 are available in "Water Resources Data for Michigan, Water Year 1987" from the U.S. Geological Survey (USGS, 1988) for the stations noted on Table 3.2. 1988 will be the last year for the Clinton River gaging stations since the federal funding for these gages has been dropped.

3.2.4 Soil Types, Erosion

The Clinton River Watershed was heavily influenced by the Wisconsin glacial ice age. The soils are the product of weathering and decomposition of glacial deposits placed there some 9,000 years ago. They are gray-brown podzolic soils and vary from poorly drained clays to well-drained sands (SEMCOG, 1978a). The northern two-thirds of Oakland County and the northwestern corner of Macomb County consist of hills with sand and gravel plains, while the remainder of the watershed is primarily an old glacial lake bed.

The northern Oakland County soils are dominated by moderately well to well-drained loams. Some overburden is underlain by gravelly sand where the erosion is moderate to severe, and measures are needed to control erosion and reduce sedimentation in the streams (USDA, 1982).

Southeastern Oakland County soils are poorly to moderately well drained and are sandy, loamy, or clayey throughout. Wetness is a major limitation for these soils, with 41 percent of Oakland County either urban, where soils are covered with impervious surfaces, or poorly to very poorly drained (USDA, 1982).

Eighty percent of the soils in Macomb County are poorly to very poorly drained because of their clayey makeup (USDA, 1971) resulting from being an old glacial lake bed.

Soils drained by Red Run are clays with low permeability which contribute to stream turbidity under all conditions. The soils around Mt. Clemens are poorly drained loams and sandy loams overlaying an ancient lake bed. These soils are susceptible to erosion, but the low-lying relief of this area reduces the potential for soil loss (SEMCOG, 1978a). Seasonal high water tables cause slow permeability.

3.3 LAND USES

3.3.1 Urban/Suburban/Residential

Land use is dictated to varying extents by topography, soil type, and hydrology. For example, one would not intentionally construct a

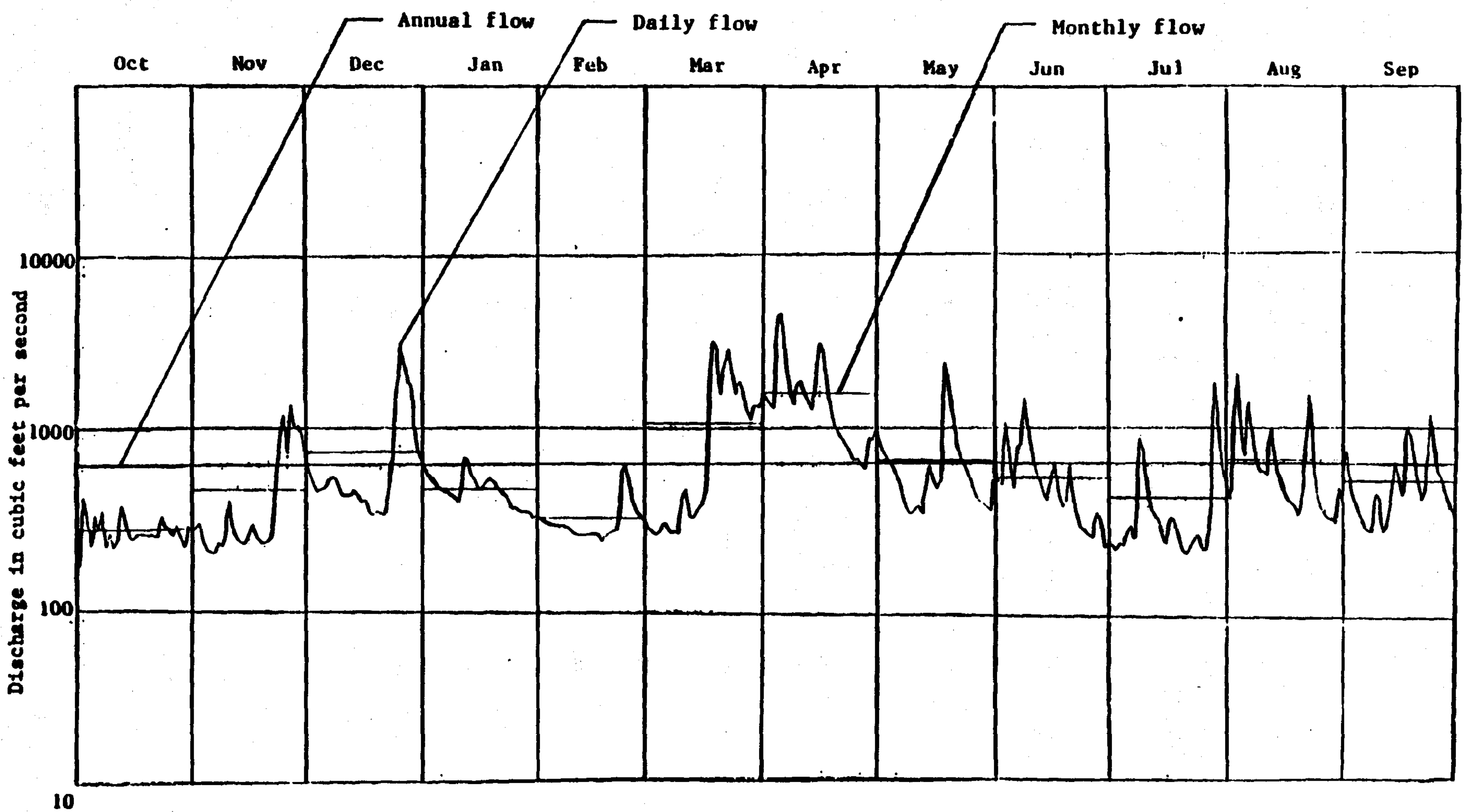


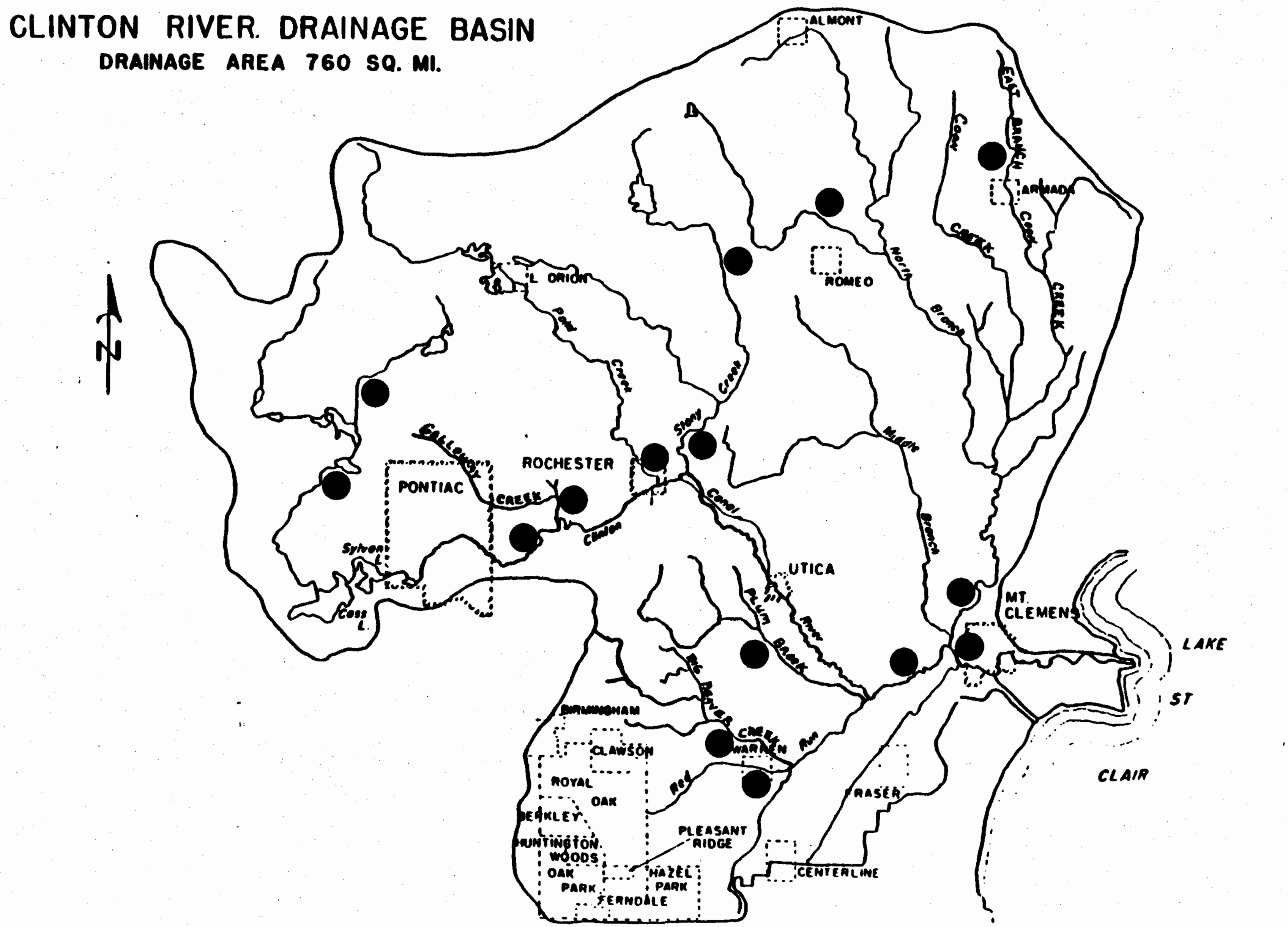
Figure 3 . 8. Clinton River Average Annual, Monthly, and Daily Flows at Mt. Clemens in water year 1980.
Source: USGS 1987, station # 04165500 Additional hydrographs are shown in Appendix 4.8.

Table 3.2 Hydrologic Information for the Clinton River at USGS Gaging Stations. Discharge Statistics and Flow Exceedences are Based on Data Through 1986.

Station Name	Period of Record	U.S.G.S Station Number	Drainage Area (sq. mi.)	Distance from Mouth (mi.)	Slope (ft./mi.)	Altitude (ft.)	Maximum Discharge (cfs)*	Minimum Discharge (cfs)*	Average Discharge (cfs)*	50% Exceedence Flow (cfs)*	95% Exceedence Flow (cfs)*
Sashabaw Creek near Drayton Plains	1960-1987	04160800	20.9	65.0	4.6	970	181	0.05	12.7	8.2	0.77
Clinton River near Drayton Plains	1960-1987	04160900	79.2	60.8	5.3	940	276	2.40	50.9	42.1	7.80
Clinton River at Auburn Heights	1935-1940 1957-1982	04161000	123.0	42.3	5.1	846	1700	4.80	104.0	89.2	26.50
Galloway Creek near Auburn Heights	1960-1987	04161100	17.9	39.6	17.5	830	536	0.01	10.6	4.6	0.21
Paint Creek at Rochester	1960-1987	04161540	70.9	33.6	13.4	755	918	1.20	52.6	37.4	12.90
Stony Creek near Washington	1959-1987	04161800	68.2	31.9	14.5	773	427	0.90	43.0	29.5	6.80
Stony Creek near Romeo	1965-1987	04161580	25.6	-	-	-	290	0.92	17.6	11.0	2.20
Red Run near Warren	1980-1987	04162010	**	-	-	-	2940	0.30	31.1	6.4	1.70
Big Beaver Creek near Warren	1959-1987	04162900	23.0	4.2	21.6	599	1240	0	4.7	2.0	0.15
Plum Brook near Utica	1966-1987	04163400	16.5	6.2	25.4	625	1160	0	13.5	4.9	0.64
Clinton River near Fraser	1948-1987	04154000	444.0	15.4	7.1	578	8840	47.00	381.0	262.0	92.00
East Pond Creek at Romeo	1959-1987	04154100	21.8	3.6	17.2	780	358	0.80	16.1	10.2	2.30
East Branch Coon Creek, Armada	1959-1987	04164300	13.0	13.9	7.9	735	910	0	7.3	0.8	0.07
North Branch Clinton River near Mt. Clemens	1948-1987	04164500	199.0	11.0	19.9	576	6700	0.20	127.0	37.6	4.10
Clinton River at Mt Clemens	1935-1987	04165500	734.0	-	-	570	21200	**	542.0	300.0	91.2

* cubic feet per second
** indeterminant

Source: USGS 1987



ure 3.9. Location of active U.S. Geological Gag Station in the Clinton River Basin, 1987.

high-rise hotel in mucklands that are inundated with flood water every time it rains. However, the land use also impacts the quality and quantity of water leaving the site. For instance, a very different quality and quantity of materials leave a parking lot or industrial site than a grassy meadow. Clinton River Basin land uses (1975) by river section are shown in Table 3.3. In 1985, the basin-wide estimated land use was 52 percent grassland or brushland, followed by 20 percent active cropland, and 28 percent urban use (T. Starbuck, SEMCOG, Personal Communication October, 1987).

In 1975, grassland or brushland dominated the watershed in river Sections 1, 2, 3, 5 (reported as one unit), and 6, while urban dominated the land use type in river Section 4.

In 1985, active cropland decreased and was converted into fallow fields (grasslands) or to urban land. Urban land was estimated to increase from 24 percent in 1975 to 28 percent in 1985. (T. Starbuck, SEMCOG, Personal Communication, October, 1987).

The entire AOC is urbanized. Areas along the main branch of the river and Red Run experienced rapid urbanization with population growth rates which quickly surpassed projections. This rapid population rise resulted in overtaxed municipal facilities such as storm drains, sewers, and treatment works (SEMCOG, 1978a).

3.3.2 Sewer Service Area

Seven continuously discharging wastewater treatment facilities are located in the Clinton River Basin, but not all domestic or industrial wastewater is treated in the Clinton River watershed or discharged to the Clinton River. Urban areas surrounding Pontiac, Rochester, Mt. Clemens, Armada, Almont, Romeo and Warren are serviced by local WWTPs. Most of the remaining population in the Clinton River watershed is serviced by the Detroit WWTP which discharges to the Detroit River. Communities within the southern corner of the Clinton River watershed, including Utica, Sterling Heights, Troy, Birmingham, Clawson, Beverly Hills, Royal Oak, Madison Heights, Berkley, Centerline, Southfield, Huntington Woods, Pleasant Ridge, Ferndale, Hazel Park, Fraser, Roseville, and the Village of Lake Orion, Clarkston, and several other small northern communities are also serviced by the DWWTP (Figure 3.10). However, not all surface runoff from this geographic area goes to Detroit.

The Twelve Towns district of the Red Run watershed is drained via a combined sewer network (USCOE, 1979). The area is serviced by the Twelve Towns Drain Relief District [also known as the Southeast Oakland County Sewage Disposal System (SOCSDS)] which has a retention basin with a storage capacity of 90 million gallons. Wet weather overflows occur when this capacity and the Dequindre Interceptor capacity (21 million cubic feet per day) is exceeded. Overflows averaged 12 per year between 1973-1987, and are chlorinated prior to discharge to Red Run.

Red Run became an artificial drainage channel from Dequindre Road to the Clinton River (11 miles) in 1952. The drain ranges from 40 to 110 feet wide and drains 140 densely developed square miles (USCOE, 1979).

Table 3-3. Land Use Summary of the Clinton River Basin

River Section Drainage Area	Main Branch Total Hectares (Acres)	Urban Hectares (Acres)	Active Cropland Hectares (Acres)	Grassland Brushland Hectares (Acres)
River Sections 1, 2, 3 and 5	82,015 (225,143)	22,107 (54,627)	3,633 (31.460)	56,275 (139,056)
River Section 6 North Branch	72,812 (179.921)	4,710 (11,639)	41,811 (103,316)	26,291 (64,966)
River Section 4 Red Run	32,892 (81,280)	20,027 (49,486)	622 (1,537)	12,445 (30,257)
TOTAL	197,719 (486,343)	46,844 (115,572)	46,066 (136,312)	94,811 (234,279)
PERCENT OF TOTAL	100%	23.8%	28.0%	48.2%

Source: Modified from SEMCOG 1978a

Figure 3.10 Suburban sewer interceptor map for areas in the Clinton River Watershed serviced by the Detroit WWTP.

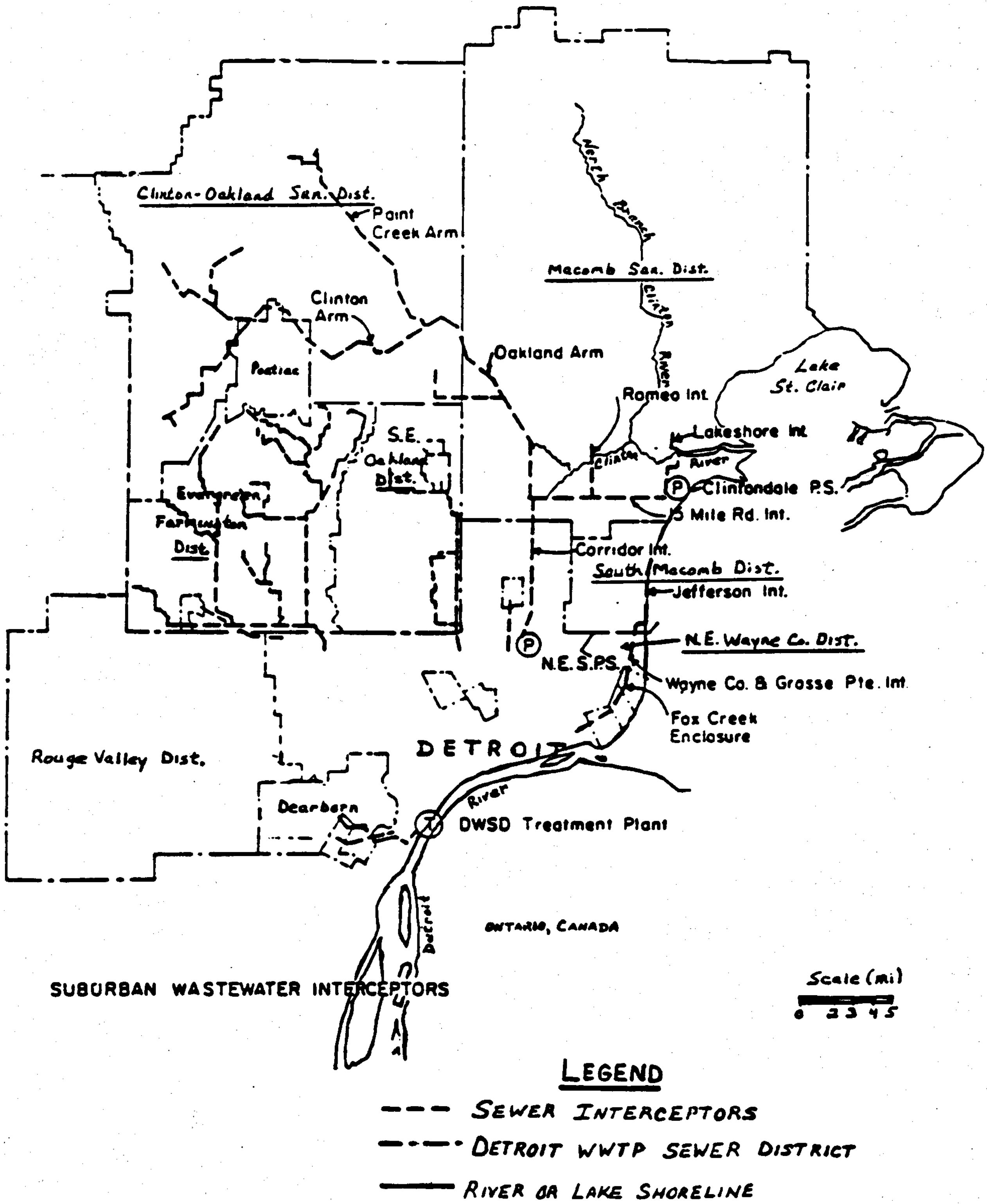
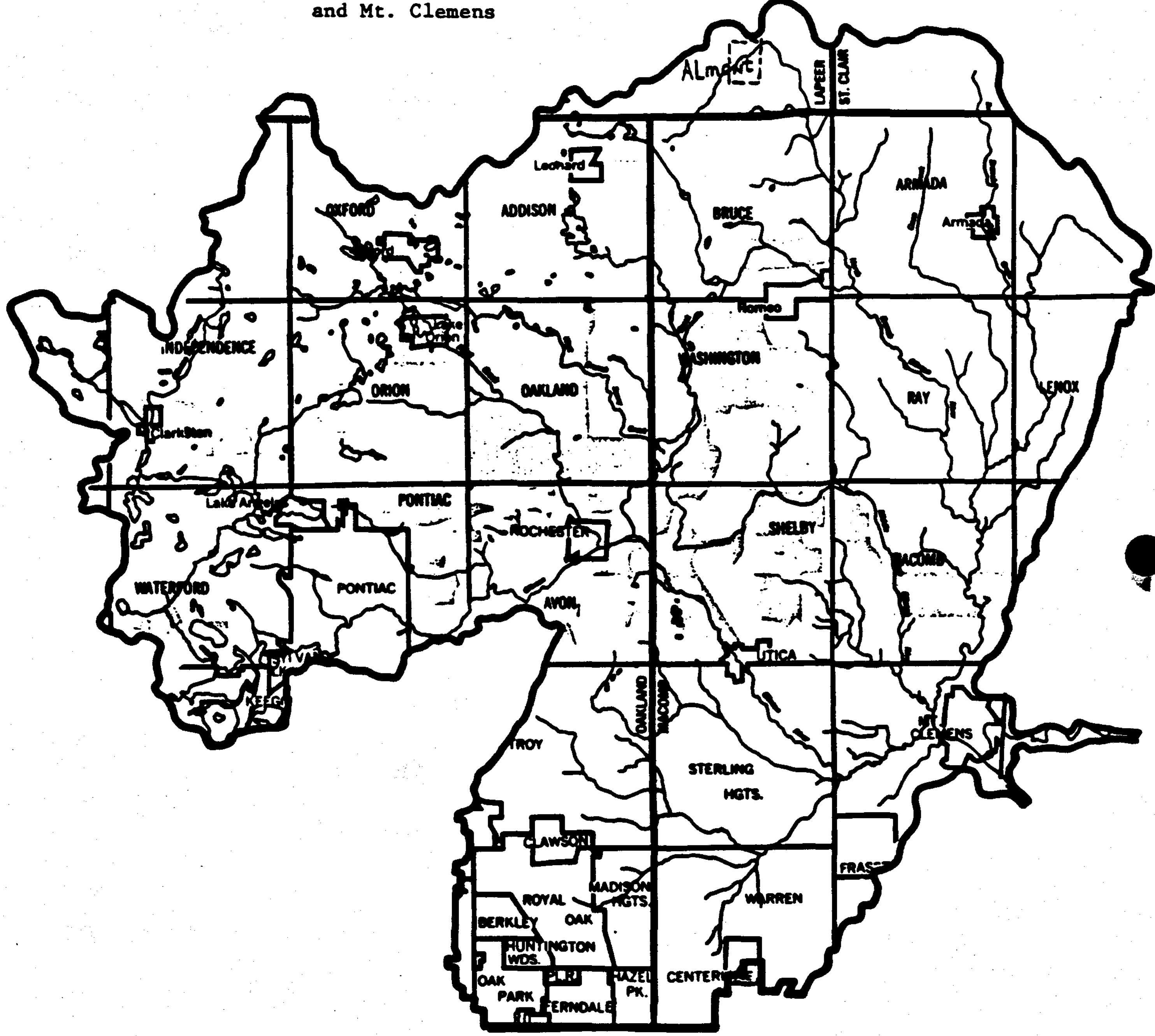


Figure 3.11 **PRIORITY SEPTIC SYSTEM MANAGEMENT AREAS IN THE CLINTON RIVER BASIN**
and
local sewer service districts of Pontiac, Rochester, Romeo, Almont, Armada, Warren, and Mt. Clemens



Priority area for septic system management.

SURFACE WATER

0 10 20 Kilometres
0 5 10 Miles
north

CLINTON RIVER

Source: SEMCOG 1981

3.3.4 Industrial

The main industries in the watershed are automotive related and are centered in Pontiac and the southeastern metropolitan area. MDNR estimates that major manufacturing comprised approximately 1 percent of the land use in the basin, while light industrial and minor manufacturing may account for up to 10 percent of the land use.

3.3.5 Recreation

The Clinton River Basin has numerous parks and open spaces that are dependent on high water quality to provide opportunities for water oriented recreation, i.e., swimming, boating, and fishing. The greatest amount of recreational activity occurs in the western portion of the basin. The Rochester-Utica State Recreation area, located along the main branch of the Clinton River contains some of the most scenic areas in the watershed (SEMCOG, 1978a).

Metropolitan Beach, located on Lake St. Clair between the spillway and the mouth, is a major recreation area near the AOC. Metropolitan Beach provides access for hiking, fishing, swimming, and other water activities that require good water quality for optimal use (SEMCOG, 1978a).

3.3.6 Agriculture

About 20 percent of the land use in the Clinton River watershed is active cropland, most of which is in Section 6. Soybeans, corn, and wheat are the major crops (SEMCOG, 1978a).

3.3.7 Wildlife Habitat

Information on land use for wildlife habitat is minimal. The most valuable wildlife habitat lies in the western portion of the watershed and in the less populated areas near the headwaters of the tributaries. The AOC is highly urbanized with wildlife habitat restricted mainly to parks and the river (SEMCOG, 1978a). No Federally listed endangered or threatened species reside in the area (Best, 1986).

3.4 CLINTON RIVER WATER USES

3.4.1 Water Supply

Clinton River water withdrawals are mainly for industrial and agricultural water supply. No drinking water is obtained from the Clinton river. A majority (87 percent) of the watershed population is serviced by the Detroit Water and Sewage Department which uses Lake Huron and the Detroit River as their potable water sources. Mt. Clemens takes its drinking water from an intake south of the Clinton River approximately 300 yards north of the spillway and 5,000 feet offshore in Lake St. Clair. Most small municipalities in the northern part of the watershed rely on groundwater to drink.

3.4.2 Fish and Wildlife Habitat

Most of the significant water-related wildlife habitat in the Clinton River Basin exists along Stony Creek, East Pond Creek, Paint Creek, in the lakes region above Pontiac (Section 5), and the Middle and North Branches (Section 6).

The lower Clinton River is a designated warmwater stream. The US Army Corps of Engineers (1976) reported that yellow perch and alewives dominated fish collections in the lower river in September, 1975. Recent sampling of game fish within the recreational navigation channel include northern pike, yellow perch, pumpkinseed, large and smallmouth bass, rock bass, white bass, black crappie, walleye, and muskellunge (R. Haas, Personal Communication, 1987, MDNR).

3.4.3 Sport Fishing

Sport fishing is common and expanding in the Clinton River watershed. Portions of Paint Creek, East Pond Creek, Gallager Creek, and tributaries to the North Branch upstream of East Pond Creek are designated coldwater streams and stocked annually with brown trout. Stony Creek, above Stony Creek Impoundment, is currently stocked annually with brown trout. Both brown and naturally reproducing brook trout have been collected in stream shocking surveys of the North Branch and Paint Creek (Spitler, MDNR, Personal Communication, 1987). Resident populations of brown trout in the Main Branch of the Clinton River have been established due to annual stocking of 1,500 yearling trout at each of the following stations for the past five years: Crooks Road, Avon Road, Dequindre Road, and Ryan Road (not stocked in 1987) (Spitler, Personal Communication, 1987).

There has been a resurgence of sport fishing in the main branch of the river. In the 1960's, the U.S. Fish and Wildlife Service (USFWS) conducted a survey along the main branch of the Clinton River from Pontiac to the confluence of the North Branch and found no living fish (Johnson, 1984). In 1980, the USFWS recorded 33 species in that section. In 1984, an area downstream of Yates Dam was sampled by the MDNR Fisheries Division with a D.C. backpack shocker. Four chinook salmon fingerlings (1.5-2.0 inches) were captured downstream of Avon Road (Section 5). The abundance of spawning gravel, combined with the presence of fingerlings is evidence of successful natural reproduction in the mainstream of the Clinton River (Nuhfer, MDNR, Personal Correspondence, 1984). The Lake St. Clair Advisory Committee in conjunction with the MDNR Fisheries Division have been working toward increasing the walleye spawning population by planting fingerlings in the Clinton River. Eggs are obtained from walleye captured during the spring "spawning runs" and are raised in the Selfridge Air National Guard ponds (Haas, MDNR, Personal Communication, 1986).

The USFWS fish sampling effort confirms the development of this fishery with estimated 1980 and 1981 spawning runs of 18,700 to 24,000 walleye. Natural reproduction has not yet been documented.

There is no commercial fishing in the Clinton River.

Once water quality appeared to improve sufficiently, MDNR Fisheries Division planted steelhead trout as well as brown trout at a rate of 15,000 smolts each year below Yates Dam. The resulting spring and fall fishery is bringing increasing numbers of anglers to the lower river each year. These anglers are discovering improved fisheries for chinook salmon, coho salmon, steelhead trout, and brown trout in the fall. More trout and steelhead are also present in the spring, along with walleye and suckers.

3.4.4 Contact Recreation

Other than fishing, canoeing and swimming are the major recreational activities in the Clinton River watershed. Most total body contact recreation occurs in the upper reaches and lakes region or at Metropolitan Beach on Lake St. Clair. All public bathing beaches are monitored for bacterial contamination and all are located on lakes. Refer to Chapter 4 for information on beach closings.

3.4.5 Noncontact Recreation

The flood plain along the Clinton River is available for various forms of noncontact recreation. Numerous wetlands and bird/mammal sanctuaries exist. The Rochester-Utica State Park is a popular area for canoeing, camping, hiking, and fishing.

3.4.6 Navigation and Channel Maintenance

The Clinton River is not used for commercial navigation, but the USCOE has maintained a recreational navigation channel from Cass Street Bridge (River Mile 7.5) to the eight-foot contour in Anchor Bay since the late 1800's. The authorized dredged channel is 15.2 meters (50 feet) wide and 2.4 meters (8 feet) deep at Cass Avenue to near the mouth where it widens gradually to approximately 90 meters (300 feet). There are 47 marinas and boat facilities along the Clinton River between Mt. Clemens and the natural channel mouth (USCOE, 1986).

The river hydrology and local topography described in earlier sections of this report describe river Section 1 as a depositional zone. Sediments from upstream are deposited as the velocity approaches zero, or actually flows upstream. The Clinton River is an extension of Lake St. Clair throughout river Section 1. At one time dredged river sediments, called dredge spoils, were probably deposited behind bulkheads along the river bank and used to raise the level of the land along the river for residential development. Some may have also been side cast along the dredged channel within the river itself, or deposited in open Lake St. Clair. As concern for the environment became more widespread, people realized that these generally silty clay sediments were not environmentally compatible with the sediments in the open lake. They also learned that sediment metals levels might be harmful to bottom- dwelling aquatic life, so they began placing dredge spoils in confined disposal facilities.

Table 3.4 Comparison of estimated and percent annual loadings to the Clinton River by Sections.

Area		Point Source	Urban Stormwater	Runoff from Grassland	Runoff from Active Cropland	Combined Sewer Overflows	Total
Section 1,2,3, and 5							
Metric	(SS)	299.0	29969	811	1247	0	31666.0
Tons	(BOD)	338.0	996	72	101	0	1507.0
Per	(N)	301.0	129	33	48	0	511.0
Year	(P)	21.9	55	5	7	0	88.9
Percent	(SS)	0.8	92.7	2.6	3.9	0	100%
Load	(BOD)	22.4	66.1	4.8	6.7	0	100%
	(N)	58.9	25.2	6.5	9.4	0	100%
	(P)	24.6	61.9	5.6	7.9	0	100%
Section 4							
Metric	(SS)	199.2	18223	87.0	38.0	636.0	19129.2
Tons	(BOD)	49.8	620	27.0	29.0	170.0	889.8
Per	(N)	3.9	78	13.5	11.5	49.0	155.9
Year	(P)	14.9	34	1.2	1.0	18.4	69.5
Percent	(SS)	0.7	95.3	0.5	0.2	3.3	100%
Load	(BOD)	5.6	69.7	3.0	2.6	19.1	100%
	(N)	2.5	50.0	8.7	7.4	31.4	100%
	(P)	21.4	48.9	1.7	1.5	26.5	100%
Section 6							
Metric	(SS)	41.1	12865	1523.0	25722	0	40151.1
Tons	(BOD)	29.1	440	109.0	2012	0	2590.1
Per	(N)	20.1	56	56.0	1170	0	1302.1
Year	(P)	10.3	24	7.5	129	0	170.8
Percent	(SS)	0.1	32.0	3.8	64.1	0	100%
Load	(BOD)	1.1	17.0	4.2	77.7	0	100%
	(N)	1.5	4.3	4.3	89.9	0	100%
	(P)	6.0	14.1	4.4	75.5	0	100%
Total Basin							
Metric	(SS)	419.4	60457	2421.0	27007.0	636.0	90940.4
Tons	(BOD)	411.2	2056	208.0	2136.0	170.0	4981.2
Per	(N)	324.5	263	102.5	1229.5	49.0	1968.5
Year	(P)	46.8	113	13.7	145.0	18.4	336.9
Percent	(SS)	0.4	66.5	2.7	29.7	0.7	100%
Load	(BOD)	8.2	41.3	4.2	42.9	3.4	100%
	(N)	16.5	13.4	5.2	62.4	2.5	100%
	(P)	13.9	33.5	4.1	43.0	5.5	100%

Table 3.5 Marinas and Boat Facilities located in the Vicinity of the Clinton River Federal Navigation Project

1.	Aggressive Yacht Sales	30575 South River Road
2.	Albatross Yacht Club	29325 South River Road
3.	Atlantis Marine & Industrial	32020 North River Road
4.	J. Remi Blom	28830 North River Road
5.	Blue Water Marine Corp.	30200 North River Road
6.	Bryers Marina	31580 North River Road
7.	Burr Yacht Sales, Inc.	32575 South River Road
8.	C & N Marina	32241 North River Road
9.	C & N Marina	30600 North River Road
10.	Clinton River Marina	32190 North River Road
11.	Duffy Marine	32393 South River Road
12.	Ed's Marina	31677 South River Road
13.	Fox Marine	32525 South River Road
14.	Gasow Pte.	33001 South River Road
15.	Elizabeth K. Gasow	32795 South River Road
16.	Douglas J. Harvey	31707 South River Road
17.	Jerry's Boat Livery	32705 South River Road
18.	Land's End Marina, Inc.	32894 South River Road
19.	Lighthouse Inn	32100 North River Road
20.	Marina Office	30281 South River Road
21.	Mariners Boat Club	31970 North River Road
22.	Mariners Landing, Inc.	31950 North River Road
23.	Markley Marine, Inc.	31300 North River Road
24.	Virginia Marsh	31675 South River Road
25.	Ken Marshall's Marina	31687 South River Road
26.	McMachen Marina	30077 South River Road
27.	Michigan Marine and Salvage	32475 South River Road
28.	Morsal Marina	32825 South River Road
29.	North River Road Marina	30310 North River Road
30.	North Star Sail Club	32041 South River Road
31.	Pal Marina	31743 South River Road
32.	Pearson Yachts	32685 South River Road
33.	Penta Marina	30292 North River Road
34.	Pier 7	30400 North River Road
35.	Chris Pike Marine Services	31695 South River Road
36.	Romick's Boats	32081 North River Road
37.	Ruddy's Landing	31785 South River Road
38.	Sail Haven South	32393 South River Road
39.	Sail Haven North	30310 North River Road
40.	Sailmaster's of Michigan	30055 South River Road
41.	Sailor's Cove Marina	30200 North River Road
42.	Sarns Marine Manufacturing	30530 North River Road
43.	Scrimshaw Yachts	31637 South River Road
44.	Ship Chandler Marina	32489 South River Road
45.	South Bank Marine	31784 South River Road
46.	South River Marina	31865 South River Road
47.	Turowskie's	31631 South River Road

* Compiled from 1986 Michigan Department of Resources - Land Resource Program Data and 1982 Michigan State University Cooperative Extension Service

Between 1964 and 1979, dredge spoils were deposited in a Confined Disposal Facility (CDF) near the river mouth. The CDF reached capacity in 1979. In January, 1976 the USCOE prepared a draft Environmental Impact Statement (EIS) for maintenance dredging and a replacement CDF (USCOE, 1976). The project did not proceed for lack of a local sponsor. In 1982, the MDNR assumed this role and in 1986, the USCOE prepared a supplementary draft EIS for a proposed CDF (USCOE). This CDF will hold 291,200 cubic meters (370,000 yd^3) of dredged material. An estimated backlog of 148,000 cubic meters (175,000 yd^3) of undredged sediment is presently in the authorized recreational navigational channel (USCOE, 1987). The CDF was completed in the Fall of 1988.

3.4.7 Waste Disposal

The Clinton River is used as a receiving stream for treated municipal and industrial wastewater from Pontiac, Rochester, Warren, Romeo, Almont, Armada, and Mt. Clemens.

In 1986, municipal and industrial discharges accounted for 0.4 percent of the suspended solids, 69 percent of the BOD_5, 14 percent of the total nitrogen, and 11.7 percent of the total phosphorus in the Clinton River basin (Table 3.4). Total NPDES permitted flow from industrial and municipal facilities, 126 cfs, is a significant percentage of the total 95 percent exceedence flow of the Clinton River (Table 3.1) (Figure 3.7).

Numerous landfills, waste disposal sites, Act 307 sites of possible environmental contamination and hazardous waste treatment, storage and disposal facilities are located in the Clinton River basin (see maps 6.6, 6.7, and 6.8). Movement of waste or contaminants from these sites to the Clinton River or its tributaries is not well documented. These sites are discussed in Chapter 5.

3.5 LAKE ST. CLAIR WATER USES

Lake St. Clair is the receiving water for the Clinton River but is not part of the Area of Concern.

Lake St. Clair connects Lake Huron with Lake Erie via the St. Clair and Detroit Rivers, and is a vital link for Great Lakes commercial water transportation. It is the most concentrated center of recreational boating in the world (Johnson, 1983). Johnson (1985) reported that over 50,000 pleasure boats use Lake St. Clair annually. The Lake St. Clair Clinton River area supports approximately 100 marinas with an estimated 0.5 million user days which generate an annual income of $3 million (Johnson, 1983) (Table 3.5).

3.5.1 Fish and Wildlife Habitat

Lake St. Clair provides much habitat for fish and birds, and is an important resting site for birds along the Mississippi flyway (Best 1986). The Michigan side of Lake St. Clair is largely developed, but some areas are suitable waterfowl habitat. A large number of wintering and migratory waterfowl, including redhead, canvasback, common goldeneye, and bufflehead ducks, as well as tundra swans, are periodically found (Best, 1986).

Lake St. Clair supports a variety of sport fish and is best known for its walleye and muskellunge fishing. Commercial fishing on the lake has been banned for many years (R. Sptiler, Personal Communication, 1987). Other species commonly caught include: northern pike, yellow perch, black crappie, rock bass, large and smallmouth bass, channel catfish, and bluegills. The MDNR presently supports trout and walleye stocking in the Clinton River, Lake St. Clair vicinity (Limno-Tech, 1985). Spawning areas for largemouth bass, channel catfish, and bluegill are located near the mouth of the spillway.

The Lake St. Clair Fisheries Station found the most common catches to be walleye, rock bass, and yellow perch in a seven month sampling period. Haas, et al (1983) found that over half of the sport fishing in Lake St. Clair occurs in Anchor Bay.

3.5.2 Limnology

Limnological data characterizing nearshore Lake St. Clair in the vicinity of the Clinton River natural channel and the spillway mouths are sparse. In 1973, water quality in the vicinity of the Clinton River natural channel and spillway mouth was surveyed (MDNR, 1973). Lake St. Clair in the vicinity of the Clinton River spillway mouth was characterized as eutrophic.

This conclusion was based on elevated total phosphorus and chlorophyll a concentrations, low diversity and pollution tolerant dominated benthic macroinvertebrate communities, and typically eutrophic phytoplankton assemblages dominated by *Stephanodiscus* sp. In addition, sediments at the spillway mouth contained elevated levels of heavy metals and PCB. These data suggest that loading from municipal and/or industrial discharges were entering Lake St. Clair through the spillway. Those conditions were not reported off the natural Clinton River mouth. No bacteria problems were reported.

In 1980, the MDNR surveyed a similar area to assess the fecal coliform concentrations in nearshore Lake St. Clair. Fecal coliforms exceeded MWQS for a radius of 3,000 feet from the mouth of the Clinton River spillway, but not off the mouth of the natural channel. The most likely source of the bacteria was from the Clinton Township WWTP Number One outfall, located immediately upstream of the weir at the entrance to the spillway. This WWTP was decommissioned in 1981.

3.6 WATER QUALITY STANDARDS, GUIDELINES, AND DESIGNATED USES

Michigan's Water Quality Standards were amended in November, 1986 and are included as Appendix 3.3 (MWRC, 1986). Major standards affecting the AOC are:

1. All waters of the State are protected for total body contact during warm water months (i.e., waters shall not contain more than 200 fecal coliform organisms per 100 milliliters) (Rule 323.1062).

2. A minimum of 7 mg/l of dissolved oxygen in all Great Lakes and connecting waterways shall be maintained. A minimum of 7 mg/l dissolved oxygen shall be maintained in river segments designated for coldwater fish. All other warm water rivers shall maintain 5 mg/l of dissolved oxygen (Rule 323.1064).

3. Waters that serve as migratory routes for anadromous salmonids shall maintain a minimum of 5 mg/l of dissolved oxygen (Rule 323.1064).

4. Dredging/CDF projects are not necessarily exempt from standards.

In addition, the provisions of the antidegradation rule have been strengthened. All Michigan waters of the Great Lakes, trout streams, reaches of county/scenic, wild/scenic, and scenic/recreational rivers are protected against any degradation of water quality. Dredging criteria are based on U.S. EPA Dredge Spoil guidelines.

4. DEFINITION OF THE PROBLEM

4.1 IMPAIRED USES, USE ATTAINABILITY, AND OTHER PROBLEMS

The designated uses of the Clinton River are described in Section 1.6. The only known use impairments in the AOC are: (1) Agricultural water use for irrigation, because waters in the AOC exceed Michigan's Water Quality Standards for total dissolved solids (500 mg/l) (Rule 323.1051); (2) Aquatic life (Rule 323.1100), because a diverse and abundant macroinvertebrate community is not present in the AOC and does not support a healthy resident warmwater fishery.

This chapter identifies the locations where these local impairments occur. Other problems, including low dissolved oxygen, beach closings, partial/total body contact recreation, loss of aesthetic qualities, human health impacts, sediment transport, sedimentation, and urban storm water are reviewed here since they relate to water quality and past and/or present exceedences of Michigan's Water Quality Standards.

- <u>Impairment of Agricultural Use for Irrigation Due to High Total Dissolved Solids (TDS)</u>

  TDS is determined by weighing the residue left after a filtered water sample is evaporated. Elevated concentrations of TDS usually contain chlorides over 500 mg/l resulting in objectionable tastes. It is primarily of interest for agricultural irrigation since elevated levels of TDS can have detrimental effects on sensitive crops. Michigan's WQS Rule 323.1051 requires that TDS not exceed 500 mg/l as a 30-day average and at no time is TDS in the water to exceed 750 mg/l as a result of controllable point sources. TDS are related to soil types, with fine clay and silty soils producing higher TDS than coarse soils. The soils in the Clinton River watershed are generally clay-silt resulting in high background TDS ranges from 300 mg/l to 500 mg/l TDS (Figures 4.1 and 4.2). Average measured TDS concentrations from Clinton River tributaries, including Paint Creek, Stony Creek, Trout Creek, and East Pond Creek, range from 300 to 330 mg/l upstream of any point source discharges. Urban nonpoint and point source loadings add to the already high TDS levels resulting in concentrations exceeding Michigan's Water Quality Standards. TDS is not a treatable parameter.

- <u>Degraded Benthic Macroinvertibrate Community</u>

  Pollution-tolerant macroinvertebrate species have long dominated in the AOC. Likely causes are a combination of low dissolved oxygen levels, sediment contaminants, and unsuitable substrates for aquatic life. It is unlikely that high quality aquatic life will exist in the AOC, primarily due to stagnant conditions and poor substrate (See Section 4.3.1, Dissolved Oxygen).

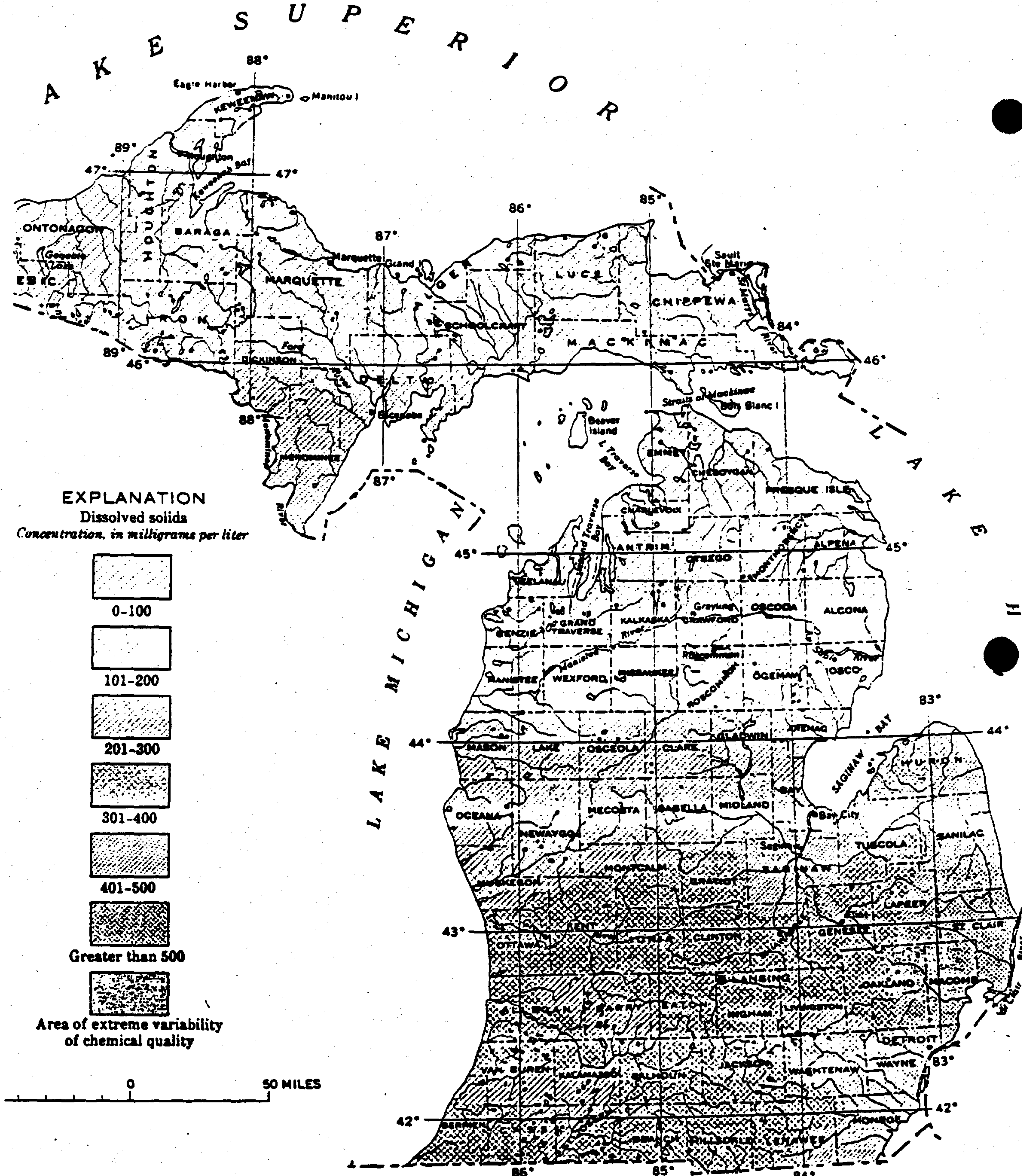


Figure 4.1 Concentration of dissolved solids in streams under low-flow conditions.

Source: U. S. Geological Survey, 1970.

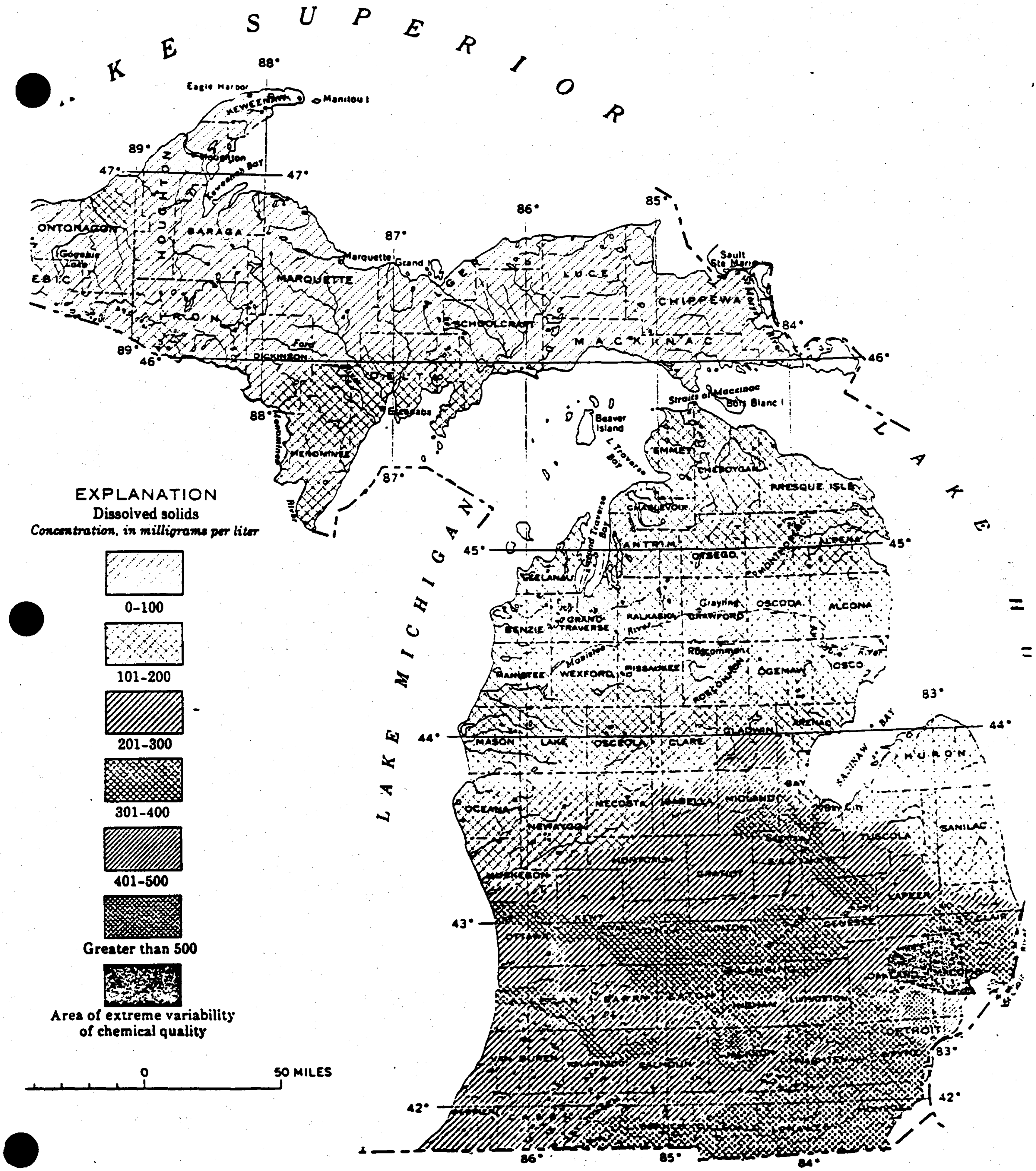


Figure 4.2 Concentration of dissolved solids in streams under high-flow conditions.

Source: U.S. Geological Survey, 1970.

- Degraded Warm Water Resident Fish Community

  Degraded resident fish communities are present in the AOC, most likely due to poor oxygen concentrations resulting from stagnant water, high sediment oxygen demand, enriched conditions, and possibly poor physical habitat.

4.1.1 Definition of the Problem

The Clinton River was identified by the IJC as an AOC several years after the State of Michigan had identified it as a "problem area." The original problems identified by Michigan included those that were, and still are, associated with many urban areas including excessive loadings of conventional pollutants and heavy metals which tend to accumulate in and contaminate river sediments. These pollutants result in the inability of healthy communities of aquatic life to dwell in the river. Most of these problems are localized and do not result in impairments in the Great Lakes.

The sources of these pollutants include industrial and municipal treatment plants but urban stormwater appears to be the major contributor for many contaminants. Excessive conventional pollutants (i.e. nutrients) generally give rise to enriched conditions resulting in aesthetically unpleasant water quality. These conditions also result in widely fluctuating dissolved oxygen concentrations allowing only pollution tolerant aquatic organisms to survive. As a result, the majority of naturally occurring water purification organisms are impacted, drastically reducing the density and diversity of the aquatic community. Consequently, the assimilative capacity of the stream is reduced and stream quality recovery time is greatly lengthened causing desirable fish communities to avoid these areas.

Lack of oxygen is toxic to some sedentary aquatic organisms. Toxicity may also occur if other contaminants in the water exceed long-term safe concentrations for naturally occurring aquatic organisms. Long-term safe concentrations have not been determined for many contaminants either individually or in the myriad of possible combinations of contaminants that could occur. Furthermore, species specific chronic toxicity values are not available. However, criteria for some contaminants have been established based on the most sensitive species tested in laboratory and field bioassays.

An additional urban problem is fecal coliform bacteria, which has been used to indicate the presence of human wastes in aquatic systems. Water is used to transport domestic waste to wastewater treatment plants via sewers which may also receive stormwater. The wastewater treatment plants occasionally overflow untreated combined wastewater and stormwater during wet weather, and then fecal coliform bacteria are found in the surface water, making it unhealthy for total body contact recreation.

4.1.2 Beach Closings and Partial/Total Body Contact Recreation

In the past, Metropolitan Beach on Lake St. Clair had been periodically closed due to the presence of elevated levels of fecal coliform bacteria in the water (Table 4-1). In recent years (1983 to present) this has not been a problem (Figure 4.3).

Limited data are available concerning the suitability of the rest of the AOC for partial and total body contact recreation. In 1980 fecal coliform concentrations exceeding the State Water Quality Standard of 200 organisms/100 ml occurred at the mouth of the spillway channel (Horvath, 1981). No studies have been done to document the absence of fecal coliform bacteria, but the suspected source was eliminated in 1981.

Generally, the high fecal coliform problems experienced in the Clinton River basin have been resolved by upgrading WWTPs, chlorinating large known CSOs in the lower river, fixing sewer line breaks as they occur, and discontinuing flows from outdated facilities. The only CSOs in the basin that do not receive primary treatment and chlorination prior to discharge are at Armada.

4.1.3 Urban Stormwater

Urban stormwater entering the river via storm sewers that may contain many contaminants is uncontrollable at present, and contributes to flooding.

There are few methods to deal with stormwater other than retention basins in the headwaters. The extent of impact of stormwater flow and contaminant loadings has not been measured and will be difficult to quantify given the variability of natural systems.

4.1.4 Loss of Aesthetic Qualities

There are no documented reports of aesthetic impacts caused by poor water quality in the AOC. Occasionally, however, the stagnation of river water at Mt. Clemens has resulted in undesirable odors.

4.1.5 Human Health Impacts

There are no reported human health impacts in the AOC.

4.1.6 Sediment Transport and Sedimentation

Sedimentation in the lower Clinton River (Sections 1 and 3) occurs naturally because of the local topography and soil types. The lower 10-17 miles acts as a natural settling basin.

Two things have recently occurred that exacerbate sedimentation in Section 1.

A. High Great Lakes water levels result in stagnation, producing estuary conditions, and causing the spillway weir to be submerged nearly all of the time.

Table 4.1. Dates and locations where fecal coliform bacteria concentrations historically exceeded Michigan's Water Quality Standards, and recent sampling results indicating that fecal coliform bacteria are no longer exceeding these standards. Sources: MDNR undated file, and Macomb County Health Department, 1987.

Public Bathing Beach	County	Time Period	Cause
A. Water Year 1977-78			
New Baltimore	Macomb	7/31-8/11	Clinton River Sewer Spill
Metropolitan Beach	Macomb	7/31-8/11	Clinton River Sewer Spill
Metropolitan Beach	Macomb	Labor Day	Clinton River Sewer Spill
Memorial Park	Macomb	Labor Day	Clinton River Sewer Spill
St. Clair Shores Civic Center	Macomb	Labor Day	Clinton River Sewer Spill
B. Water Year 1982-83			
Civic Center Beach	Macomb	7/22/83	Sanitary Sewer Break
Memorial Park	Macomb	7/29/83	Sanitary and storm sewer discharge from the Martin retention and settling basin

ANNUAL GEOMETRIC MEANS-FECAL COLIFORM

Sampling Location*	1984	1985	1986
No. 1	14	4	7
No. 2	14	4	7
No. 3	12	9	7
No. 4	12	5	5
No. 5	12	3	4
No. 6	14	3	6
No. 7	12	7	19
No. 8	16	6	11
No. 9	10	5	5
No. 10	12	10	4

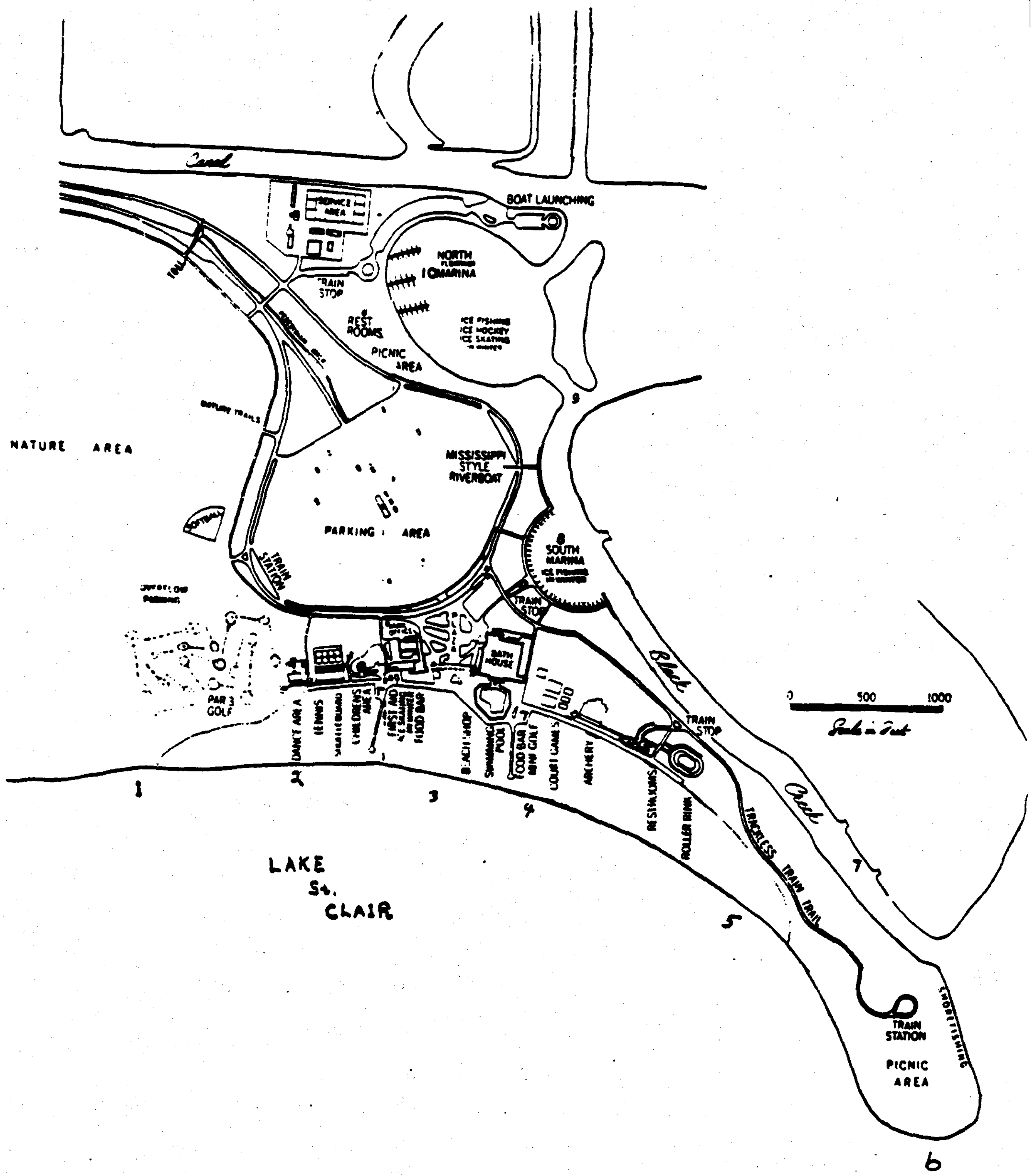
The sampling locations are described as follows:

Sampling locations 1-6 are evenly divided across the beach front with location one being at the East end and location six being at the West end;

- location seven is the point where the Black River discharges into the lake;
- location eight is the Black River at the Metro boat harbor;
- location nine is the Black River at the entrance to the Metro boat basin;
- location 10 is the Metro boat basin.

* See figure 4.3 for locations

Figure 4.3. Fecal Coliform sampling stations near Metropolitan Beach 1984-1986.



B. The submerged weir allows much of the Clinton River flow to go down the Spillway instead of the natural channel. This results in increasing sedimentation in the natural channel, which further decreases the flow down the natural channel because of partial channel blockage at the natural channel/spillway divergence.

These problems are not unique to the Clinton River, nor have they been ignored in the Clinton River Basin; but, they are localized and do not reach the Grat Lakes. Remedial actions are already in place and their estimated cost to date is discussed in Chapter 7. However, several hydrologic, topographic, and geographic factors described in Chapter 3 magnify the above problems in the AOC.

With the exception of sediment transport and sedimentation, these problems are primarily restricted to urban areas.

4.1.7 Degree of Problem Resolution by Catagory Within River Section

All of the problems identified by the WQB do not exist in all river sections. Some are naturally occurring problems from urban development or from the basin topography. Also, some problems have been fully resolved while other problems have only been partially addressed. In addition, some problems are just emerging, while for other problems, not enough data exists to determine the extent of problem resolution.

For these reasons, the IJC identified problems were divided into six categories listed below.

Category Number	Degree of Resolution
1.	Historical point source problems that have been resolved.
2.	Historical point source problems that are partially resolved or are being addressed through structural or engineering modifications.
3.	Naturally occurring problems that are continuing to cause aquatic life or agricultural impacts.
4.	Problems from urban development.
5.	Emerging problems.
6.	Not enough data to determine the degree of problem resolution.

In the following paragraphs, the degree of resolution by category number is described within each river section.

4.1.7.1 Section 1 - The Natural Channel of the Clinton River Downstream of the Spillway

Category 1

Problems in the natural channel of the Clinton River downstream of the spillway have been historically attributed to upstream point sources, urban runoff, Mt. Clemens WWTP, and CSO loadings. These conventional and metals loadings have been drastically reduced by improvements in upstream point source industrial and municipal treatment facilities. These discharges are presently in substantial compliance with their NPDES permits.

Category 2

A. Reductions in conventional pollutants, fecal coliform bacteria and heavy metals loadings will result when Mt. Clemens completes its normal and wet weather facility (WWTP) improvements (completion date December, 1988).

   Some sediment contaminants are proposed to be removed by dredging by the U.S. COE under the Recreational Navigational Channel Dredging project. The proposed dredging date is 1989 or 1990.

Category 3

A. River velocity is likely to remain unchanged (unless modifications are instituted) resulting in stagnant water and fine particle sedimentation. This leads to poor substrate for the benthic macroinvertebrate community and low dissolved oxygen. Dredging the shoal at the spillway/natural channel split may improve flow.

B. Section 1 will continue to have high total dissolved solids (TDS) concentrations based primarily on naturally high TDS plus wastewater additions. There is no economically achievable treatment for removal of TDS.

Category 4

Continued stormwater loadings from urban runoff contain undocumented quantities of conventional, metals, and organic contaminants which temporarily reduce water quality. These constituents may be transferred to the sediments, resulting in long-term stream degradation.

Category 5

Selfridge Air National Guard Base Landfills - See Section 5.6.2.4 for progress and studies underway.

Category 6

Additional data are needed to document reductions in conventional pollutant and fecal coliform bacteria concentrations and the condition of the benthic macroinvertebrate and resident fish communities inside and outside of the dredged channel.

4.1.7.2 Section 2 - The Clinton River Spillway

The spillway presently has no point source discharges and is basically an extension of Section 3 designed to alleviate flooding by routing the water by a shorter path around Mt. Clemens to Lake St. Clair.

Category 1

Resolved historical problems include elimination of conventional pollutants, fecal coliform bacteria and heavy metals by elimination of some of the direct point source discharges and improvements or removal of upstream discharges. However, there are very little data to document these changes in the spillway.

Category 2

None.

Category 3

Elevated TDS as discussed in category 3 of Section 1

Category 4

Stormwater loading as discussed in category 4 of Section 1

Category 5

None.

Category 6

Additional data is needed to document the sediment oil and grease, heavy metal and organic contaminant concentrations, the benthic macroinvertebrate and resident fish communities, and the bottom sediment substrate types for aquatic habitat suitability.

4.1.7.3 Section 3 - The Main Branch Clinton River Between Red Run and The Spillway

Section 3 is a relatively slow flowing, meandering section which receives a large flow from River Section 4, and a relatively small flow from River Section 6.

Category 1

Resolved historical problems largely reflect upstream reductions of heavy metals and fecal coliform bacteria. Conventional pollutants have also been considerably reduced.

Category 2

Conventional pollutants causing low dissolved oxygen may still be a problem although much work and money has already gone into water quality improvements. More restrictive NPDES permits, improved stormwater treatment, or other alternatives may be necessary in Sections 4, 5, and 6 to meet water quality standards in Section 3.

Category 3

Sedimentation due to geographical and hydrological factors as discussed in category 3A and 3B of Section 1.

Category 4

Urban stormwater as described in category 4 of Section 1

Category 5

None

Category 6

Sediment contaminant concentrations and condition of the benthic macroinvertebrate and resident fish communities as in Section 2.

4.1.7.4 Section 4 - Red Run

Red Run has had major physical alterations and it receives a large intermittent discharge of combined storm and sanitary sewage after primary treatment and chlorination, and a discharge from a major WWTP. Its drought flow is 0.4 cfs, but receives 48 cfs of treated municipal effluent and 20 cfs of industrial noncontact cooling water.

Category 1

Resolved historical problems include conventional pollutants, heavy metals and fecal coliform bacteria from municipal and industrial point sources.

Category 2

Partially resolved historical problems include:

A. Conventional, heavy metals and fecal coliform bacteria from one large intermittent point source (SOCSDS/PCF).

B. Reductions of some sediment contaminants by dredging sediment depositional zones.

C. Some problems with conventional pollutants from municipal discharges may still exist because low dissolved oxygen concentrations are reported in Section 4 and downstream in Section 3.

Category 3

A. TDS as described in Category 3B of Section 1.

B. Build up of sediments in Red Run requiring periodic dredging with unknown impacts on aquatic life.

Category 4

Stormwater as described in Category 4 of Section 1.

Category 5

An emerging problem is the impact of landfill leachate on the aquatic life in Red Run and the Clinton River from old landfills located along Red Run.

Category 6

The extent of oil and grease, heavy metals and organic sediment contamination and the condition of the benthic macroinvertebrate community is unknown.

4.1.7.5 <u>Section 5 - Main Branch Clinton River Upstream of Red Run</u>

Category 1

A. Point source loadings of conventional pollutants, heavy metals and fecal coliform bacteria in water, and sediment oil and grease and heavy metals have been considerably reduced due to improvements in wastewater treatment at municipal facilities.

B. Recovering benthic macroinvertebrate communities

C. Recovering fish community.

Category 2

No new structural improvments occuring at the present.

Category 3

Elevated TDS as discussed in Category 3B of Section 1.

Category 4

Stormwater loadings as discussed in Category 4 of Section 1.

Category 5

The impact of the cessation of flow augmentation at Pontiac on the water quality and aquatic community downstream.

Category 6

The resident fish community downstream from Pontiac may need to be resurveyed to determine its current status.

4.1.7.6 <u>Section 6 - North Branch Clinton River</u>

The watershed of Section 6 is primarily agricultural and most conventional loadings are from nonpoint sources.

Category 1

A. Historical problems resolved include conventional pollutants, metals, and fecal coliform bacteria at Romeo and Almont.

B. Recovered aquatic communities.

Category 2

A. Sediment oil, grease and heavy metal contaminants have been considerably reduced now that Armada has completed its WWTP.

B. Combined sewer overflows at Armada will continue to discharge primarily conventional pollutants resulting in localized water quality and aquatic life degradation until they have completed their CSO project.

Category 3

Elevated TDS as discussed in Category 3 of Section 1.

Category 4

Stormwater loading as discussed in Category 4 of Section 1.

Category 5

None.

Category 6

A macroinvertebrate community survey is needed to document the improvement in stream quality now that Armada has completed its WWTP.

4.2 CONDITION OF THE CLINTON RIVER ECOSYSTEM

The following section describes the chemical conditions of water and sediment in the Clinton River basin between 1970 and 1987. Exceedences of Michigan's Rule 57(2) allowable levels and U.S. EPA dredge disposal guidelines are noted.

Chemical contaminants in fish are described and exceedences of chemical criteria for the edible portions are indicated.

The quality of the aquatic macroinvertebrate and fish communities are described by river section for the years 1970 to 1984, where data are available.

4.2.1 Data Presentation and Description with Respect to Data Tables, Map ID Numbers and Station Codes

The data in this chapter are based on all samples collected during a particular year at each sampling location. In some years there was only one sample at that location and that value is reported. Some years, many samples were taken at that location and the average value is reported. Values less than detection were included as one-half the detection level.

The data are summarized within the six river sections described earlier. Since water flows from upstream to downstream and the impact of point and nonpoint sources is generally cumulative, most discussions of water, sediment, fish, and aquatic macroinvertebrates are generally described by river section in the following order: Sections 5, 4, 3, 6, 2, 1, and 7 where appropriate. Because not all sections have data in all years, the river sections in the data tables are presented in numerically consecutive order. Within each river section, the data are ordered from upstream to downstream to reflect changes across geographical distances within the river sections. Within each station, data are ordered by year to reflect changes across time.

Each station has a map ID number which can be located on the data tables and the attached maps located in Chapter 6. The first value in the map ID number reflects the river section. The remaining two digits reflect the position relative to other river sampling stations for all years from upstream to downstream. Data for all years at a given station may be easily reviewed using the map ID number in the data tables.

The map ID numbers for each data set are unique to that data set and are not transferable to another data set on another map. For example, the 106 in the sediment table is not the same location as 106 on the water or macroinvertebrate table or map. Fish are listed as F106, indicating that they are "fish" only.

The station code abbreviates the document name from which the data were gathered and sometimes the year collected. The last page of each data table shows these station codes and a more complete document citation which can be found in the Literature Cited Section.

4.3 HISTORICAL SUMMARY OF CHEMICAL ANALYSIS OF CLINTON RIVER WATER

All available chemical data between 1970 and 1987 for selected water parameters were reviewed and summarized (Tables 4.2 through 4.4). Major conventional parameters include dissolved oxygen, BOD_5, fecal coliform bacteria, total dissolved and total suspended solids, nutrients, hardness and chlorides. Metals include total arsenic, aluminum, cadmium, copper, chromium, cyanide, iron, lead, mercury, nickel, silver, selenium and zinc. Organic parameters include a variety of classes of materials, some of which are pesticides, herbicides, phthalates, polynuclear aromatic hydrocarbons, and PCB.

These data reflect the chemical analysis of ambient grab samples collected from the Clinton River and its tributaries and reflect the condition of the river where aquatic life live. They do not include effluent samples collected from point source discharges. Loadings from point source dischargers are described in Chapter 5. The intent of this summary is to present general water quality at given locations across the approximate 17-year span.

4.3.1 Conventional Pollutants in Clinton River Water

Total Phosphorus

Phosphorus is generally the limiting nutrient for most aquatic plant growth in the northern midwest U.S. so phosphorus additions normally result in increased plant growth. Increased plant growth sometimes results in nuisance algal growths, and often results in widely fluctuating dissolved oxygen concentrations. Considerable effort has been made to limit phosphorus loading to fresh waters, by reducing phosphorus in soaps and detergents and through large capital expenditures for phosphorus removal from wastewater.

Concentrations of total phosphorus in the Clinton River at station 502 in the 1970s averaged about 0.030 mg/l (see Map 6.1). Downstream of Pontiac, concentrations increased to about 0.135 mg/l and downstream of Rochester, concentrations increased further to 0.178 mg/l (Table 4.2). Phosphorus concentrations reached 0.195 mg/l at station 552 just upstream of Red Run. Total phosphorus concentrations in Red Run were significantly greater, averaging 0.900 mg/l in the 1970s. Flows containing elevated phosphorus from Red Run raised the Main Branch to approximately 0.440 mg/l at station 302.

Samples from Section 6, the North and Middle Branches of the Clinton River, contained phosphorus concentrations averaging nearly 0.200 mg/l, resulting in total phosphorus concentrations approaching 0.300 mg/l at station 310. Local inputs in the vicinity of Mt. Clemens resulted in even higher total phosphorus concentrations in Sections 1 (greater than 0.330 mg/l) and 2 (0.400 mg/l).

By 1980, total phosphorus concentrations were 0.020 mg/l at station 502, 0.070 mg/l downstream of Pontiac, 0.130 mg/l downstream of Section 4, and 0.160 mg/l downstream of Section 6 (Appendix 4.1). Total phosphorus concentrations were locally higher (0.200 mg/l) in Section 1 at stations 103 and 109, and in Section 2 at station 210 in the vicinity of Mt. Clemens. At station 115, concentrations reflect Lake St. Clair water with total phosphorus concentrations at 0.020 mg/l. Reductions in total phosphorus have resulted in improved stream quality in the Clinton River.

Dissolved Oxygen

During the 1970s, the annual average dissolved oxygen (D.O.) ranged from 4.2 to 13.2 mg/l in Section 5 with the lowest values at stations 502, 517, and 556 in the Upper River, below Pontiac, and near the confluence of Red Run and the North Branch. Values ranged from 3.4 to 11.0 mg/l D.O. in Section 4 with lowest concentrations at stations 406, 408, and 409. Section 6 D.O. concentrations were 5.9 mg/l and greater. Section 3 D.O. concentrations ranged from 3.9 to 12 mg/l while Sections 1 and 2

TABLE 4.2. SELECTED CONVENTIONAL CHEMICAL CONSTITUENTS IN CLINTON RIVER WATER, 1970-1984. SECTION 1, MAIN BRANCH OF THE CLINTON RIVER DOWNSTREAM OF THE SPILLWAY. RESULTS ARE YEARLY AVERAGES. RESULTS ARE IN MG/L, UNLESS OTHERWISE NOTED.

MAP ID & YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLRPHYL a (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONZ NH3	NH3 + NH4	NO2 & NO3	ORG. NITR.
									SECTION 1										
101 - 80	DNRWTC-500366	19.5	505.0	11.7	8.1	6.1	31.0	800.0	-	50.0	-	-	-	0.26	0.00	0.022	0.39	1.32	3.20
101 - 84	LTICRS-3	20.0	210.0	9.9	7.8	-	-	-	-	66.0	-	-	-	-	-	-	0.34	0.06	-
102 - 80	DNRWTC-500368	18.2	590.0	12.4	8.2	7.1	31.0	220.0 b	352.0	25.5	6.0	-	-	0.23	0.00	0.034	0.44	1.34	2.20
102 - 84	LTICRS-4	20.3	210.0	9.8	7.3	-	-	-	-	34.0	-	-	-	-	-	-	0.44	<0.05	-
103 - 84	LTICRS-5	20.9	200.0	10.3	7.9	-	-	-	-	33.0	-	-	-	-	-	-	0.90	<0.05	-
104 - 73	DNRRTM-500213	22.9	374.0	6.6	7.9	5.0	-	<600.0	182.0	41.0	-	-	17.0	U	U	-	0.56	0.52	0.66
104 - 80	DNRWTC-500213	18.3	895.0	13.3	8.3	8.8	29.0	190.0 b	372.0	18.0	10.0	-	-	0.24	0.11	0.053	0.66	1.30	1.70
105 - 83	ERG-8	17.0	270.0	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
106 - 84	LTICRS-6	17.0	180.0	9.6	7.2	-	-	-	-	31.0	-	-	-	-	-	-	<0.01	<0.01	-
107 - 80	DNRWTC-500378	18.6	855.0	16.1	8.8	15.0	38.0	215.0 b	360.0	20.8	23.0	-	-	0.15	0.02	0.006	0.03	1.17	2.25
108 - 83	ERG-7	18.0	200.0	5.9	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
109 - 73	DNRRTM-500214	23.0	279.0	7.7	8.0	2.2	-	304.0	156.0	34.0	-	-	34.5	U	U	-	0.27	0.26	0.59
109 - 73	DNRPTM-500214	27.8	-	9.7	8.4	3.6	-	-	-	13.0	1.9	111.7	18.7	U	U	-	0.06	0.07	0.50
109 - 74	CRWC-B	22.0	-	7.6	7.8	3.9	-	267.2 a	295.3	20.0	-	-	-	U	-	-	0.66	0.62	-
109 - 75	CRWC-B	20.0	-	7.5	7.7	4.2	-	393.1 a	323.8	49.0	-	-	-	0.20	-	-	0.69	1.46	-
109 - 76	CRWC-B	24.0	-	7.9	7.9	3.5	-	277.0 a	326.6	19.7	-	-	-	0.28	-	-	0.99	0.70	-
109 - 77	CRWC-B	22.0	-	9.6	7.5	7.9	-	890.0 a	476.2	45.9	-	-	-	0.40	-	-	0.97	2.05	-
109 - 78	CRWC-B	23.8	-	6.5	7.4	6.0	-	201.3 a	456.0	36.0	-	-	-	0.43	-	-	1.25	2.07	-
109 - 79	CRWC-B	19.6	-	8.6	8.1	4.7	-	-		39.5	-	-	-	0.22	-	-	0.05	1.06	-
109 - 80	DNRWTC-500214	18.7	530.0	16.1	8.9	12.0	34.0	335.0 b	300.0	19.0	31.0	-	-	0.16	0.02	0.007	0.03	1.00	2.15
109 - 84	LTICRS-7	17.0	170.0	9.3	8.1	-	-	-	-	43.0	-	-	-	-	-	-	<0.01	<0.02	-
110 - 83	ERG-6	18.0	200.0	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
110 - 84	LTICRS-8	18.3	170.0	9.2	7.7	-	-	-	-	21.0	-	-	-	-	-	-	<0.01	<0.02	-
111 - 80	DNRWTC-500364	18.0	487.5	15.3	8.8	8.7	20.5	395.0 b	320.0	10.5	21.0	-	-	0.15	0.01	0.006	0.02	0.01	2.15
112 - 80	DNRWTC-500363	19.2	472.5	17.0	8.9	8.9	37.0	210.0 b	360.0	14.5	39.0	-	-	0.10	0.01	0.004	0.01	0.72	2.50
113 - 84	LTICRS-9	17.9	160.0	9.1	7.7	-	-	-	-	22.0	-	-	-	-	-	-	<0.01	-	-

Table 4.2. continued.

HMP ID & YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLOROPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONZ NH3	NH3 + NH4	NO2 & NO3	ORG. NITR.
114 - 83	ER8-5	10.0	190.0	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
115 - 70	DNRSTO-500000	12.3	701.3	8.0	8.0	7.6	-	535.0	454.9	15.1	-	243.2	87.1	U	U	-	2.05	-	0.90
115 - 71	DNRSTO-500000	12.7	410.2	9.0	8.0	4.0	-	234.5	270.7	17.5	-	175.0	43.0	U	U	-	0.81	-	0.77
115 - 72	DNRSTO-500000	12.1	503.5	9.4	7.9	5.4	-	146.3	327.4	10.9	-	185.4	54.1	U	U	-	0.77	-	0.70
115 - 73	DNRSTO-500000	17.3	407.3	8.5	8.1	3.7	-	74.3	201.4	14.7	-	179.2	32.2	U	U	-	0.47	0.33	0.40
115 - 76	CBECDF-500000	-	652.3	6.4	7.7	6.0	41.1	771.5	-	-	-	209.7	73.4	0.60	1.00	-	2.40	0.00	0.50
115 - 80	DNRSTO-500000	1.0	240.0	14.9	7.3	0.5	7.0	< 10.0	-	6.0	-	105.0	-	0.02	0.00	-	0.41	0.30	-
115 - 84	LTICRS-10	17.0	170.0	9.3	8.1	-	-	-	-	20.0	-	-	-	-	-	-	<0.01	-	-
117 - 83	ER8-4	10.0	195.0	7.5	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
118 - 84	LTICRS-11	17.5	160.0	9.1	8.0	-	-	-	-	20.0	-	-	-	-	-	-	-	-	-
119 - 84	LTICRS-12	17.0	160.0	9.3	8.0	-	-	-	-	10.0	-	-	-	-	-	-	-	-	-
120 - 83	ER8-3	10.0	190.0	8.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
121 - 73	DNRRTH-500215	22.9	241.3	9.1	8.5	2.3	-	< 20.0	156.0	20.0	-	-	0.0	U	U	-	0.05	0.10	0.34
121 - 80	DNRLSC-500215	22.0	376.5	-	-	-	-	394.0	239.0	-	-	-	-	-	-	-	-	-	-
122 - 84	LTICRS-13	17.0	160.0	9.7	7.4	-	-	-	-	6.0	-	-	-	-	-	-	-	-	-
123 - 83	ER8-2	10.0	190.0	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
124 - 83	ER8-1	16.0	180.0	9.2	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

b = Results based on colony counts outside the acceptable range.
G = Value calculated as geometric mean instead of arithmetic mean (average).
U = Unreliable data.
< = Actual concentration is less than the value shown.

Table 4.2. continued.

MAP ID & YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLOROPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONZ NH3	NH3 + NH4	NO2 & NO3	ORG. NITR.
								SECTION 2. CLINTON RIVER SPILLWAY											
201 - 73	DNRRFH-500100	22.4	535.0	4.1	7.4	6.6	-	2120.0	325.0	67.0	-	-	40.0	U	U	-	1.10	0.66	0.94
201 - 74	CRWC-A	22.0	-	6.0	7.0	3.3	-	454.1 G	410.2	25.0	-	-	-	U	-	-	1.32	1.32	-
201 - 75	CRWC-A	21.0	-	9.2	7.7	3.0	-	899.7 G	410.0	49.0	-	-	-	0.32	-	-	0.79	1.51	-
201 - 76	CRWC-A	23.0	-	8.2	7.9	2.0	-	314.4 G	479.0	10.6	-	-	-	0.30	-	-	0.64	1.97	-
201 - 77	CRWC-A	21.0	-	9.0	7.8	5.6	-	6.7 G	501.3	61.9	-	-	-	0.37	-	-	0.70	3.29	-
201 - 78	CRWC-A	22.1	-	7.4	7.3	46.6	-	179.6 G	501.4	101.4	-	-	-	0.70	-	-	1.04	2.79	-
201 - 79	CRWC-A	16.6	-	7.6	7.5	3.2	-	-	456.5	34.0	-	-	-	0.29	-	-	1.01	2.16	-
201 - 80	DNRNFC-500100	17.9	702.5	10.9	8.0	4.6	23.5	1300.0	420.0	40.0	22.0	-	-	0.21	0.10	0.014	0.36	2.45	1.25
201 - 84	LTICRS-2	19.3	410.0	9.4	7.9	-	-	-	-	56.0	-	-	-	-	-	-	0.30	-	-
202 - 84	LTICRS-14	10.0	440.0	9.1	7.9	-	-	-	-	40.0	-	-	-	-	-	-	0.35	-	-
203 - 80	DNRLSC-500229	22.7	655.0	-	-	-	-	4140.0	414.0	-	-	-	-	-	-	-	-	-	-
204 - 84	LTICRS-18	10.0	630.0	8.6	7.8	-	-	-	-	34.0	-	-	-	-	-	-	0.19	-	-
205 - 80	DNRLSC-500333	23.0	630.2	-	-	-	-	3700.0	417.4	-	-	-	-	-	-	-	-	-	-

G = Value calculated is geometric mean instead of arithmetic mean (average).

U = Unreliable data.

* = Estimated from conductivity

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Table 4.2. continued.

MAP ID 8-YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI 0/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLOROPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONIZ NH3	NH3 + NH4	NO2 & NO3	ORG. NITR.
SECTION 3. MAIN BRANCH OF THE CLINTON RIVER BETWEEN RED RUN AND THE SPILLWAY.																			
301 - 01	USFWS-†	22.0	810.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
302 - 73	DNRRTN-500200	20.7	790.0	6.4	7.0	6.0	-	654.0	520.0	29.0	-	-	80.5	U	U	-	1.00	1.20	1.64
302 - 74	CRWC-E	20.0	-	7.3	7.0	4.7	-	301.0 B	465.0	37.2	-	-	-	U	-	-	2.75	1.77	-
302 - 75	CRWC-E	21.0	-	10.0	7.0	3.9	-	204.5	446.0	50.3	-	-	-	0.32	-	-	0.76	1.94	-
302 - 76	SEMCOG-C10	10.0	-	6.7	7.6	2.4	-	4720.0	463.0	37.7	5.2	-	93.0	0.53	-	-	0.10	4.20	0.06
302 - 76	CRWC-E	15.1	-	8.0	7.9	3.3	-	620.0 B	494.0	27.3	-	-	-	0.34	-	-	0.60	2.08	-
302 - 77	CRWC-E	19.0	-	9.5	7.6	5.3	-	150.7 B	590.4	50.4	-	-	-	0.40	-	-	0.72	3.77	-
302 - 78	CRWC-E	10.0	-	7.7	7.1	12.3	-	240.0 B	400.0	84.4	-	-	-	0.04	-	-	2.57	2.25	-
302 - 79	CRWC-E	17.2	-	7.9	7.9	2.6	-	-	569.0	24.5	-	-	-	0.22	-	-	0.45	3.75	-
302 - 80	DNRSTO-500200	2.0	855.0	12.5	7.0	1.0	23.0	100.0	540.0	12.0	-	255.0	-	0.13	0.00	-	0.31	4.00	-
302 - 87	CTYWAR-Garfield	21.2	-	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
303 - 73	DNRPTN-500231	25.0	-	5.7	8.0	3.6	-	-	-	62.3	-	241.7	75.0	U	U	-	1.53	1.60	1.13
304 - 73	DNRRTN-500209	20.1	732.5	5.0	7.0	7.0	-	1670.0	520.0	34.0	-	-	77.0	U	U	-	2.11	1.70	1.01
305 - 73	DNRPTN-500225	24.0	-	4.0	7.9	13.0	-	-	-	30.3	-	260.0	79.3	U	U	-	1.00	1.97	1.53
306 - 73	DNRPTN-500010	23.7	-	3.9	7.9	12.7	-	-	-	20.5	-	269.0	77.7	U	U	-	1.75	1.92	1.00
306 - 73	112wrd-04165500	13.5	810.0	-	7.6	-	-	-	-	-	-	-	89.0	-	-	-	-	6.30	-
306 - 74	112wrd-04165500	7.2	830.7	9.9	7.9	-	-	340.0	509.0	-	-	260.0	102.7	U	-	-	-	1.33	-
306 - 75	112wrd-04165500	10.0	712.7	9.0	8.0	-	-	2314.2	411.0	-	-	265.0	60.1	U	-	-	-	2.17	-
306 - 76	112wrd-04165500	11.0	717.9	10.6	7.9	-	-	3001.2	411.7	-	-	249.1	75.0	0.26	-	-	-	2.60	-
306 - 77	DNRSTO-500010	0.3	639.1	-	8.0	-	-	-	-	80.2	-	-	77.0	0.25	0.10	-	0.20	1.01	-
306 - 77	112wrd-04165500	11.6	832.9	8.4	7.8	-	-	-	475.9	-	-	252.5	111.2	0.32	-	-	0.22	3.12	-
306 - 78	112wrd-04165500	10.5	825.7	9.2	8.0	-	-	-	403.9	-	-	245.0	110.0	0.23	-	-	0.29	3.07	1.03
306 - 79	112wrd-04165500	10.6	839.3	9.2	7.9	-	-	-	497.2	-	-	263.3	105.1	0.19	-	-	0.19	4.10	1.33
306 - 80	112wrd-04165500	11.3	765.4	9.4	7.9	-	-	-	467.6	-	-	249.2	87.3	0.19	-	-	0.16	3.63	0.90
306 - 80	DNRSTO-500010	1.5	895.0	12.0	7.0	1.4	19.0	140.0	536.0	9.0	-	275.0	-	0.13	0.09	-	0.25	4.90	-
306 - 81	112wrd-04165500	12.0	765.7	9.9	8.1	-	-	-	407.0	-	-	250.9	99.3	0.16	0.04	-	0.13	2.99	0.76
306 - 82	112wrd-04165500	11.0	720.0	7.6	7.7	-	-	-	420.0	-	-	230.0	86.5	0.20	0.09	-	-	-	-
306 - 83	112wrd-04165500	11.3	705.3	8.9	8.0	-	-	-	440.3	-	-	300.0	85.5	0.09	0.07	-	-	-	-
306 - 84	DNRSTO-500233	9.5	814.2	9.3	7.9	2.2	-	-	517.4*	34.6	6.0	265.0	100.1	0.10	0.12	-	0.21	2.79	1.02
306 - 85	112wrd-04165500	10.6	729.2	9.0	8.1	-	-	-	439.0	-	-	290.0	99.3	0.11	0.05	-	0.15	-	0.65
306 - 86	112wrd-04165500	15.2	704.7	9.0	8.2	-	-	-	457.5	-	-	265.0	85.5	0.12	0.05	-	0.09	3.08	0.90
307 - 73	DNRRTN-500211	21.0	740.0	4.0	7.6	5.2	-	2190.0	507.0	36.0	-	-	72.0	0.72	0.54	-	1.76	1.60	1.03

Table 4.2. continued.

MAP ID & YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLOROPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONIZ NH3	NH3 + NH4	NO2 & NO3	ORG. NITR.
308 - 73	DNRATN-S00212	20.1	809.0	8.3	7.9	6.1	-	1004.0	546.0	16.0	-	-	105.0	U	U	-	0.16	0.72	0.92
308 - 84	112wrd-04165900	12.9	791.3	8.9	8.0	-	-	-	463.8	-	-	-	99.2	0.12	0.07	-	-	-	-
309 - 74	CRWC-B	22.0	-	6.9	7.9	2.0	-	300.1 G	539.3	27.4	-	-	-	U	-	-	1.44	1.65	-
309 - 75	CRWC-B	21.0	-	10.0	7.0	3.6	-	151.0	435.6	40.3	-	-	-	0.27	-	-	0.65	1.46	-
309 - 76	CHRC-B	15.4	-	8.6	7.9	2.4	-	490.0 G	500.0	20.5	-	-	-	0.29	-	-	0.81	2.26	-
309 - 77	CHRC-B	21.0	-	8.9	7.6	6.4	-	964.0 G	402.9	107.6	-	-	-	0.40	-	-	0.57	3.57	-
309 - 78	CHRC-B	21.0	-	6.0	7.4	4.2	-	460.0 G	560.0	32.4	-	-	-	0.20	-	-	0.71	3.16	-
309 - 79	CHRC-B	10.2	-	8.6	8.0	3.3	-	-	542.0	26.0	-	-	-	0.23	-	-	0.45	2.79	-
310 - 74	DNRST0-S00233	11.1	795.5	8.2	7.8	6.5	-	1140.0	499.4	24.7	3.1	253.0	96.0	U	U	-	1.03	1.34	1.11
310 - 75	DNRST0-S00233	15.1	649.5	8.1	7.8	3.3	23.3	2200.0	422.0	40.0	9.3	266.5	66.6	0.30	0.20	-	0.43	1.70	0.00
310 - 76	COECDF-S00233	-	766.4	8.3	7.8	5.6	28.8	1145.7	-	-	-	260.8	89.4	0.60	0.40	-	1.00	1.30	0.90
310 - 76	SEMCOG-C22	10.0	-	8.5	7.6	1.5	-	5632.0	445.0	27.0	3.9	-	90.0	0.39	-	-	0.19	3.14	0.70
310 - 76	DNRST0-S00233	11.1	670.0	9.4	7.9	2.9	19.6	1230.0	453.0	29.0	7.7	249.9	74.0	0.30	0.23	-	0.26	2.34	0.80
310 - 77	DNRST0-S00233	13.4	770.0	8.1	8.0	3.3	21.0	2726.7	503.3*	31.5	8.0	252.5	106.2	0.34	0.28	-	0.24	3.27	0.01
310 - 78	DNRST0-S00233	11.4	899.2	9.3	8.0	3.8	22.7	2921.7	584.5*	18.3	7.6	282.9	129.6	0.21	0.15	-	0.24	3.50	0.05
310 - 79	DNRST0-S00233	10.0	843.3	9.2	8.1	2.6	24.3	790.0	540.1*	27.4	5.1	236.0	115.0	0.22	0.13	-	0.19	3.36	0.97
310 - 80	DNRST0-S00233	12.1	750.0	9.3	7.9	3.8	27.3	3010.0	522.0	30.0	3.2	282.5	91.4	0.18	0.10	-	0.19	2.90	1.07
310 - 83	DNRST0-S00233	14.0	702.5	8.8	8.1	3.0	30.0	-	455.3*	34.9	11.0	270.0	77.3	0.19	0.10	-	0.20	2.43	1.02
310 - 84	LTICRS-1	10.0	630.0	8.7	7.8	-	-	-	-	42.0	-	-	-	-	-	-	0.11	-	-
310 - 85	DNRST0-S00233	10.0	800.4	9.4	7.9	2.0	-	-	304.0	47.9	4.3	252.0	105.4	0.19	0.07	-	0.20	2.02	1.14
310 - 86	DNRST0-S00233	10.0	769.3	9.1	8.0	3.8	-	-	490.9*	42.5	6.1	143.0	103.1	0.16	0.11	-	0.16	1.64	1.05
310 - 87	DNRST0-S00233	8.0	939.4	10.0	8.2	1.7	-	-	610.6*	21.6	0.9	-	136.4	0.13	0.07	-	0.16	2.02	0.01

G = Value calculated is geometric mean instead of arithmetic mean (average).
U = Unreliable data.
* = Estimated from conductivity

Table 4.2. continued.

MAP ID 8-YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLORPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONZ NH3	NH3 + NH4	NO2 & NO3	ORG. NITR.
SECTION 4. RED RUN AND ITS TRIBUTARIES.																			
401 - 81	USFWS-1 Bequi Rd	10.0	995.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
402 - 81	USFWS-2 Mound Rd	25.6	1,055.0	9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
403 - 75	CRWC-P	20.0	-	0.0	7.6	4.5	-	1564.4 @	570.2	96.2	-	-	-	0.25	-	-	0.43	1.06	-
403 - 76	SEMCOG-C15	10.1	-	7.1	7.9	2.6	-	2300.0	360.0	20.0	12.2	-	92.0	0.19	-	-	0.06	0.60	0.90
403 - 76	CRWC-P	22.0	-	0.0	0.0	5.3	-	132.0 @	624.3	31.3	-	-	-	0.20	-	-	0.74	0.66	-
403 - 77	CRWC-P	10.0	-	10.5	7.6	7.1	-	235.2 @	676.5	00.9	-	-	-	0.39	-	-	0.70	2.29	-
403 - 78	CRWC-P	21.0	-	6.0	7.4	4.0	-	43.0 @	771.4	52.6	-	-	-	0.19	-	-	0.54	0.71	-
403 - 79	CRWC-P	10.5	-	0.1	7.0	3.4	-	-	772.5	27.5	-	-	-	0.13	-	-	0.61	0.65	-
403 - 81	USFWS-3 VanDyke	20.3	1,150.0	6.5															
403 - 87	CTYWAR-Vandyke	22.0	-	6.3															
404 - 76	SEMCOG-C14	10.5	-	4.2	7.4	5.9	-	6009.0	355.0	21.5	4.3	-	04.0	0.30	-	-	0.25	0.86	0.82
405 - 76	SEMCOG-C13	17.7	-	4.4	7.4	2.7	-	2394.0	334.0	51.0	11.4	-	34.0	0.13	-	-	0.56	1.14	1.10
406 - 71	DNRSTO-500011	16.1	450.0	3.4	7.6	20.0	-	14000.0	292.0	136.0	-	140.0	56.0	U	U	-	2.70	0.00	1.20
406 - 72	DNRSTO-500011	15.4	970.3	0.9	7.6	6.0	-	12.5	635.6	47.4	-	267.0	130.9	U	U	-	6.70	0.48	1.40
406 - 73	DNRSTO-500011	15.7	1000.0	0.6	7.7	6.3	-	27.2	627.3	56.3	-	269.5	134.4	U	U	-	6.59	0.50	2.06
406 - 74	DNRSTO-500011	12.1	1110.5	9.0	7.6	5.0	-	< 10.0	673.2	20.7	-	202.5	170.0	U	U	-	0.25	0.49	2.03
406 - 75	DNRSTO-500011	2.0	1190.0	10.3	7.0	2.5	37.0	40.0	704.0	23.0	-	305.0	100.0	4.00	3.40	-	13.0	0.64	2.00
406 - 75	CRWC-0	22.0	-	0.9	7.6	4.5	-	1097.9 @	592.2	40.0	-	-	-	1.25	-	-	3.11	3.50	-
406 - 76	CRWC-0	22.5	-	0.0	7.6	3.6	-	16.7 @	579.0	10.0	-	-	-	0.92	-	-	0.77	6.59	-
406 - 77	CRWC-0	20.0	-	0.0	7.4	4.3	-	27.1 @	710.3	42.0	-	-	-	0.97	-	-	1.13	5.90	-
406 - 78	CRWC-0	20.5	-	5.5	7.2	7.3	-	102.9 @	660.0	34.0	-	-	-	0.62	-	-	0.60	5.60	-
406 - 79	CRWC-0	10.2	-	7.0	7.6	1.4	-	-	603.5	13.0	-	-	-	0.60	-	-	0.61	6.45	-
406 - 87	CTYWAR-14 mile	22.0	-	0.0															
407 - 73	DNRPTH-500227	29.0	-	7.3	7.9	9.0	-	-	-	71.3	-	245.0	02.0	U	U	-	3.50	1.10	2.27
407 - 76	SEMCOG-C16	20.2	-	7.1	7.3	2.0	-	1006.0	420.0	24.7	3.0	-	07.0	0.05	-	-	0.26	5.51	0.00
407 - 81	USFWS-4 15 mile	20.3	007.5	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
407 - 87	CTYWAR-15 mile	22.0	-	4.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
408 - 73	DNRRTH-500207	21.0	002.0	5.0	7.4	7.1	-	<1320.0	572.0	42.0	-	-	90.5	U	U	-	5.30	0.53	7.24
408 - 74	CRWC-H	20.0	-	5.0	7.6	13.5	-	09.0 @	600.2	23.9	-	-	-	U	-	-	10.41	0.35	-
408 - 75	CRWC-H	22.0	-	0.3	7.6	4.9	-	94.9 @	572.9	39.5	-	-	-	1.10	-	-	2.79	4.13	
408 - 76	CRWC-H	21.0	-	0.3	0.0	4.0	-	122.0 @	500.6	26.0	-	-	-	0.02	-	-	0.90	7.03	-
408 - 77	CRWC-H	10.0	-	0.2	7.4	5.6	-	106.0 @	750.4	40.4	-	-	-	0.79	-	-	1.10	5.66	-
408 - 78	CRWC-H	19.5	-	5.4	7.1	7.9	-	99.5 @	546.4	131.2	-	-	-	0.67	-	-	0.92	5.46	-
408 - 79	CRWC-H	17.0	-	6.0	7.4	2.5	-	-	712.5	23.0	-	-	-	0.50	-	-	0.73	7.57	-
408 - 81	USFWS-5 16 mile	22.2	750.0	-															
409 - 76	SEMCOG-C11	17.3	-	7.0	7.0	1.0	-	3546.0	474.0	74.2	11.5	-	04.0	0.14	-	-	0.16	0.50	0.01
410 - 71	DNRSTO-500046	11.0	700.0	3.0	7.5	12.0	-	200.0	455.0	10.0	-	195.0	134.0	U	U	-	0.49	-	0.50
410 - 72	DNRSTO-500046	13.2	007.0	9.1	7.9	5.7	-	220.5	576.0	20.4	-	265.0	151.1	U	U	-	0.45	0.42	0.90
410 - 73	DNRSTO-500046	7.3	963.3	11.0	7.0	6.0	-	313.3	576.5	07.0	-	295.0	139.0	U	U	-	0.41	1.20	0.70
410 - 74	DNRSTO-500046	25.5	550.0	7.4	0.0	1.9	-	00.0	392.0	49.0	-	165.0	01.0	U	U	-	0.07	0.56	0.37
410 - 76	SEMCOG-C12	10.6	-	6.6	7.6	1.0	-	2729.0	392.0	45.0	0.6	-	69.0	0.15	-	-	0.10	0.61	0.79
411 - 81	USFWS-6 Utica Rd	25.6	000.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
411 - 87	CTYWAR-Utica Rd	20.7	-	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

@ = Value calculated is geometric mean instead of arithmetic mean (average).
U = Unreliable data.
# = Estimated from conductivity
< = Actual concentration is less than the value shown.

Table 4.2. continued.

WMP ID & YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLOROPHYL a (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONZ NH3	NH3 + NH4	NO2 & NO3	ORG. NITR.
S E C T I O N 5. MAIN BRANCH OF THE CLINTON RIVER AND TRIBUTARIES UPSTREAM OF RED RUN.																			
501 - 76	SEMCOG-1	17.1	-	7.3	7.7	0.0	-	609.0	301.0	6.1	9.7	-	20.0	0.05	-	-	0.05	0.16	0.57
501 - 77	DNRSTO-630600	0.1	440.0	-	8.0	-	-	-	-	0.0	-	-	24.0	0.04	0.01	-	0.53	0.25	-
502 - 73	DNRSTO-630529	15.0	555.0	8.6	8.0	1.4	-	307.8	363.3M	23.7	-	249.3	46.5	U	U	-	0.12	0.20	0.40
502 - 74	DNRSTO-630529	11.5	530.5	10.6	8.0	2.5	-	55.0	355.0	0.4	-	236.5	47.0	U	U	-	0.00	0.25	0.52
502 - 75	DNRSTO-630529	13.9	522.0	8.9	7.9	2.6	20.1	476.0	342.9	10.5	-	239.0	43.4	0.03	<0.01	-	0.00	0.20	0.59
502 - 76	SEMCOG-2	16.9	-	6.6	7.5	0.0	-	520.0	342.0	0.7	4.7	-	53.0	0.05	-	-	0.10	0.20	0.41
502 - 76	DNRSTO-630529	10.5	530.3	9.7	8.0	1.0	17.6	11.7	345.3	7.3	-	231.5	42.9	0.02	0.01	-	0.00	0.22	0.40
502 - 77	DNRSTO-630529	13.7	547.1	9.4	8.1	1.9	15.0	210.0	357.4M	6.0	-	232.1	52.3	0.02	<0.01	-	0.20	0.10	0.51
502 - 78	DNRSTO-630529	11.6	595.4	9.4	8.0	2.0	14.0	245.0	387.2M	9.3	-	246.4	51.5	0.02	0.01	-	0.00	0.23	0.53
502 - 79	DNRSTO-630529	10.5	599.2	9.6	8.1	1.0	17.5	300.6	389.4M	6.4	-	220.0	54.3	0.02	0.01	-	0.00	0.10	0.56
502 - 80	DNRSTO-630529	11.9	540.0	10.3	8.1	2.1	19.0	210.3	351.3M	7.4	-	220.0	49.6	0.02	0.01	-	0.04	0.14	0.66
502 - 81	DNRSTO-630529	11.8	573.3	10.1	8.0	2.1	10.0	156.0	372.7M	7.1	1.4	200.0	53.0	0.02	0.01	-	0.08	0.17	0.57
502 - 82	DNRSTO-630529	12.0	582.1	10.0	7.9	2.2	10.0	41.0	370.3M	6.2	-	200.0	53.4	0.02	0.01	-	0.08	0.19	0.50
502 - 83	DNRSTO-630529	11.7	575.0	9.0	8.2	1.5	10.4	-	374.2M	5.7	-	225.0	54.0	0.02	0.01	-	0.09	0.13	0.55
502 - 84	DNRSTO-630529	10.1	590.6	8.6	7.9	1.3	-	-	390.7M	0.7	1.7	255.0	50.5	0.02	0.01	-	0.10	0.15	0.57
502 - 85	DNRSTO-630529	11.0	560.2	9.4	7.9	1.5	-	-	369.3M	6.4	-	207.0	55.5	0.02	0.01	-	0.07	0.12	0.56
502 - 86	DNRSTO-630529	10.0	594.0	9.3	7.9	1.4	-	-	306.2M	6.0	4.0	199.0	50.7	0.02	0.01	-	0.07	0.25	0.67
502 - 87	DNRSTO-630529	8.3	615.0	10.3	8.0	1.1	-	-	399.6M	0.0	-	-	60.2	0.01	0.01	-	0.09	0.15	0.55
503 - 73	DNRPTN-630629	23.7	-	7.3	8.0	2.0	-	-	-	44.3	-	220.0	41.3	U	U	-	0.09	0.29	0.01
504 - 73	DNRPTN-630630	23.7	-	6.0	8.0	1.5	-	-	-	0.0	-	230.3	44.0	U	U	-	0.02	0.29	0.62
505 - 74	CRWC-M	23.0	-	9.0	7.0	1.7	-	24.5 G	366.6	5.4	-	-	-	U	-	-	0.32	0.25	-
505 - 75	CRWC-M	22.0	-	11.2	7.0	2.0	-	20.5 G	340.0	4.1	-	-	-	0.03	-	-	0.27	0.22	-
505 - 76	CRWC-M	25.0	-	9.7	8.1	1.5	-	20.2 G	340.5	5.5	-	-	-	0.05	-	-	0.30	0.10	-
505 - 77	CRWC-M	21.0	-	10.7	7.0	2.5	-	2.3 G	370.1	10.0	-	-	-	0.04	-	-	0.22	0.30	-
505 - 78	CRWC-M	24.0	-	9.1	7.7	2.5	-	5.0 G	349.6	21.6	-	-	-	0.05	-	-	0.23	0.21	-
505 - 79	CRWC-M	20.6	-	9.0	8.1	2.6	-	-	391.0	10.5	-	-	-	0.06	-	-	0.19	0.10	-
506 - 73	DNRPTN-630631	26.0	-	7.6	8.3	1.4	-	-	-	7.3	-	206.7	46.3	U	U	-	0.01	0.02	0.65
507 - 73	DNRPTR-630600	24.4	520.0	7.0	8.2	1.7	-	81.4	312.0	0.0	-	-	50.0	U	U	-	<0.02	0.04	0.66
508 - 73	DNRPTR-630599	24.3	566.2	7.0	8.3	2.3	-	241.4	330.0	0.0	-	-	60.0	U	U	-	<0.02	0.07	0.67
508 - 73	DNRPTN-630599	25.3	-	8.4	8.2	4.7	-	-	-	0.3	-	213.0	60.7	U	U	-	0.01	0.02	0.73
509 - 76	SEMCOG-4	18.7	-	6.6	7.4	1.7	-	386.0	525.0	9.0	3.3	-	125.0	0.10	-	-	0.46	5.03	0.74
509 - 80	DNRSTO-630632	25.0	845.0	8.4	7.7	7.2	-	-	-	15.0	-	190.0	-	0.07	-	-	0.07	0.07	0.83
510 - 73	DNRPTR-630590	24.1	630.4	7.9	8.1	1.4	-	< 10.0	390.0	6.0	-	-	75.5	U	U	-	0.52	1.29	0.83
512 - 73	DNRPTR-630597	24.1	710.1	7.4	7.7	1.5	-	< 10.0	442.0	10.0	-	-	92.5	U	U	-	0.40	3.17	0.89
513 - 80	DNRSTO-630717	24.5	707.0	7.3	7.6	-	-	-	410.0	19.0	-	-	-	0.10	0.03	-	0.05	3.07	0.91
514 - 73	DNRPTN-630633	25.0	-	7.4	7.9	3.2	-	-	-	15.3	-	245.0	89.7	U	U	-	0.31	2.70	0.80
514 - 80	DNRSTO-630633	24.3	726.7	7.4	7.6	-	-	-	400.0	10.7	-	-	-	0.10	0.03	-	0.05	3.27	0.92

Table 4.2. continued.

MAP ID & YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLRPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONZ NH3	NH3 & NH4	NO2 & NO3	ORG. NITR.
515 - 73	DNRPTR-630596	23.7	727.7	6.9	7.7	3.0	-	< 21.4	442.0	16.0	-	-	89.0	U	U	-	0.34	2.94	0.85
517 - 73	DNRPTM-630595	24.3	-	8.7	8.1	3.3	-	-	-	14.7	-	243.3	86.3	U	U	-	0.05	2.30	0.80
517 - 73	DNRPTR-630598	23.1	731.2	6.9	7.9	2.7	-	105.7	416.0	10.0	-	-	83.5	U	U	-	0.21	2.90	0.96
517 - 74	CRWC-L	21.0	-	9.1	7.0	2.2	-	135.1 B	573.5	10.3	-	-	-	U	-	-	0.03	2.01	-
517 - 75	CRWC-L	21.0	-	10.2	7.7	2.9	-	155.3 B	260.4	14.9	-	-	-	0.13	-	-	0.56	1.71	-
517 - 76	SEMCOB-5	10.0	-	6.0	7.6	1.5	-	812.0	804.0	9.5	2.4	-	144.0	0.17	-	-	0.10	7.10	0.72
517 - 76	CRWC-L	22.5	-	9.4	7.9	3.0	-	35.6 B	489.9	9.5	-	-	-	0.12	-	-	0.67	2.21	-
517 - 77	CRWC-L	20.0	-	10.0	7.0	5.0	-	3.7 B	527.7	16.9	-	-	-	0.12	-	-	0.53	3.34	-
517 - 78	CRWC-L	19.5	-	8.7	7.8	4.3	-	82.6 B	521.4	20.0	-	-	-	0.15	-	-	0.52	3.66	-
517 - 79	CRWC-L	20.0	-	11.7	8.3	2.2	-	-	502.5	12.0	-	-	-	0.12	-	-	0.30	2.94	-
518 - 72	DNRSTO-630252	13.3	806.3	9.7	7.8	4.7	-	500.0	519.0M	32.0	-	251.9	115.3	U	U	-	0.49	2.66	0.92
518 - 73	DNRSTO-630252	19.4	740.1	8.0	7.8	4.6	-	243.5	495.4M	20.0	-	260.0	97.4	U	U	-	0.56	2.60	0.87
518 - 74	DNRSTO-630252	11.2	754.5	10.6	7.9	4.0	-	34.0	469.6	10.9	-	253.5	96.6	U	U	-	0.54	2.12	0.90
518 - 75	DNRSTO-630252	13.0	706.5	9.1	7.8	3.7	20.0	1169.0	446.6	17.0	-	253.5	92.9	0.16	0.07	-	0.39	2.32	0.75
518 - 76	DNRSTO-630252	11.0	720.3	9.9	7.9	4.2	20.4	162.5	462.6	22.4	-	251.3	91.4	0.16	0.08	-	0.71	1.95	0.74
518 - 77	DNRSTO-630252	15.3	817.0	9.4	8.1	3.0	20.1	7639.5	535.0M	13.4	-	239.5	120.2	0.14	0.09	-	0.33	3.60	0.71
518 - 78	DNRSTO-630252	12.5	850.3	10.0	8.0	4.4	21.2	309.2	557.9M	14.4	-	253.6	117.1	0.10	0.04	-	0.31	4.14	0.94
518 - 79	DNRSTO-630252	9.0	814.4	10.0	8.2	3.1	23.9	924.0	529.2M	10.9	-	240.0	113.4	0.09	0.03	-	0.14	3.46	0.90
518 - 80	DNRSTO-630252	14.1	746.3	10.0	8.1	2.5	22.0	302.2	460.0	13.5	-	240.0	102.0	0.07	0.02	-	0.07	3.25	0.86
518 - 81	DNRSTO-630252	12.1	830.4	11.9	8.1	3.1	22.1	454.7	539.0M	13.5	1.0	200.0	119.0	0.09	0.03	-	0.07	3.33	0.92
518 - 82	DNRSTO-630252	13.1	779.3	11.1	8.1	2.7	22.5	112.0	506.6M	14.1	-	230.0	103.4	0.07	0.02	-	0.08	2.49	0.79
518 - 83	DNRSTO-630252	12.4	723.6	11.7	8.4	2.7	24.7	-	470.6	24.6	-	255.0	90.6	0.14	0.05	-	0.12	2.91	1.08
518 - 84	DNRSTO-630252	10.6	779.0	10.7	7.9	2.4	-	-	507.3	12.4	9.2	205.0	104.0	0.12	0.07	-	0.22	3.41	1.00
518 - 85	DNRSTO-630252	12.3	774.0	10.5	8.0	2.5	-	-	503.0M	36.0	-	292.0	102.0	0.12	0.05	-	0.13	2.09	0.91
518 - 86	DNRSTO-630252	11.4	874.2	10.3	8.0	2.6	-	-	560.1M	46.3	5.4	150.0	142.6	0.14	0.07	-	0.15	1.78	1.10
518 - 87	DNRSTO-630252	8.5	805.0	12.1	8.1	2.0	-	-	575.2M	14.0	-	-	139.1	0.08	0.03	-	0.11	1.82	0.80
519 - 73	DNRPTR-630067	23.1	725.0	7.4	8.0	2.3	-	214.3	403.0	12.0	-	-	86.5	U	U	-	0.12	2.79	0.73
520 - 73	DNRPTR-630594	22.0	725.4	7.7	8.1	2.6	-	660.0	364.0	8.0	-	-	81.0	U	U	-	<0.13	2.43	0.30
520 - 73	DNRRTM-630594	19.0	763.0	8.0	7.8	2.6	-	110.0	494.0	13.0	-	-	88.0	U	U	-	0.11	3.20	0.75
521 - 73	DNRRTM-630682	19.6	702.0	8.2	7.9	2.3	-	<130.0	507.0	8.0	-	-	89.5	U	U	-	0.07	3.18	0.71
522 - 74	CRWC-K	21.0	-	10.1	7.8	2.2	-	154.3 B	607.3	17.2	-	-	-	U	-	-	0.39	4.05	-
522 - 75	CRWC-K	20.0	-	11.3	7.8	3.3	-	444.0 B	833.9	19.2	-	-	-	0.16	-	-	0.52	2.85	-
522 - 76	CRWC-K	22.0	-	9.8	8.0	3.3	-	44.2 B	509.5	14.3	-	-	-	0.13	-	-	0.60	2.58	-
522 - 77	CRWC-K	20.0	-	11.3	7.8	4.1	-	33.0 B	593.0	33.3	-	-	-	0.12	-	-	0.40	3.49	-
522 - 78	CRWC-K	19.5	-	9.1	7.5	3.7	-	65.6 B	571.4	25.0	-	-	-	0.12	-	-	0.42	3.05	-
522 - 79	CRWC-K	19.3	-	11.5	8.1	2.1	-	-	614.0	11.0	-	-	-	0.10	-	-	0.26	3.25	-
524 - 73	DNRPCK-630613	25.0	471.7	7.9	8.6	1.3	-	< 10.0	292.0	12.0	-	-	20.0	U	U	-	0.01	0.03	0.87
525 - 73	DNRPCK-630614	24.9	465.0	6.3	8.4	1.0	-	4100.0	299.0	13.0	-	-	22.0	U	U	-	0.14	0.06	0.90
526 - 73	DNRPCK-630615	23.7	481.7	6.9	8.2	1.3	-	1016.7	312.0	17.0	-	-	23.0	U	U	-	0.06	0.15	0.99
527 - 73	DNRPCK-630617	21.2	510.0	6.9	8.2	0.6	-	436.7	331.0	17.0	-	-	25.0	U	U	-	0.03	0.00	0.84
528 - 73	DNRPCK-630616	23.3	510.0	7.5	8.4	1.3	-	1180.0	312.0	18.0	-	-	22.0	U	U	-	0.02	0.16	0.89

Table 4.2. continued.

MAP ID 8-YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI 8/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLOROPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONZ NH3	NH3 + NH4	NO2 & NO3	ORG. NITR.
529 - 73	DNRPCK-630618	21.9	512.5	7.0	8.2	0.7	-	463.3	325.0	19.0	-	-	23.0	U	U	-	0.03	0.10	0.91
530 - 73	DNRPCK-630619	21.7	524.2	7.8	8.2	0.9	-	203.3	330.0	23.0	-	260.0	25.0	U	U	-	0.02	0.19	0.04
531 - 73	DNRPCK-630620	21.3	527.5	7.5	8.2	0.0	-	216.7	330.0	6.0	-	-	28.0	U	U	-	0.01	0.19	0.04
532 - 72	DNRSTO-630004	14.5	450.0	7.2	8.0	<0.5	-	140.0	-	15.0	-	270.0	45.0	U	U	-	0.02	0.16	0.20
532 - 73	DNRSTO-630004	13.0	-	9.0	8.0	1.3	-	410.0	-	21.0	-	245.0	27.9	U	U	-	0.02	0.12	0.50
532 - 74	DNRSTO-630004	22.5	530.0	9.4	7.7	0.9	-	120.0	316.0	5.0	-	260.0	29.0	U	U	-	0.02	0.13	0.19
533 - 73	DNRPCK-630621	21.5	525.0	7.7	8.3	0.9	-	253.3	351.0	26.0	-	-	27.0	U	U	-	0.01	0.22	0.90
534 - 76	SENCO8-6	18.9	-	8.9	8.1	1.2	-	1306.0	360.0	12.5	4.3	-	40.0	0.07	-	-	0.02	0.20	0.31
535 - 73	DNRPCK-630622	21.9	855.0	8.4	8.4	1.5	-	296.7	351.0	39.0	-	265.0	30.0	U	U	-	0.01	0.25	1.11
535 - 73	DNRRTN-630622	16.9	850.0	9.9	7.0	1.9	-	232.5	387.0	6.0	-	-	30.0	U	U	-	<0.03	0.25	0.42
536 - 73	DNRPTN-630636	24.0	-	10.1	8.4	2.0	-	-	-	12.0	-	253.3	40.0	U	U	-	0.02	2.40	0.59
537 - 73	DNRRTN-630604	19.2	703.0	8.6	7.9	2.4	-	230.0	460.0	2.0	-	-	72.0	U	U	-	0.07	2.25	0.92
539 - 70	DNTSTO-800012	14.0	460.0	8.4	8.0	-	-	-	299.0	21.0	-	230.0	19.0	U	U	-	0.00	0.20	-
540 - 73	DNRRTN-630605	19.5	501.0	8.5	8.1	1.5	-	100.0	310.0	7.0	-	-	22.5	U	U	-	0.03	0.11	0.62
540 - 76	SENCO8-7	17.7	-	8.3	8.0	0.9	-	271.0	307.0	11.1	5.1	-	25.0	0.07	-	-	0.02	0.21	0.40
541 - 73	DNRRTN-630606	19.5	741.0	8.0	8.0	2.9	-	202.0	507.0	8.0	-	-	77.0	U	U	-	0.21	2.00	0.09
541 - 74	CRNC-J	20.0	-	9.6	7.9	3.1	-	541.0 @	459.7	17.2	-	-	-	U	-	-	0.41	2.00	-
541 - 75	CRNC-J	21.0	-	11.5	7.9	3.1	-	255.6 @	445.4	23.5	-	-	-	0.16	-	-	0.46	1.34	-
541 - 76	SENCO8-8	17.0	-	8.7	7.9	1.5	-	1020.0	492.0	13.5	4.7	-	90.0	0.24	-	-	0.26	3.63	0.69
541 - 76	CRNC-J	21.0	-	9.9	8.0	3.5	-	31.1 @	375.0	15.5	-	-	-	0.10	-	-	0.50	1.50	-
541 - 77	CRNC-J	20.0	-	10.9	7.0	6.1	-	3.2 @	556.5	22.1	-	-	-	0.25	-	-	0.49	2.37	-
541 - 78	CRNC-J	19.5	-	9.1	7.6	3.7	-	55.4 @	510.4	20.4	-	-	-	0.15	-	-	0.44	2.21	-
541 - 79	CRNC-J	10.0	-	10.1	7.0	2.3	-	-	533.0	13.0	-	-	-	0.09	-	-	0.30	1.92	-
542 - 83	LBI-1	-	710.0	-	8.3	1.3	19.0	-	400.0	16.0	-	250.0	79.0	0.12	0.06	-	-	3.60	-
543 - 83	LBI-2	-	710.0	-	8.4	1.4	23.0	-	400.0	12.0	-	255.0	80.0	0.10	0.06	-	-	3.70	-
544 - 83	LBI-3	-	710.0	-	8.4	1.6	21.0	-	420.0	22.0	-	255.0	80.0	0.11	0.06	-	-	3.60	-
545 - 83	LBI-4	-	715.0	-	8.4	2.0	22.0	-	420.0	18.0	-	265.0	80.0	0.10	0.07	-	-	3.60	-
546 - 83	LBI-5	-	LA	-	LA	LA	10.0	-	LA	LA	-	270.0	LA	0.11	LA	-	-	3.60	-
547 - 73	DNRRTN-500201	19.4	732.0	8.3	8.0	3.0	-	170.0	507.0	10.0	-	265.0	78.0	U	U	-	0.19	1.97	0.03
547 - 73	DNRPTN-500201	23.3	-	8.5	8.2	4.7	-	-	-	17.7	-	250.3	81.0	U	U	-	0.14	2.00	0.00
547 - 80	DNRSTO-500201	3.0	790.0	13.9	8.2	5.0	27.0	20.0	500.0	6.0	-	270.0	-	0.07	0.02	-	0.20	2.80	-
547 - 83	LBI-6	-	722.5	-	8.2	1.5	19.0	-	430.0	13.5	-	262.5	79.0	0.10	0.06	-	-	3.10	-
548 - 83	LBI-7	-	740.0	-	8.4	1.1	16.0	-	450.0	9.0	-	200.0	80.0	0.10	0.06	-	-	3.40	-

Table 4.2. continued.

MAP ID & YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLAPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONIZ NH3	NH3 + NH4	NO2 & NO3	ORG. NITR.
549 - 83	LBI-8	-	735.0	-	8.5	1.0	14.0	-	460.0	14.0	-	255.0	80.0	0.10	0.06	-	-	3.40	-
550 - 83	LBI-9	-	740.0	-	8.4	1.1	15.0	-	440.0	15.0	-	260.0	80.0	0.10	0.06	-	-	3.40	-
551 - 73	DNRRTM-500202	19.4	730.0	8.0	7.9	3.2	-	162.0	401.0	14.0	-	-	72.5	U	U	-	0.23	1.01	0.06
552 - 73	DNRRTM-500203	19.3	720.0	7.9	8.0	2.0	-	110.0	401.0	18.0	-	260.0	70.5	U	U	-	0.22	1.04	0.98
552 - 73	DNRPTM-500203	23.7	-	7.7	8.1	3.1	-	-	-	22.3	-	261.7	70.0	U	U	-	0.10	1.90	0.77
552 - 74	CRWC-8	20.0	-	8.5	7.9	3.5	-	236.6 G	475.0	29.0	-	-	-	U	-	-	0.42	2.15	-
552 - 75	CRWC-8	20.0	-	10.6	7.9	3.7	-	164.7 G	400.0	30.6	-	-	-	0.17	-	-	0.44	1.29	-
552 - 76	SEMCOG-9	10.0	-	7.3	7.0	1.0	-	1732.0	405.0	44.4	5.6	-	94.0	0.26	-	-	0.20	3.51	0.69
552 - 76	CRWC-8	21.5	-	7.6	7.0	3.3	-	236.4 G	435.9	20.3	-	-	-	0.17	-	-	0.57	1.68	-
552 - 77	CRWC-8	19.0	-	9.5	7.6	5.1	-	-	500.4	35.4	-	-	-	0.10	-	-	0.86	2.10	-
552 - 78	CRWC-8	20.0	-	8.3	7.4	3.0	-	139.4 G	502.0	40.2	-	-	-	0.26	-	-	0.51	2.06	-
552 - 79	CRWC-8	17.1	-	8.4	7.6	2.0	-	-	495.5	29.5	-	-	-	0.13	-	-	0.40	2.14	-
553 - 73	DNRRTM-500204	19.3	734.0	7.0	7.9	2.7	-	190.0	474.0	27.0	-	-	71.5	U	U	-	0.20	1.72	0.07
554 - 73	DNRRTM-500205	19.7	729.0	7.7	8.1	3.9	-	230.0	460.0	33.0	-	-	72.5	U	U	-	0.17	1.72	0.75
555 - 73	DNRRTM-500206	19.7	723.0	7.4	7.9	2.9	-	206.0	401.0	34.0	-	-	73.0	U	U	-	0.19	1.00	0.93
556 - 71	DNRSTO-500047	11.0	450.0	4.2	7.7	21.0	-	3500.0	292.0#	336.0	-	170.0	66.0	U	U	-	1.00	-	0.70
556 - 72	DNRSTO-500047	12.2	796.1	8.1	7.0	8.1	-	6767.0	517.6#	42.3	-	260.3	100.1	U	U	-	0.02	1.70	0.99
556 - 73	DNRSTO-500047	16.4	736.9	8.0	7.9	4.1	-	402.6	471.3#	32.3	-	263.5	81.9	U	U	-	0.33	1.60	0.07
556 - 74	DNRSTO-500047	10.6	679.5	9.7	7.9	3.4	-	202.0	433.6	34.9	-	259.3	76.2	U	U	-	0.27	1.45	1.01
556 - 74	CRWC-F	20.0	-	8.2	7.7	2.0	-	316.1 G	530.7	34.1	-	-	-	U	-	-	0.35	2.50	-
556 - 75	CRWC-F	21.0	-	10.1	7.7	3.0	-	101.9 G	412.0	44.7	-	-	-	0.16	-	-	0.40	1.40	-
556 - 75	DNRSTO-500047	2.0	720.0	13.2	8.1	3.0	22.0	370.0	436.0	20.0	-	275.0	86.0	0.13	0.06	-	0.56	1.20	0.76
556 - 76	CRWC-F	22.0	-	7.0	8.0	2.7	-	140.2 G	470.2	26.1	-	-	-	0.10	-	-	0.66	1.64	-
556 - 77	CRWC-F	19.0	-	8.9	7.6	5.1	-	7.5 G	517.0	29.6	-	-	-	0.22	-	-	0.51	2.41	-
556 - 78	CRWC-F	20.0	-	7.9	7.4	2.9	-	83.0 G	543.0	64.4	-	-	-	0.20	-	-	0.39	2.12	-
556 - 79	CRWC-F	17.1	-	8.4	7.0	2.0	-	-	532.5	30.0	-	-	-	0.14	-	-	0.34	2.19	-
556 - 80	DNRSTO-500047	2.0	820.0	12.0	8.0	2.1	20.0	30.0	520.0	12.0	-	260.0	-	0.07	0.04	-	0.30	2.00	-
556 - 87	CTYWAR-Hayes	21.5	-	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

G = Value calculated as geometric mean instead of arithmetic mean (average)
LA = Laboratory accident
U = Unreliable data.
# = Estimated from conductivity.
< = Actual concentration is less than the value shown.

Table 4.2. continued.

MAP ID & YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLOROPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONZ NH3	NH3 + NH4	NO2 & NO3	ORG. NITR.
SECTION 6. NORTH AND MIDDLE BRANCH OF THE CLINTON RIVER AND THEIR TRIBUTARIES.																			
601 - 73	DNRNBR-1	13.0	-	9.3	8.2	-	-	-	-	-	-	-	-	U	U	-	0.02	0.49	0.30
602 - 73	DNRNBR-2	10.0	-	9.0	8.3	-	-	-	-	-	-	-	-	U	U	-	0.03	0.20	0.30
603 - 73	DNRNBR-3	10.5	-	8.0	8.3	-	-	-	-	-	-	-	-	U	U	-	0.02	0.60	0.55
604 - 73	DNRNBR-4	22.0	-	8.7	8.3	-	-	-	-	-	-	-	-	U	U	-	0.00	0.47	0.35
604 - 75	DNRNBA-440069	17.4	576.3	8.3	8.1	1.6	-	2540.0	356.0	10.0	-	315.0	10.0	0.07	0.03	-	0.04	0.45	0.53
605 - 73	DNRNBR-6	20.0	-	7.0	8.3	-	-	-	-	-	-	-	-	U	U	-	0.15	1.60	0.60
605 - 75	DNRNBA-440060	17.3	622.5	7.4	8.1	2.9	-	3175.0	392.0	16.0	-	300.0	37.0	0.37	0.27	-	0.21	0.76	0.67
606 - 75	DNRNBA-440004	17.6	622.5	7.5	8.1	3.0	-	2000.0	300.0	10.0	-	300.0	35.0	0.44	0.35	-	0.20	0.06	0.65
607 - 73	DNRNBR-7	24.0	-	7.6	8.2	-	-	-	-	-	-	-	-	U	U	-	0.07	2.10	0.66
607 - 75	DNRNBA-440061	17.0	631.3	7.0	8.2	1.9	-	1130.0	412.0	11.0	-	315.0	34.0	0.45	0.30	-	0.11	1.03	0.57
608 - 80	DNRSTO-440102	13.9	670.0	9.6	8.4	2.5	13.6	216.0	431.0	11.0	1.0	-	-	0.47	0.41	-	0.02	2.29	0.71
609 - 80	DNRSTO-440101	15.4	864.0	9.3	8.1	2.5	10.0	110.0	610.0	15.0	2.0	-	-	0.06	0.03	-	0.03	0.11	0.64
611 - 80	DNRSTO-500362	13.3	710.0	9.6	8.4	2.3	14.3	300.0	473.0	14.0	1.0	-	-	0.34	0.20	-	0.02	1.94	0.57
612 - 73	DNRNBR-10	24.0	-	6.0	8.3	-	-	-	-	-	-	-	-	U	U	-	0.13	0.03	0.02
613 - 73	DNRNBR-11	23.5	-	7.4	8.3	-	-	-	-	-	-	-	-	U	U	-	0.06	0.66	0.64
614 - 73	DNRNBR-12	23.5	-	6.4	8.2	-	-	-	-	-	-	-	-	U	U	-	0.05	0.53	0.50
614 - 75	DNRSTO-500241	18.6	675.0	8.2	8.3	1.0	-	1500.0	416.0	3.0	-	320.0	45.0	0.16	0.11	-	0.03	0.58	0.45
615 - 75	DNRSTO-500289	20.5	525.0	7.3	8.1	1.5	-	626.0	312.0	4.0	-	210.0	45.0	0.04	0.01	-	0.04	0.03	0.53
616 - 75	DNRSTO-500288	19.1	541.0	7.7	8.1	1.2	-	1066.0	326.0	8.0	-	235.0	47.0	0.04	0.01	-	0.03	0.10	0.56
617 - 75	DNRSTO-500287	18.0	553.0	7.7	8.2	1.2	-	776.0	346.0	5.0	-	240.0	49.0	0.04	0.02	-	0.02	0.07	0.42
618 - 75	DNRSTO-500290	19.0	536.0	7.4	8.2	1.6	-	872.0	332.0	22.0	-	255.0	34.0	0.07	0.01	-	0.34	0.00	0.57
619 - 75	DNRSTO-500291	18.9	540.0	7.9	8.1	1.7	-	1096.0	346.0	12.0	-	260.0	34.0	0.09	0.03	-	0.03	0.09	0.52
620 - 72	DNRSTO-500110	14.5	720.0	3.4	7.9	<0.5	-	400.0	460.0*	19.0	-	300.0	35.0	U	U	-	0.03	0.02	0.24
620 - 75	DNRSTO-500292	18.6	559.0	8.2	8.2	2.0	-	2440.0	366.0	8.0	-	260.0	35.0	0.09	0.03	-	0.02	0.09	0.50
621 - 73	DNRSTO-500110	12.0	-	9.0	7.9	4.7	-	220.0	470.0*	11.0	-	315.0	70.0	U	U	-	0.09	0.46	1.30
621 - 74	DNRSTO-500110	25.5	610.0	10.2	8.6	3.4	-	< 10.0	412.0	9.0	-	270.0	49.0	U	U	-	0.47	0.60	0.50
621 - 75	DNRSTO-500130	19.6	612.5	7.9	8.2	2.6	-	<340.0	390.0	7.0	-	200.0	45.0	0.39	0.29	-	0.41	0.24	0.39
622 - 73	DNRNBR-13	23.5	-	7.0	8.2	-	-	-	-	-	-	-	-	U	U	-	0.00	0.64	0.51
622 - 74	CRWC-N	19.0	-	11.3	7.0	2.2	-	234.5 B	509.3	11.9	-	-	-	U	-	-	0.27	0.06	-
622 - 75	DNRSTO-500242	18.0	649.0	8.5	8.3	2.5	-	1300.0	414.0	8.0	-	300.0	40.0	0.21	0.16	-	0.10	0.40	0.51
622 - 75	CRWC-N	19.0	-	11.4	7.9	2.5	-	395.2 B	412.3	17.0	-	-	-	0.16	-	-	0.31	0.04	-
622 - 76	SEMCOG-17	17.6	-	5.9	7.9	2.7	-	2665.0	405.0	20.4	8.2	-	60.0	0.43	-	-	0.50	0.64	0.56
622 - 76	CRWC-N	20.0	-	11.4	8.0	2.5	-	279.6 B	499.2	8.0	-	-	-	0.26	-	-	0.53	0.43	-
622 - 77	CRWC-N	20.0	-	10.9	7.8	4.6	-	447.2 B	527.6	17.5	-	-	-	0.41	-	-	0.64	0.81	-
622 - 78	CRWC-N	18.0	-	9.2	7.5	4.4	-	93.7 B	507.4	22.0	-	-	-	0.32	-	-	1.12	0.58	-
622 - 79	CRWC-N	17.4	-	10.7	8.0	2.0	-	-	533.5	11.5	-	-	-	0.22	-	-	0.41	0.60	-

Table 4.2. continued,

MAP ID & YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	COD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLRPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	TOTAL ORTHO PO4	UN-IONZ NH3	NH3 + NH4	NO2 & NO3	ORG. NITR.
623 - 73	DNRMDB-14	23.5	-	7.8	8.2	-	-	-	-	-	-	-	-	U	U	-	0.05	0.57	0.72
623 - 75	DNRSTO-500243	18.9	636.0	8.1	8.3	2.7	-	1520.0	432.0	7.0	-	290.0	40.0	0.29	0.20	-	0.13	0.41	0.66
624 - 75	DNRSTO-500293	20.5	730.0	8.5	8.2	1.5	-	930.0	400.0	1.0	-	-	40.0	0.07	0.03	-	0.04	0.03	0.61
625 - 75	DNRSTO-500294	20.5	800.0	6.3	8.0	4.4	-	1001.0	521.0	12.0	-	-	61.0	1.51	0.97	-	1.97	1.66	1.40
625 - 76	SEMCOG-20	17.1	-	5.5	7.0	1.0	-	1304.0	357.0	7.0	7.4	-	40.0	0.05	-	-	0.01	0.06	0.41
626 - 75	DNRSTO-500295	21.0	823.0	7.7	8.3	2.4	-	2222.0	401.0	1.0	-	-	54.0	1.29	0.94	-	0.53	1.40	0.65
627 - 74	CRWC-1	19.0	-	10.2	8.0	2.2	-	441.3 G	617.0	11.3	-	-	-	U	-	-	0.23	0.34	-
627 - 75	CRWC-1	18.0	-	10.1	7.8	2.5	-	430.5 G	449.7	14.3	-	-	-	0.35	-	-	0.32	2.00	-
627 - 76	CRWC-1	-	-	10.4	8.2	2.3	-	249.0 G	537.7	10.0	-	-	-	0.43	-	-	0.33	1.17	-
627 - 77	CRWC-1	20.0	-	11.4	7.8	4.9	-	11.0 G	619.6	32.4	-	-	-	0.09	-	-	0.36	1.64	-
627 - 78	CRWC-1	18.0	-	9.6	7.5	2.3	-	45.0 G	642.0	23.0	-	-	-	0.39	-	-	0.42	1.43	
627 - 79	CRWC-1	17.2	-	11.0	8.1	1.9	-	-	654.0	6.0	-	-	-	0.36	-	-	0.26	1.40	-
628 - 76	SEMCOG-21	17.7	-	5.5	7.0	3.1	-	1764.0	380.0	143.7	25.4	-	75.0	0.16	-	-	0.04	0.05	0.91
629 - 83	DNRMDR-1	-	1,290.0	-	8.1	-	-	-	890.0	-	-	-	240.0	-	-	-	-	-	-
630 - 83	DNRMDR-2	-	1,450.0	-	7.9	-	-	-	700.0	-	-	-	100.0	-	-	-	-	-	-
631 - 71	DNRSTO-500045	9.5	560.0	4.8	8.0	5.0	-	2200.0	364.0	95.0	-	240.0	67.0	U	U	-	0.26	-	0.70
631 - 72	DNRSTO-500045	12.1	616.1	8.4	7.9	2.9	-	127.7	400.6	33.1	-	275.6	52.2	U	U	-	0.16	0.50	0.69
631 - 83	DNRMDR-3	-	1,100.0	-	8.3	-	-	-	600.0	-	-	-	100.0	-	-	-	-	-	-
632 - 73	DNRSTO-500045	10.5	640.6	9.0	8.0	2.5	-	123.3	418.9	32.5	-	306.0	48.7	U	U	-	0.08	0.73	0.59
632 - 74	DNRSTO-500045	10.5	643.0	9.7	8.0	2.2	-	127.3	424.7	37.7	-	289.5	51.1	U	U	-	0.09	0.72	0.74
632 - 75	DNRSTO-500045	1.0	740.0	12.7	8.0	4.1	26.0	370.0	462.0	9.0	-	335.0	70.0	0.23	0.20	-	0.32	1.30	0.64
632 - 76	SEMCOG-19	17.9	-	8.0	7.9	1.2	-	1260.0	398.0	75.0	8.0	-	61.0	0.22	-	-	0.13	0.39	0.65
633 - 79	DNRGDR-1	-	-	-	-	1.0	-	-	-	36.0	-	-	76.0	-	0.09	-	0.02	0.16	-
634 - 79	DNRGDR-3	-	-	-	-	3.0	-	-	-	5.0	-	-	340.0	-	0.15	-	0.05	0.22	-
635 - 79	DNRGDR-2	-	-	-	-	1.0	-	-	-	25.0	-	-	77.0	-	0.09	-	0.01	0.16	-
636 - 75	DNRTDR-500206	20.0	1,030.0	7.4	8.0	1.2	-	312.0	610.0	1.0	-	-	51.0	0.05	0.01	-	0.04	0.40	0.44
637 - 75	DNRTDR-500205	18.5	770.0	7.0	8.2	1.1	-	3512.0	544.0	1.0	-	-	32.0	0.32	0.26	-	0.25	0.69	0.32
638 - 75	DNRTDR-500204	19.0	741.3	8.0	8.3	1.5	-	4220.0	460.0	75.0	-	-	40.0	0.31	0.22	-	0.00	0.65	0.48
639 - 76	SEMCOG-18	17.6	-	6.4	7.9	1.3	-	2430.0	442.0	62.0	3.1	-	85.0	0.14	-	-	0.09	0.99	0.55
640 - 73	DNRRTN-500210	20.5	642.0	7.8	7.9	3.3	-	464.0	442.0	42.0	-	-	47.5	U	U	-	0.10	0.46	0.79
640 - 74	CRWC-C	20.0	-	8.7	7.9	2.3	-	346.2 G	464.2	32.2	-	-	-	U	-	-	0.35	0.73	-
640 - 75	CRWC-C	-	-	11.6	7.9	3.6	-	340.4 G	346.5	46.3	-	-	-	0.20	-	-	0.21	1.36	-
640 - 76	CRWC-C	22.5	-	6.0	7.0	2.1	-	520.0 G	540.0	40.1	-	-	-	0.23	-	-	0.53	0.48	-
640 - 77	CRWC-C	19.0	-	9.3	7.6	3.6	-	31.1 G	531.6	64.3	-	-	-	0.22	-	-	0.50	1.79	-
640 - 78	CRWC-C	21.0	-	6.9	7.4	2.6	-	62.2 G	609.2	27.4	-	-	-	0.21	-	-	0.52	1.40	
640 - 79	CRWC-C	17.3	-	9.0	8.2	3.2	-	-	495.0	24.0	-	-	-	0.20	-	-	0.44	3.10	-

G = Value calculated is geometric mean instead of arithmetic mean (average).
U = Unreliable data.
# = Estimated from conductivity.
< = Actual concentration is less than the value shown.

Table 4.2. continued.

MAP ID 8-YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLORPHYL a (ug/L)	HARDNESS	Cl	TOTAL PO4	NH3 + NH4	NO2 & NO3	ORG. NITR.
S E C T I O N 7. LAKE ST. CLAIR IN THE VICINITY OF THE CLINTON RIVER MOUTH AND THE SPILLWAY.																
702 - 00	DNRLSC-500411	23.4	219.0				7.0	144.5								
703 - 00	DNRLSC-500410	24.3	250.0				15.0	159.6								
704 - 00	DNRLSC-500409	24.7	274.4				214.0	167.4								
707 - 00	DNRLSC-500408	23.9	227.6				19.0	144.6								
708 - 00	DNRLSC-500403	22.8	212.0				11.0	136.0								
709 - 00	DNRLSC-500407	23.9	224.2				34.0	146.4								
710 - 00	DNRLSC-500399	22.0	214.2				4.0	130.4								
711 - 00	DNRLSC-500406	24.3	256.6				49.0	166.6								
712 - 00	DNRLSC-500402	23.6	212.6				8.0	130.0								
713 - 00	DNRLSC-500405	24.6	264.6				40.0	172.6								
714 - 00	DNRLSC-500404	24.0	260.6				40.0	173.6								
715 - 00	DNRLSC-500398	23.3	213.2				4.0	135.6								
716 - 00	DNRLSC-500401	24.0	247.2				72.0	160.0								
717 - 00	DNRLSC-500397	23.5	212.6				4.0	135.6								
718 - 00	DNRLSC-500400	24.3	306.2				326.0	199.6								
719 - 00	DNRLSC-500391	21.5	209.6				7.0	137.0								
720 - 00	DNRLSC-500396	23.6	213.4				5.0	138.6								
721 - 00	DNRLSC-500390	22.2	210.0				5.0	130.4								
722 - 00	DNRLSC-500389	22.9	212.4				4.0	138.6								
723 - 00	DNRLSC-500395	23.9	215.6				3.0	141.6								
724 - 00	DNRLSC-500388	23.4	211.6				6.0	136.4								
725 - 00	DNRLSC-500387	23.6	215.6				7.0	139.0								
726 - 00	DNRLSC-500394	23.0	216.6				13.0	141.4								
727 - 00	DNRLSC-500386	23.0	251.2				110.0	159.6								

Table 4.2. continued.

MAP ID O-YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLOROPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	NH3 + NH4	NO2 & NO3	ORG. NITR.
728 - 70	DNRSTO-500001	23.2					14.7									
728 - 71	DNRSTO-500001	21.0					16.2									
728 - 72	DNRSTO-500001	21.5					16.2									
729 - 70	DNRSTO-500004	24.3					12.0									
729 - 71	DNRSTO-500004	22.0					17.6									
729 - 72	DNRSTO-500004	21.0					27.0									
729 - 73	DNRSTO-500004	23.0					110.0									
729 - 74	DNRSTO-500004	24.0					< 10.0									
730 - 70	DNRSTO-500002	23.2					12.0									
730 - 71	DNRSTO-500002	21.0					13.0									
730 - 72	DNRSTO-500002	21.3					22.6									
730 - 73	DNRSTO-500002	23.0					< 10.0									
730 - 74	DNRSTO-500002	24.0					30.0									
731 - 70	DNRSTO-500003	23.2					12.0									
731 - 71	DNRSTO-500003	21.0					41.4									
731 - 72	DNRSTO-500003	21.5					15.9									
732 - 80	DNRLSC-500393	23.7	231.2				56.0	150.0								
733 - 80	DNRLSC-500384	21.4	200.0				16.0	136.4								
734 - 80	DNRLSC-500383	22.2	211.0				4.0	135.4								
735 - 80	DNRLSC-500382 $	23.2	271.0				60.0	177.0								
736 - 80	DNRLSC-500379	24.0	240.6				201.0	152.4								
737 - 80	DNRLSC-500380	23.6	220.6				16.0	140.2								
738 - 80	DNRLSC-500381	22.5	211.2				9.0	130.4								
739 - 80	DNRLSC-500376	23.6	230.0				63.0	147.4								
740 - 80	DNRLSC-500377	23.5	223.4				5.0	142.0								
741 - 80	DNRLSC-500378	22.7	212.6				7.0	142.0								
742 - 80	DNRLSC-500392	21.9	210.0				10.0	137.0								
743 - 80	DNRLSC-500385	21.3	209.0				3.0	137.0								
744 - 71	423230008251000	24.0	290.0	5.8	7.0	-	59.0	170.0	17.0	-	-	10.0	U	0.40	-	0.58
744 - 72	423230008251000	17.0	265.0	10.9	7.9	-	47.0	190.0	17.5	-	-	12.5	U	0.12	-	0.52
744 - 73	423230008251000	19.0	235.0	0.7	0.6	-	37.5	140.0	24.5	-	-	14.5	U	0.06	0.10	0.33
744 - 74	423230008251000	26.5	262.0	12.7	-	-	-	140.0	6.0	-	-	12.0	U	0.02	-	0.75

Table 4.2. continued.

MAP ID O-YEAR	STATION CODE	TEMP C	CONDUCT. (umhos/cm)	D.O.	pH	BOD	FEC COLI #/100 ml	TOTAL DISS. SOLIDS	SUSP. SOLIDS	CHLAPHYL A (ug/L)	HARDNESS	Cl	TOTAL PO4	NH3 + NH4	NO2 & NO3	ORG. NITR.
745 - 71	423400008249020	23.5	220.0	5.8	7.0	-	0.0	130.0	8.0	-	-	6.0	U	0.23	-	0.15
745 - 72	423400008249020	16.0	220.0	10.9	7.9	-	<1.5	140.0	10.0	-	-	8.0	U	0.07	-	0.32
745 - 73	423400008249020	10.3	220.0	8.7	8.6	-	3.0	135.0	26.0	-	-	15.0	U	<0.02	<0.15	0.20
745 - 74	423400008249020	27.0	245.0	12.7	-	-	-	120.0	11.0	-	-	9.0	U	0.02	-	0.75
746 - 72	423500008245000	15.5	207.5	10.1	7.0	-	<1.5	130.0	5.0	-	-	7.5	U	<0.07	-	0.19
746 - 73	423500008245000	17.0	190.0	10.1	8.1	-	<2.0	130.0	5.5	-	-	13.0	U	<0.02	0.20	0.08
746 - 74	423500008245000	18.5	217.0	10.7	-	-	-	120.0	5.0	-	-	6.0	U	0.02	-	0.13
747 - 72	423730008245000	15.5	205.0	9.9	7.2	-	<2.0	130.0	5.5	-	-	7.5	U	<0.08	-	0.18
747 - 73	423730008245000	16.0	195.0	10.2	8.3	-	<1.5	125.0	6.0	-	-	12.0	U	<0.02	0.25	0.08
747 - 74	423730008245000	17.0	220.0	9.3	-	-	-	120.0	5.0	-	-	6.0	U	0.02	-	0.13
748 - 75	423730008247300	18.6	210.6	8.7	8.2	-	-	-	5.9	2.3	-	7.0	0.01	-	-	0.21
749 - 75	423524008244320	18.2	210.0	5.9	8.7	-	-	-	6.0	-	-	7.0	0.01	-	-	0.17
750 - 00	DNRLSC-500329 $	22.7	211.0	-	-	-	6.0	130.2	-							
751 - 73	DNRLSC-500327	20.0	180.1	8.7	8.7	0.4	-	127.7#	6.5	3.7co	95.0		U	0.02		0.27
752 - 73	DNRLSC-500331	20.5	191.9	8.3	8.7	0.4	-	127.7#	6.5	1.5co	100.0		U	0.03		0.51
753 - 73	DNRLSC-500332	20.7	195.0	8.0	8.8	0.5	-	125.7#	6.0	0.0co	96.0		U	0.02		0.27
754 - 73	DNRLSC-500334	22.4	212.0	7.0	8.0	0.6	-	139.5#	29.0	17.9co	105.0		U	0.03		0.55
755 - 73	DNRLSC-500336	24.0	464.0	7.2	8.4	2.9	-	260.0#	29.3	43.4co	135.0		U	0.53		1.04
756 - 73	DNRLSC-500338	21.6	203.0	7.2	8.6	0.4	-	126.5#	11.3	6.5co	100.0		U	0.04		0.41
757 - 73	DNRLSC-500339	23.4	200.0	7.7	8.6	1.3	-	105.0#	20.0	15.1co	100.0		U	0.13		0.53
758 - 73	DNRLSC-500340	20.2	189.0	8.7	8.7	-	-	123.0#	7.0	1.5co	95.0		U	0.17		0.26

$ = Value is geometric mean.
b = Results based on colony counts outside the acceptable range.
co = corrected.
LA = Laboratory Accident.
U = Unreliable data.
# = Estimated from conductivity.
< = Actual concentration is less than the value shown.

ranged from 4.1 to 10 mg/l with lowest values at stations 201, 103, 109, and 115.

Although the data are very sparse for the 1980s, D.O. concentrations in Sections 5 and 6 have improved slightly while D.O. concentrations in Sections 1, 2, 3 and 4 have not improved.

The dissolved oxygen values reported in Table 4.2 are annual averages, most of which are above the 5.0 mg/l minimum required by Michigan Water Quality Standards for warm water streams. However, these averages are a combination of data from all seasons collected during the daylight hours.

There are two sources of oxygen to aquatic systems. The first is reaeration, or that oxygen which dissolves from the atmosphere into the water. Turbulence brought on by rapid, non-laminar flow introduces some oxygen into surface water. The other factor infusing oxygen into water is photosynthesis. Photosynthesis is the process whereby aquatic plants take in carbon dioxide and water in the presence of sunlight to produce oxygen. The more aquatic plants and sunlight, the more oxygen present during the daylight hours. At night, plants respire, that is, they take in oxygen and give off CO_2. So, at night, the more plants, the less oxygen is present. The lowest dissolved oxygen levels are found in the very early morning before dawn, since bacteria and plants have been respiring (consuming oxygen) all night.

This is a natural cycle where the dissolved oxygen level increases during the day and decreases at night, but the fluctuations in high quality systems are minor. In enriched systems with many plants, the dissolved oxygen fluctuations are often very wide. Bacteria, respiring as they decompose dead plants and other organic materials (such as those released from some WWTPs), also consume dissolved oxygen, which fish and benthic macroinvertebrates require for survival.

Warmer water holds less dissolved oxygen than cold water. Sediments may also demand dissolved oxygen in the form of sediment organic materials or sediment chemicals that also consume oxygen. Bacteria also cause oxygen demand.

Thus, a series of warm cloudy days may result in total loss of dissolved oxygen in enriched streams which have little reaeration.

Some aquatic organisms are very sensitive to even very short term, severe reductions of dissolved oxygen, while other organisms are more tolerant of low dissolved oxygen. When dissolved oxygen is absent, most sedentary aquatic life perishes.

Most Clinton River dissolved oxygen measurements were made during the daylight hours, when photosynthesis was occurring and dissolved oxygen would be high. This suggests that the minimum dissolved oxygen values were much lower than the reported average values as indicated by the aquatic community.

Below Red Run, the community remains heavily impacted, especially in Sections 3 and 1. In this area, reaeration is slight due to low slope.

In addition, the river is enriched by municipal discharges and stormwater, and sediment oxygen demand and BOD loadings are high. These conditions have also plagued the fish community in this river reach since the 1970s.

Table 4.3 shows the results of individual samples collected during the day at three stations, between 1972 and 1987. Figures 4.2 and 4.3 show the mean dissolved oxygen concentrations for two stations between 1970 and 1987 based on STORET data. Concentrations at Gratiot Avenue (310) fell below 4.0 mg/l on occasion and frequently below 6.0 mg/l dissolved oxygen. Note the wide fluctuations by season with lowest dissolved oxygen levels in the summer. Percent dissolved oxygen saturation fluctuates into the 60% range frequently and went as low as 40% in 1974. Wider dissolved oxygen concentration fluctuations are apparent at Bridgeview, located in Section 1 (115) where dissolved oxygen ranged from 2.0 to approximately 15 mg/l.

Recent MDNR modeling has indicated that with the present NPDES effluent limits for Clinton River municipal dischargers during summertime drought flow, the Clinton River will not meet Michigan's Water Quality Standards for dissolved oxygen (Reznick, 1987). This modeling indicated that from downstream of Red Run to the North Branch, where the modeling effort stopped, dissolved oxygen standards will be violated, with the lowest dissolved oxygen occurring at the confluence of the North and Main Branches.

Because the slope between the North Branch and Lake St. Clair is small (0.1 foot per mile), and river velocity is slow, it is expected that reaeration in this reach will be negligible. Also, the enriched river conditions do not end at the North Branch confluence, but continue on through the Spillway to Lake St. Clair. These factors suggest that violations of dissolved oxygen standards will continue through the Spillway to Lake St. Clair during summer drought flows. The problem could be further intensified by nutrient enrichment from the Mt. Clemens WWTP effluent flowing upstream during flow reversals and then downstream through the Spillway. The water chemistry data in this Section and a study performed by Limno Tech Inc. (LTI 1984) for the City of Mt. Clemens have demonstrated these flow reversals.

Organic Nitrogen

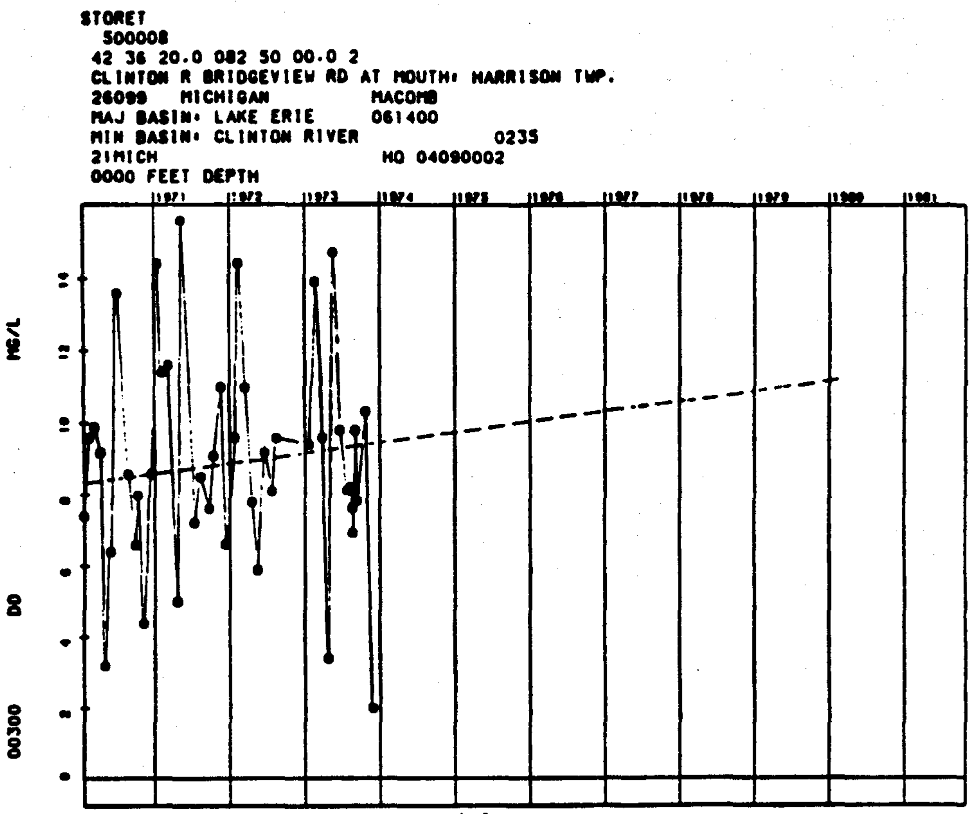
Organic nitrogen concentrations increased downstream of Pontiac and even more downstream of Red Run. Values in the 1970s were slightly higher in Sections 3 and 4. In the 1980s organic nitrogen concentrations were slightly higher in Sections 5 and 1. The higher concentrations in Section 1 were apparently due to a local source. There were no data for organic nitrogen in the mid-1980s.

Nitrite Plus Nitrate (NO_2 + NO_3)

NO_2 and NO_3 concentrations in the 1970s were low at station 502 (0.220 mg/l) but increased to 2.88 and 3.08 mg/l downstream of Pontiac at stations 518 and 522, respectively. Rochester had little impact on NO_2 and NO_3 concentrations. Section 4, station 401 and Section 6, station

Table 4.3 Dissolved oxygen concentrations less than 6.0 mg/L at three Clinton River stations.

Station:	Waterford-M59	Hamlin Rd.	Gratiot Rd.
Location:	upstream of Pontiac	downstream of Pontiac	upstream of Mt. Clemens
Map ID:	502	518	310
Storet #:	630529	630252	500233
Date			
7-72		6.0	
8-72		5.1	
9-72		6.0	
6-73		6.0	5.6
8-73		5.6	
6-74			6.0
7-74			3.8
8-74			3.5
9-74			5.3
5-75			5.5
6-75			5.2
7-75	4.0		5.6
8-75		6.0	5.2
6-76		5.6	5.5
7-76	6.0		
5-77			4.6
7-77			5.4
8-77	5.5		5.7
8-78	4.8		
9-78	5.0	5.9	
7-79	4.0		
7-80			5.1
7-81	5.3		
6-83	5.8		4.5
6-84	4.2		
7-84	4.0		
8-84	3.9		
7-85			5.0
8-85			6.0
8-86	5.1		5.0
9-86			5.7
6-87	3.9		



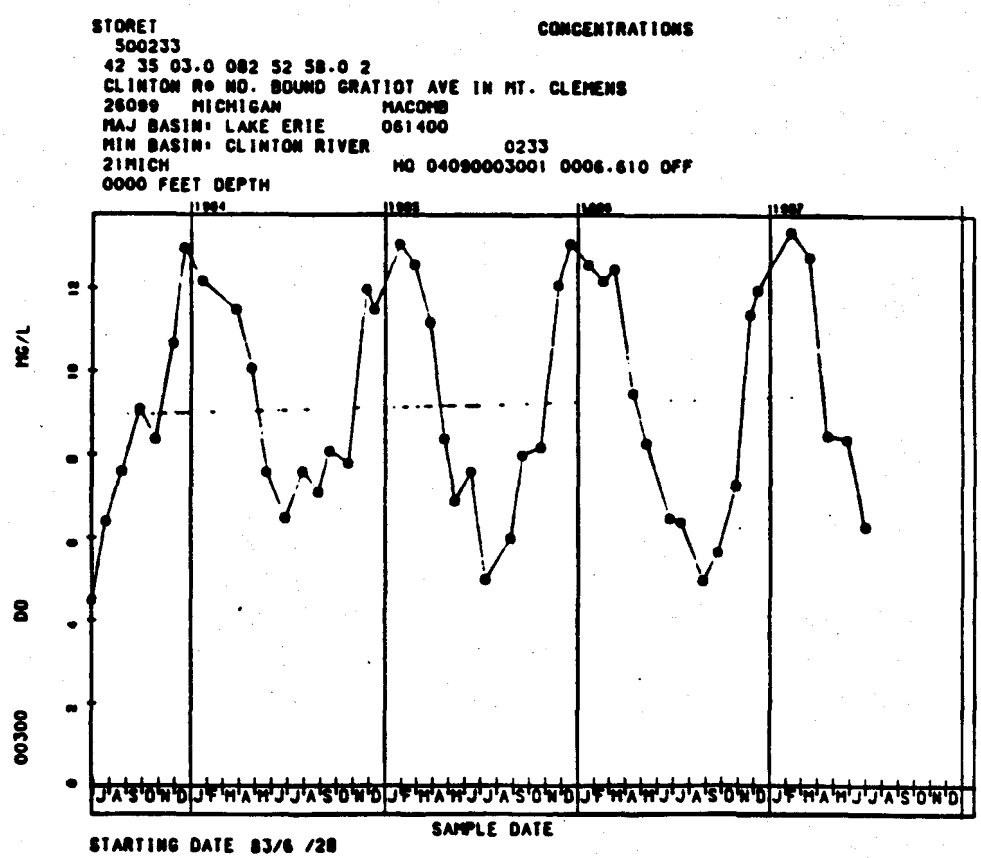
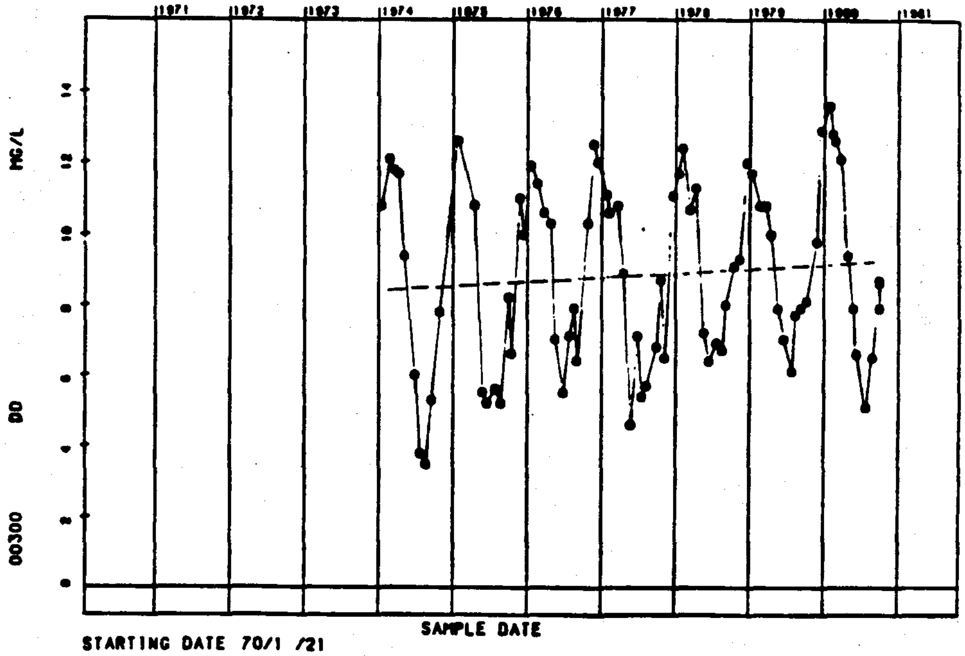


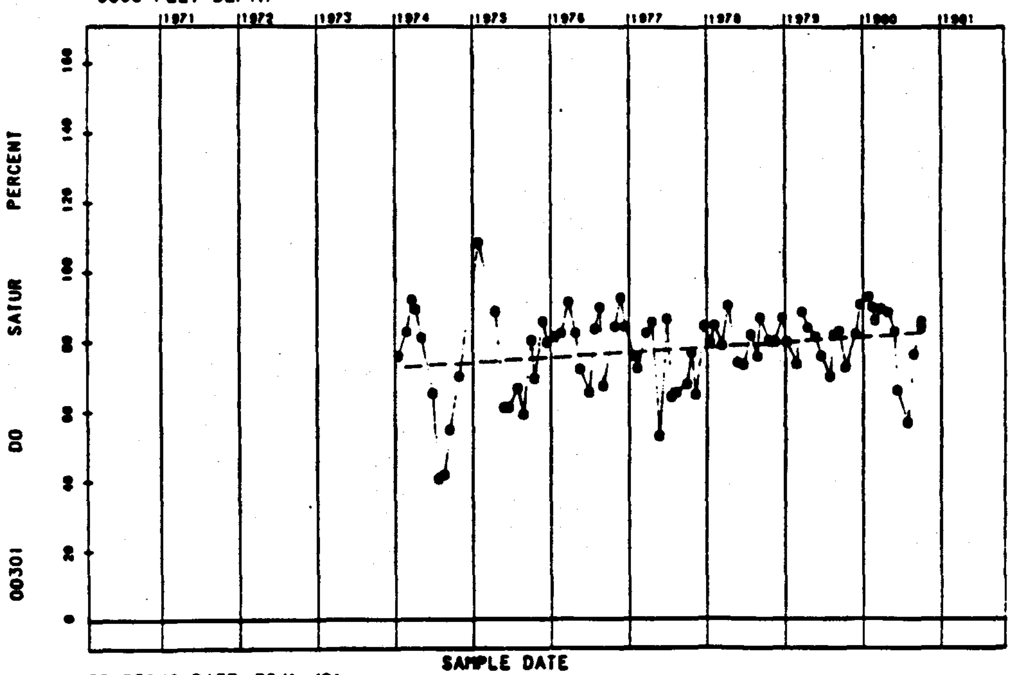
Figure 4.4 Dissolved Oxygen Concentration at Bridgeview, 1970 to 1973, and at Gratiot from 1983 to 1987.

STORET
500233
42 35 03.0 082 52 58.0 2
CLINTON R• NO. BOUND GRATIOT AVE IN MT. CLEMENS
26099 MICHIGAN MACOMB
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0233
21MICH HQ 04090003001 0006.610 OFF
0000 FEET DEPTH



STARTING DATE 70/1 /21

STORET SATURATION
500233
42 35 03.0 082 52 58.0 2
CLINTON R• NO. BOUND GRATIOT AVE IN MT. CLEMENS
26099 MICHIGAN MACOMB
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0233
21MICH HQ 04090003001 0006.610 OFF
0000 FEET DEPTH



STARTING DATE 70/1 /21

Figure 4.5 Dissolved oxygen concentrations (mg/1) and per cent saturation at Gratiot Avenue, 1974 to 1980.

640 were similar at 1.0 mg/l, but Section 4 stations 406, 407 and 410 contained 3.1 to 4.5 mg/l of NO_2 and NO_3. This slightly increased the downstream water concentrations in Section 3 at stations 302, 306, 309 and 310 to 2.74, 2.95, 2.48 and 2.50 mg/l, respectively. Reduced NO_2 and NO_3 concentrations were reported for Sections 1 and 2 with values of 0.52 mg/l at station 103, 1.05 mg/l at station 109, and 1.96 mg/l at station 201.

Although data are very sparse, the NO_2 and NO_3 concentrations appear to be very similar in the early 1980s and the 1970s (Table 4.2, Appendix 4.2). There may have been an increase in NO_2 and NO_3 in Section 4 since concentrations in Section 3 increased over upstream concentrations in Section 5.

Ammonia (NH_3 + NH_4)

In the 1970s, ammonia concentrations at station 502 were 0.102 mg/l and increased to 0.445 mg/l at stations 518 and 522 below Pontiac. The Rochester area had little impact and downstream stations (552, 556) in Section 5 and station 640 in Section 6 were similar to station 522.

Section 4 stations 406 and 408 contained 4.350 and 3.200 mg/l which impacted Section 3 stations 302 through 310 with concentrations averaging about 0.850 mg/l. The trend continued into Section 2 at station 201, and Section 1 at stations 103 and 109, where ammonia concentrations averaged 0.950, 0.560 and 0.800 mg/l, respectively.

In the 1980s, Section 5 ammonia concentrations were less impacted by the Pontiac area with stations 547 and 556 at 0.200 and 0.300 mg/l, respectively. There are no 1980s data from Section 4 or 6, but Section 3 stations reflect drastically decreased inputs from Section 4 with concentrations at stations 302, 306 and 310 at 0.310, 0.160 and 0.190 mg/l, respectively. Sections 2 and 1 continued to be impacted by local WWTPs (the Clinton Township #1 WWTP) since stations 201, 103, and 115 contained NH_3 and NH_4 concentrations of 0.360, 0.660 and 0.400 mg/l, respectively.

Chlorophyll a

Chlorophyll a is a measure of the pigment in floating aquatic plants (algae). Higher chlorophyll a values indicate higher production which is resultant from nutrient enrichment and can cause rapid fluctuations in dissolved oxygen concentrations. Chlorophyll a concentrations in the 1970s were generally slightly higher in Sections 5 and 2 than in the 1980s. There were no chlorophyll a measurements in Sections 4 and 6 in the 1980s. Chlorophyll a concentrations in Section 1 were higher in the 1980s than in the 1970s. Section 2 contained elevated chlorophyll a in the 1980s, but there are no 1970s data for comparison.

BOD_5

Biological oxygen demand (BOD_5) patterns in the 1980s were very similar to the 1970s with lowest values reported at station 502 followed by moderate increases downstream of Pontiac at station 518 (Table 4.2, Appendix 4.3). In the 1970s, values remained slightly elevated in

Sections 3, 2, and 1 while BOD_5 values declined in Section 3 in the 1980s, apparently because of lowered BOD_5 inputs from Section 4. BOD_5 in Sections 2 and 1 were higher in the 1980s. The lower portion of Section 3 (station 310) and Sections 1 and 2 were all above (3.5, 2.6 and 8.8 mg/l BOD_5) values reported in upstream Section 3 (1.4 to 1.8 mg/l). These data suggest a local BOD_5 source or a lack of reaeration in this section.

COD

Measurements of chemical oxygen demand (COD) in the 1970s showed slight increases from station 502 (17 mg/l) to station 518 (22 mg/l) downstream of Pontiac. Red Run COD values were nearly twice (37 mg/l) the Main Branch COD values, but the impact on downstream Section 3 water quality was not apparent. There are no COD values for Section 2, but at station 115, COD values were very high (41.1 mg/l). COD measurements in the early 1980s were similar to earlier years where values increased downstream of Pontiac and remained similar through Section 3 and 2 with elevated levels in Section 1 downstream of Mt. Clemens. However, at station 115 in 1980, COD measurements were very low, reflecting Lake St. Clair waters.

Hardness

Hardness varied little within each section. Hardness varied little among the sections, averaging about 250 mg/l over the years. Section 6 hardness was greatest (300 mg/l). Lake St. Clair water impacts Sections 1 and 2 resulting in variable hardness of 105 to 198 mg/l at station 109 and 115, respectively. There were no hardness measurements in the spillway but hardness should be approximately 250 mg/l based on the hardness in Section 3.

Suspended Solids

Suspended solids at station 502 were similar across all years and increased downstream of Pontiac. Elevated suspended solids from Section 4 contributed to high concentrations in Section 3, as did flows from Section 6. Suspended solids concentrations decreased as these solids began to settle out in lower Section 3, and in Sections 2 and 1. In the 1980s, suspended solids were higher in Sections 1 and 2 than in the immediately upstream Section 3 suggesting local suspended solids inputs.

Chloride

In the 1970s, chlorides at station 502 were 50 mg/l (see Map 6.1). Downstream of Pontiac, chlorides increased to about 85 mg/l and remained at 85 to 95 mg/l downstream of Red Run and the North Branch. Chlorides in Sections 1 and 2 were less than upstream concentrations indicating dilution with Lake St. Clair water. Stations sampled through the years show that chlorides increased about 5 to 10 mg/l across the basin between 1973 and 1987. Data in Table 4.2 and Appendix 4.4 indicate a sharp rise in chloride loadings between February and April at station 310 in 1985 and 1986, probably due to road runoff.

Total Dissolved Solids

In the 1970s, total dissolved solids (TDS) concentrations at station 502 averaged 365 mg/l and ranged between 342.0 and 389.4 mg/l (Appendix 4.5). Downstream of Pontiac, TDS increased to about 500 mg/l. TDS in Sections 4 and 6 averaged 615 and 480 mg/l respectively, resulting in lower Section 3 concentrations of approximately 500 mg/l. Sections 1 and 2 TDS concentrations were less, probably as a result of Lake St. Clair water flowing upstream through the natural channel (Section 1) into the Spillway (Section 2). TDS concentrations have changed little since the 1970s. Total dissolved solids concentrations often exceed the Michigan Water Quality Criteria of 500 mg/l in Section 5 downstream of Pontiac and in Sections 4 and 3.

While it is true that TDS are added by dischargers, the headwaters of the Clinton River in Sashabaw (301), Paint (292), Stony (299), Big Beaver (334), Bear (355), and Coon (480) Creeks, Plumb Brook (474), Taft (610), Yates (460) and McBride (380) Drains contain total dissolved solids near or exceeding 300 mg/l. These high TDS values originate from the watershed soil types (Figure 4.1).

Fecal Coliform Bacteria

The fecal coliform bacteria data are difficult to interpret because some results were reported as geometric means, calculated to compare with Michigan Water Quality Standards, and others were only available as arithmetic means. All data are old and probably do not represent present conditions. Only four values, two at station 502 and two at station 518, are more recent than 1980. One out of four of these results was greater than 200 counts per 100 ml. Annual arithmetic mean fecal coliform bacteria counts ranged from 11 to 528 in the 1970s, and 41 to 218 from 1980-1982 at station 502. Counts were slightly higher at station 517 and 518, downstream of Pontiac, with occasionally higher counts (7639 1977).

Below the Rochester WWTP, similar counts were reported with occasional high values (1020, 1732) at stations 541 and 552, respectively. Counts from Sections 4 and 6 were similar, with stations 403 and 407 in Red Run and stations 605 and 639 showing elevated counts (1000-2548) in the mid-1970s. The results were the same in the mid and late 1970s for the Main Branch at stations 306, 109, and 115, and the Spillway at station 201.

In 1980, fecal coliform concentrations exceeded the 200 counts per 100 ml at station 518 downstream of Pontiac, station 310 in Mt. Clemens, station 201 in the spillway and station 109 at I-94 downstream of the Mt. Clemens WWTP. Elevated fecal coliform bacteria in the spillway resulted in Water Quality Standards exceedences in Lake St. Clair for approximately 3000 feet from the shoreline (Horvath 1981).

Metropolitan Beach is located along the southern edge of the Clinton River delta, north and east of the outfall from the Clinton River spillway. Since the 1960s, the majority of Clinton River flow has exited through the spillway. In the 1970s and 1980s, Metropolitan Beach was closed periodically due to the presence of elevated levels of fecal coliform bacteria in the water (Table 4.1). The 1983 closing was caused by the failure of a 3.3 m interceptor sewer. In addition, water in the natural channel to which the Mt. Clemens WWTP discharges and to which there were combined sewer overflows reverses and flows down the spillway as well. The Clinton Township WWTP #1 outfall was located at the entrance to the spillway in 1980.

The Clinton River upstream of the spillway receives effluent from six other continuously discharging WWTPs and a very large CSO at Red Run. Recent sampling at Metropolitan Beach (Figure 4.3) indicates no exceedences of the fecal coliform bacteria standard.

4.3.2 Metals in Clinton River Water

Metals in water have been analyzed at least once since 1970 at sixty of the nearly 200 water sampling stations in the Clinton River basin, and seven stations in nearshore Lake St. Clair. Most stations were sampled during the mid 1970s. Twelve stations were sampled in 1980, and three stations were sampled in 1981, 1982, 1984, 1985 and 1986. Water was sampled at fifteen stations for metal analysis in 1983 and eight stations were sampled in 1987 (Table 4.4) (see Map 6.1).

Concentrations of metals in water at headwater stations (upstream of Pontiac) are generally low and have changed little over the years. Metals concentrations in water at each station have generally decreased over the years where point source discharges have been and continue to be present. Metal concentrations in water were variable during the mid-seventies, with the highest concentrations of copper, chromium, lead, iron, nickel, and zinc reported in Red Run. High heavy metals concentrations from Red Run contributed to elevated metal concentrations in Sections 3 and 2. Elevated metals were only infrequently reported in Section 1 suggesting that most of the flow from Section 3, and the main branch of the Clinton River, passes through the spillway (Section 2) not the natural channel (Section 1). Low concentrations may also be due to dilution by Lake St. Clair water or from settling out of fine particulate matter to which metals are often adsorbed.

When data across all years were reviewed, chromium, copper, iron, nickel, lead and zinc followed similar patterns. The lowest concentrations were found upstream of Pontiac at station 502 or at station 115, 3.5 miles upstream from the mouth in the natural channel. Concentrations at station 115 reflect the influence of Lake St. Clair water.

These same metals increased 115% to 360% downstream of Pontiac at station 518 over levels at station 502. Concentrations of these metals in Red Run ranged from 130% to 1,434% greater than those at station 518 in the Main Branch of the Clinton River resulting in increases of 125% to 250% at station 302 downstream of Red Run after mixing. This was most pronounced for nickel and zinc, especially during 1978. Concentrations of these metals in the North Branch at stations 632 and 640 were generally greater than those at station 502, but always less than those at station 302.

TABLE 4.4. SELECTED METAL CONSTITUENTS IN CLINTON RIVER WATER, 1971-1987. RESULTS ARE YEARLY AVERAGES IN UG/L.

MAP ID NUMBER-YEAR	STATION CODE	Total Copper	Total Chromium	Total Hex-Cr	Total Lead	Total Iron	Total Nickel	Total Cadmium	Total Aluminum	Total Mercury	Total Silver	Total Arsenic	Total Selenium	Total Cyanide	Total Zinc
	SECTION 1. THE MAIN BRANCH OF THE CLINTON RIVER DOWNSTREAM OF THE SPILLWAY.														
109 - 74	CRWC-B	10.0 k	10.0 k			690.0	10.0 k	U							40.0
109 - 75	CRWC-B	8.0	9.0			1127.0	10.0	U							37.7
109 - 76	CRWC-B	5.0	10.0 k			400.0	19.0	U							32.0
109 - 78	CRWC-B	17.0	21.0			675.0	61.0	U							92.0
109 - 79	CRWC-B	8.5	19.0			1615.0	30.0	U							91.0
115 - 71	STO-500000			0.0						0.0				0.0	
115 - 72	STO-500000			10.0 k						0.2 k				200.0 k	
115 - 73	STO-500000			10.0 k						0.2 k				100.0 k	
115 - 76	COECDF-500000	1.3		6.6	2.3	827.7	3.3			0.1					7.5
115 - 80	STO-500000													1.0 k	
116 - 75	COE-4	19.0		10.0 k		90.0	10.0 k	5.0 k				10.0 k		25.0 k	7.5
121 - 73	STO-500215	10.0		10.0 k		220.0								100.0 k	70.0
	SECTION 2. CLINTON RIVER SPILLWAY.														
201 - 73	STO-500100			10.0 k						0.2 k				10.0 k	
201 - 74	CRWC-A	10.0 k	10.0			620.0	30.0	2.0 k							80.0
201 - 75	CRWC-A	6.7	11.0			1677.0	19.7	U							52.0
201 - 76	CRWC-A	11.0	10.0 k			520.0	10.0 k	U							47.0
201 - 78	CRWC-A	26.5	23.0			985.0	200.0 m	U							256.5 m
201 - 79	CRWC-A	10.5	10.0			1670.0	40.0	U							73.0
203 - 80	STO-500229													0.0 k	
	SECTION 3. MAIN BRANCH OF THE CLINTON RIVER BETWEEN RED RUN AND THE SPILLWAY.														
302 - 73	STO-500200-73	50.0 m		10.0 k		770.0				No Data				10.0 k	80.0
302 - 74	CRWC-E	20.0	20.0			800.0	50.0	U							60.0
302 - 75	CRWC-E	15.0	7.7			1263.0	20.7	U							40.7
302 - 76	SEMCOG-10				34.0 m	1241.0									
302 - 76	CRWC-E	5.0	10.0 k			730.0	11.0	U							36.0
302 - 78	CRWC-E	14.5	17.0			895.0	240.0 m	U							120.5
302 - 79	CRWC-E	15.5	17.5			1530.0	41.5	U							114.0
302 - 80	STO-500200													5.0 k	
302 - 87	CITYWAR-GARFIELD	12.5	10.0 k		10.0 k	-	10.0 k	0.4		0.2 k	0.1 k			10.0 k	42.3

Table 4.4. continued.

MAP ID NUMBER-YEAR	STATION CODE	Total Copper	Total Chromium	Total Hex-Cr	Total Lead	Total Iron	Total Nickel	Total Cadmium	Total Aluminum	Total Mercury	Total Silver	Total Arsenic	Total Selenium	Total Cyanide	Total Zinc
306 - 74	112WRD-04165500	13.0	20.0 k		14.0 *	560.0	-	U	-	U	U	3.0	1.0 k	-	40.0
306 - 75	112WRD-04165500	11.0	20.0 k		13.3 *	900.0	-	U	-	U	U	2.0	1.0 k	-	55.0
306 - 76	112WRD-04165500	20.0 k	20.0 k		31.3 *	1527.5	-	U	-	U	U	1.7	1.0 k	-	53.3
306 - 77	112WRD-04165500	20.0 k	20.0 k		29.0 *	1100.5	-	U	-	U	U	1.7	1.0 k	-	50.0
306 - 78	112WRD-04165500	8.3	20.0 k		10.5 *	820.0	-	U	-	U	U	2.0	1.0 k	-	52.5
306 - 79	112WRD-04165500	7.7	20.0 k		9.3	965.0	-	U	-	U	U	2.5	1.0 k	-	43.3
306 - 80	112WRD-04165500	7.7	16.7		7.5	1050.0	7.7	U	-	U	U	3.5	0.0	-	30.0
306 - 81	112WRD-04165500	9.0	13.3		11.0	536.7	10.7	U	-	U	U	2.0	0.0	-	50.0
306 - 82	112WRD-04165500	22.7	10.0		6.3	1747.5	15.7	U	-	U	U	2.0	1.0 k	-	70.0
309 - 74	CRWC-B	10.0	20.0			840.0	40.0	U							40.0
309 - 75	CRWC-B	9.0	5.3			1463.0	21.7	U							51.7
309 - 76	CRWC-B	5.0	10.0 k			670.0	30.0	U							48.0
309 - 78	CRWC-B	22.0	19.0			635.0	212.0 *	U							117.0
309 - 79	CRWC-B	13.5	10.5			1290.0	42.5	U							111.5
310 - 74	STO-500233			10.0 k						NC				10.0 k	
310 - 75	STO-500233									NC				10.0 k	
310 - 76	STO-500233	7.0	16.0		2.0	1200.0	49.0	NC		NC	NC	2.0	2.0	10.0 k	27.0
310 - 76	SEMCOG-22				31.0 *	1113.0									
310 - 76	COECDF-500233	7.0		10.0	5.0	10.0	39.0			0.2					16.0
310 - 77	STO-500233	9.0	9.0		32.0 *	1700.0	61.0	NC		NC	NC	3.0	1.0 k	4.0 k	39.0
310 - 78	STO-500233	8.0	12.0		11.0	660.0	88.0	NC		NC	NC	2.0	1.0 k	3.0 k	29.0
310 - 79	STO-500233	9.0	-		19.0 *	690.0	50.0	NC		NC	NC	2.0	0.4 k	3.0 k	40.0
310 - 80	STO-500233	11.5	5.5 k		25.0 *	705.0	27.5	NC		NC	NC	1.0 k	1.0 k	6.0 k	25.0
310 - 83	STO-500233	17.7	6.7		6.7	1255.7	23.7	0.3		0.5 k	NC	1.7	0.6 k	14.0 k	26.7
310 - 84	STO-500233	8.7	4.4 k		7.2	990.0	23.7	0.4	400.0 k	0.5 k	0.2 k	2.0	0.5 k		35.5
310 - 85	STO-500233	8.1	4.6		8.0	1073.0	10.3 k	0.5 k	1100.0	0.5 k	0.5 k	3.0 k	3.0 k		40.6
310 - 86	STO-500233	7.6	4.0 k		10.3	2130.1	8.9	0.6	5740.0	0.5 k	0.5 k	3.0 k	3.0 k		40.9
310 - 87	STO-500233	4.2	3.0 k		3.2	450.0	14.4	0.2					1.0 k		31.0

* Value exceeds long term safe criteria.
NC=Method changed, data is unreliable.
k=Actual concentration is less than the value shown.
U=Unreliable data.

Table 4.4. continued.

MAP ID NUMBER-YEAR	STATION CODE	Total Copper	Total Chromium	Total Hex-Cr	Total Lead	Total Iron	Total Nickel	Total Cadmium	Total Aluminum	Total Mercury	Total Silver	Total Arsenic	Total Selenium	Total Cyanide	Total Zinc
							SECTION 4. RED RUN AND ITS TRIBUTARIES.								
403 - 74	CRNC-P	10.0	10.0			1490.0	160.0	U							160.0
403 - 75	CRNC-P	25.7	10.0			4317.0	19.7	U							301.7 *
403 - 76	CRNC-P	0.0	10.0			1200.0	15.0	U							263.0 *
403 - 78	CRNC-P	10.5	29.0			1265.0	34.0	U							222.0 *
403 - 79	CRNC-P	9.0	21.5			1360.0	25.0	U							85.0
403 - 87	CTYWWR-VANDYKE	11.9	10.0 k		10.0 k	-	10.0 k	0.2		0.2 k	0.1 k			10.0 k	50.3
406 - 71	STO-800011	25.0			10.0	130.0				0.0	0.0			0.0	50.0
406 - 72	STO-800011			10.0 k						0.2 k				20.0	
406 - 73	STO-800011			30.0						0.2 k				30.0	
406 - 74	STO-800011			40.0						0.2 k				10.0 k	
406 - 74	CRNC-0	40.0	60.0			900.0	200.0 *	U							200.0 *
406 - 75	CRNC-0	20.3	37.7			1963.0	90.3	U							196.0
406 - 76	CRNC-0	22.0	13.0			470.0	466.0 *	U							304.0 *
406 - 78	CRNC-0	13.0	24.0			435.0	1330.0 *	U							636.5 *
406 - 79	CRNC-0	11.5	16.5			840.0	131.5	U							107.0
407 - 87	CTYWWR-15 MILE	13.1	10.0 k		10.0 k	-	19.0	0.4		0.2 k	0.1 k			10.0 k	50.3
408 - 73	STO-800207	40.0		10.0 k		700.0								10.0 k	110.0
408 - 74	CRNC-N	30.0	40.0			700.0	160.0	U							160.0
408 - 75	CRNC-N	17.7	50.7			2503.0	80.3	U							173.0
408 - 76	CRNC-N	24.0	30.0			400.0	117.0	U							210.0 *
408 - 78	CRNC-N	15.5	10.0			1445.0	1260.0 *	U							295.5 *
408 - 79	CRNC-N	10.5	22.5			1210.0	145.0	U							150.0
408 - 80	STO-800207													16.0	
410 - 71	STO-500046					840.0		2.0 *		NC				0.0	
410 - 72	STO-500046			10.0 k						0.2 k				20.0 k	
410 - 73	STO-500046			10.0 k						0.2 k				10.0 k	
410 - 74	STO-500046			80.0						0.2 k				10.0 k	
411 - 87	CTYWWR-UTICA RD.	14.4	10.0 k		10.0 k	-	24.5	0.6		0.2 k	0.1 k			10.0 k	62.0

* Value exceeds Long Term Safe Criteria.
NC=Method changed, data is unreliable.
k=Actual concentration is less than the value shown.

Table 4.4. continued.

MAP ID NUMBER-YEAR	STATION CODE	Total Copper	Total Chromium	Total Hex-Cr	Total Lead	Total Iron	Total Nickel	Total Cadmium	Total Aluminum	Total Mercury	Total Silver	Total Arsenic	Total Selenium	Total Cyanide	Total Zinc
SECTION 5. MAIN BRANCH OF THE CLINTON RIVER AND TRIBUTARIES UPSTREAM OF RED RUN.															
502 - 73	STO-630529			10.0 k						0.2 k				10.0 k	-
502 - 74	STO-630529			10.0 k						0.2 k				10.0 k	-
502 - 75	STO-630529									0.2 k				10.0 k	-
502 - 76	STO-630529	4.0	4.0		4.0	350.0	22.0	0.1 k		0.2 k	1.0 k	3.0	2.0 k	10.0 k	12.0
502 - 77	STO-630529	2.0	4.0		15.0 m	370.0	16.0	2.0 m		0.1	1.0 k	3.0	1.0 k	2.0	12.0
502 - 78	STO-630529	4.0	2.0		5.0 k	550.0	8.0	1.0 m		0.2 k	U	3.0	U	1.0	9.0
502 - 79	STO-630529	3.0	2.0 k		3.0	290.0	3.0 k	2.0 k		0.3 k	2.0	2.0	0.4 k	1.0 k	50.0
502 - 80	STO-630529	5.0	5.0 k		10.0	120.0	5.0	2.0 k		1.0 k	3.0	1.0	-	1.0 k	5.0 b
502 - 81	STO-630529	10.0	4.0 k		11.0	300.0	2.0 k	1.0 k		0.5 k	1.0 k	2.0	1.0 k	1.0 k	19.0
502 - 82	STO-630529	1.0	5.0 k		7.0	160.0	5.0 k	2.0 k		0.5 k	2.0 k	2.0	-	1.0 k	20.0
502 - 83	STO-630529	2.0 k	5.0 k		5.0 k	107.0	5.0 k	2.0 k		0.5 k	2.0 k	2.0	-	1.0 k	5.0 b
502 - 84	STO-630529	3.0	1.0 k		2.0 k	430.0	4.0 k	0.2 k		0.5 k	0.2 k	2.0	0.5 k	-	7.0
502 - 85	STO-630529	3.0	3.0 k		3.0	214.0	4.0 k	0.2 k	100.0	0.5 k	0.5 k	3.0 k	3.0 k	-	26.0
502 - 86	STO-630529	4.0	3.0 k		5.0	263.0	4.0 k	0.2 k	224.0	0.5 k	0.3 k	3.0 k	3.0 k	-	32.0
502 - 87	STO-630529	2.6	3.0 k		1.0 k	206.0	4.0 k	0.2	100.0 k	0.5 k	0.5 k	2.0 k	1.0 k	-	17.0
505 - 74	CRWC-M	10.0 k	10.0 k			420.0	10.0 k	U							20.0
505 - 75	CRWC-M	5.0	6.7			150.0	5.0	U							16.0
505 - 76	CRWC-M	5.0	10.0 k			90.0	10.0 k	U							22.0
505 - 78	CRWC-M	8.0	11.0			105.0	11.0	U							56.5
505 - 79	CRWC-M	6.5	18.5			245.0	20.0	U							75.5
507 - 73	STO-630600	10.0 k		10.0 k		200.0	50.0 k							10.0 k	10.0 k
508 - 73	STO-630599	10.0		10.0 k		330.0	50.0 k							10.0 k	10.0 b
510 - 73	STO-630598	10.0		10.0 k		300.0	50.0 k							10.0 k	40.0
512 - 73	STO-630597	10.0		10.0 k		600.0	50.0 k							10.0 k	40.0
517 - 74	CRWC-L	10.0	10.0 k			500.0	20.0	U							80.0
517 - 75	CRWC-L	5.0	3.7			437.0	3.7	U							31.0
517 - 76	CRWC-L	5.0	10.0 k			370.0	10.0 k	U							55.0
517 - 78	CRWC-L	12.0	12.0			935.0	40.0	U							107.0
517 - 79	CRWC-L	11.5	16.0			445.0	32.5	U							59.0
518 - 72	STO-630252			10.0 k						0.2 k				20.0 k	-
518 - 73	STO-630252			10.0 k						0.2 k				10.0 k	-
518 - 74	STO-630252			10.0 k						0.2 k				10.0 k	-
518 - 75	STO-630252									0.3				10.0 k	-
518 - 76	STO-630252	10.0	13.0		2.0	760.0	26.0	0.2		0.2 k	1.0 k	1.0	2.0 k	10.0 k	30.0
518 - 77	STO-630252	12.0	7.0		25.0 m	395.0	15.5	3.0 m		0.1 k	1.0 k	3.0	1.0 k	11.0	36.0
518 - 78	STO-630252	11.0	4.5		11.0 m	265.0	41.5	2.0 m		0.2 k	U	0.5	U	3.0	42.5
518 - 79	STO-630252	11.0	3.0 k		15.0 m	280.0	17.0	2.0 k		0.5 k	2.0	2.0	0.4 k	8.0	30.0
518 - 80	STO-630252	8.0	5.0 k		20.0 m	200.0	3.0	2.0 k		1.0 k	3.0	1.0	-	3.0	12.0
518 - 81	STO-630252	10.0	5.0		13.0 m	640.0	6.0	1.0 k		0.5 k	1.0 k	2.0	1.0 k	3.0	39.0
518 - 82	STO-630252	0.5	5.0 k		14.0 m	460.0	7.0	2.0 k		0.5 k	2.0 k	2.0	-	4.0	26.5
518 - 83	STO-630252	10.0	5.0 k		8.0	490.0	16.0	2.0 k		0.5 k	2.0 k	1.0	-	5.0	15.0
518 - 84	STO-630252	5.0	2.0		2.0 k	545.0	9.0	0.2 k		0.5 k	0.2 k	2.0	0.5 k	-	17.0
518 - 85	STO-630252	5.0	3.0 k		3.0	521.0	11.0	0.2 k	95.0	0.5 k	0.5 k	3.0 k	3.0 k	-	22.0
518 - 86	STO-630252	16.0	8.0		27.0 m	9230.0	17.0	0.5	5500.0	0.5 k	0.5 k	5.0	3.0 k	-	102.0
518 - 87	STO-630252	5.6	3.0 k		6.7	632.0	4.0 k	0.2 k	200.0	0.5 k	0.5 k	2.0 k	1.0 k	-	23.4
519 - 71	STO-630067	10.0				250.0	27.0								10.0
520 - 73	STO-630594	10.0 k		10.0 k		525.0	50.0 k			0.2 k				10.0 k	
521 - 80	STO-630602													5.0	
522 - 74	CRWC-K	10.0	10.0 k			340.0	20.0	U							20.0
522 - 75	CRWC-K	10.3	3.0 k			650.0	13.7	U							34.7
522 - 76	CRWC-K	5.0	10.0 k			490.0	11.0	U							32.0
522 - 78	CRWC-K	15.0	24.0			1010.0	34.0	U							77.5
522 - 79	CRWC-K	11.0	16.0			915.0	35.5	U							83.0

Table 4.4. continued.

MAP ID MARKER-YEAR	STATION CODE	Total Copper	Total Chromium	Total Hex-Cr	Total Lead	Total Iron	Total Nickel	Total Cadmium	Total Aluminum	Total Mercury	Total Silver	Total Arsenic	Total Selenium	Total Cyanide	Total Zinc
S30 - 73	STO-630619	20.0			50.0 k	300.0									300.0 H
S32 - 72	STO-630004			10.0 k						0.2 k				20.0 k	
S32 - 73	STO-630004			10.0 k						0.2 k				10.0 k	
S32 - 74	STO-630004			10.0 k						0.2 k				10.0 k	
S35 - 73	STO-630622	30.0		10.0 k	50.0 k	530.0									95.0
S37 - 73	STO-630604													10.0 k	
S39 - 70	STO-500012					900.0									
S41 - 74	CRWC-J	10.0 k	10.0 k			400.0	10.0	U							20.0
S41 - 75	CRWC-J	6.7	3.0			773.0	4.0	U							33.0
S41 - 76	CRWC-J	5.0 k	10.0 k			750.0	10.0 k	U							22.0
S41 - 78	CRWC-J	7.0	17.0			830.0	30.0	U							47.0
S41 - 79	CRWC-J	6.0	16.0			590.0	23.0	U							56.5
S42 - 83	LDI-1	20.0 k	50.0 k		5.0 k	565.0	50.0 k	1.0 k	230.0	0.2 k	10.0 k	10.0 k	2.0 k	10.0 k	19.0
S43 - 83	LDI-2	20.0 k	50.0 k		5.0 k	625.0	50.0 k	1.0 k	200.0 k	0.2 k	10.0 k	10.0 k	2.0 k	10.0 k	20.0
S44 - 83	LDI-3	20.0 k	50.0 k		6.0 k	635.0	50.0 k	1.0 k	396.5	0.2 k	10.0 k	10.0 k	2.0 k	10.0 k	22.5
S45 - 83	LDI-4	20.0 k	10.0 k		0.2	500.0	50.0 k	1.0 k	220.0	0.2 k	10.0 k	10.0 k	2.0 k	10.0 k	15.0
S46 - 83	LDI-5	20.0 k	10.0 k		5.0 k	505.0	50.0 k	1.0 k	370.0	0.2 k	10.0 k	10.0 k	2.0 k	10.0 k	23.0
S47 - 80	STO-500201	8.0	5.0 k		10.0	310.0	7.0	2.0 k		1.0 k	3.0	1.0 k	1.0 k	3.0	23.0
S47 - 83	LDI-6	20.0 k	10.0		0.1	310.0	50.0 k	1.0 k	292.0	0.2 k	10.0 k	10.0 k	2.0	10.0 k	15.0
S48 - 83	LDI-7	20.0 k	16.0		5.0 k	470.0	50.0 k	1.0 k	205.0	0.2 k	10.0 k	10.0 k	3.0	10.0 k	17.0
S49 - 83	LDI-8	20.0 k	16.0		5.0 k	565.0	50.0 k	1.0 k	201.0	0.2 k	10.0 k	10.0 k	0.2	10.0 k	13.0
S50 - 83	LDI-9	20.0 k	10.0 k		5.0 k	530.0	50.0 k	1.0 k	331.0	0.2 k	10.0 k	10.0 k	2.0 k	10.0 k	13.0
S51 - 80	STO-500202													3.0	
S52 - 74	CRWC-8	10.0	10.0 k			490.0	10.0	U							20.0
S52 - 75	CRWC-8	4.7	4.0			947.0	12.0	U							30.3
S52 - 76	CRWC-8	13.0	10.0 k			680.0	10.0 k	U							25.0
S52 - 78	CRWC-8	8.5	23.0			730.0	40.0	U							69.5
S52 - 79	CRWC-8	12.0	27.5			1590.0	26.0	U							82.5
S53 - 80	STO-500204					510.0								3.0	
S56 - 71	STO-500017	10.0			10.0	860.0	20.0								10.0
S56 - 72	STO-500017			10.0 k						0.2 k				10.0 k	
S56 - 73	STO-500017	30.0		10.0 k		800.0				0.2 k				10.0 k	50.0
S56 - 74	STO-500017			10.0 k						0.2 k				10.0 k	
S56 - 80	STO-500017													3.0	
S56 - 74	CRWC-F	10.0 k	10.0 k			420.0	10.0 k	U							110.0
S56 - 75	CRWC-F	5.3	6.0			793.0	6.7	U							32.0
S56 - 76	CRWC-F	5.0	10.0 k			690.0	13.0	U							26.0
S56 - 78	CRWC-F	14.0	22.0			870.0	40.0	U							55.0
S56 - 79	CRWC-F	13.0	21.0			1550.0	21.0	U							76.0
S56 - 87	CTYWWR-HAYES RD	10.0 k	10.0 k		10.0 k	-	10.0 k	0.1		0.2 k	0.1 k			10.0 k	33.3

H Value exceeds Long Term Safe Criteria.
U=Unreliable data.
k=Actual concentration is less than the value shown.

Table 4.4. continued.

MAP ID NUMBER-YEAR	STATION CODE	Total Copper	Total Chromium	Total Hex-Cr	Total Lead	Total Iron	Total Nickel	Total Cadmium	Total Aluminum	Total Mercury	Total Silver	Total Arsenic	Total Selenium	Total Cyanide	Total Zinc
		SECTION 6. NORTH AND MIDDLE BRANCH OF THE CLINTON RIVER AND THEIR TRIBUTARIES.													
618 - 75	STO-500290	460.0 **		10.0 k	5.0 k	550.0	5.0 k	2.0 k							5.0 k
619 - 75	STO-500291	22.0		10.0 k	5.0 k	700.0	5.0 k	2.0 k							6.0
621 - 72	STO-500110			10.0 k						0.2 k				20.0 k	
621 - 73	STO-500110			10.0 k						0.2 k				20.0 k	
621 - 74	STO-500110			10.0 k						0.2 k				20.0 k	
622 - 74	CRMC-H	10.0 k	10.0 k			260.0	10.0	U							10.0
622 - 75	CRMC-H	6.7	4.7			633.0	6.0	U							29.0
622 - 76	CRMC-H	5.0 k	10.0 k			400.0	11.0	U							26.0
622 - 78	CRMC-H	9.0	19.0			490.0	26.0	U							59.0
622 - 79	CRMC-H	3.0	17.0			425.0	22.0	U							38.5
627 - 74	CRMC-I	10.0 k	10.0 k			320.0	10.0	U							120.0
627 - 75	CRMC-I	15.0	4.7			633.0	11.7	U							20.7
627 - 76	CRMC-I	5.0	10.0 k			300.0	10.0 k	U							40.0
627 - 78	CRMC-I	8.0	14.0			405.0	23.0	U							70.0
627 - 79	CRMC-I	5.5	15.5			275.0	10.0	U							42.5
629 - 83	BHRMDR-1	30.0	50.0 k		80.0 k	9250.0	50.0 k	20.0 k							65.0
630 - 83	BHRMDR-2	20.0 k	50.0 k		50.0 k	3100.0	50.0 k	20.0 k							290.0 *
631 - 83	BHRMDR-3	20.0 k	50.0 k		50.0 k	1710.0	50.0 k	20.0 k							50.0 k
632 - 71	STO-500045	5.0			10.0	640.0		2.0							60.0
632 - 72	STO-500045			10.0 k						0.2 k				20.0 k	
632 - 73	STO-500045			10.0 k						0.2 k				20.0 k	
632 - 74	STO-500045			10.0 k						0.2 k				20.0 k	
636 - 75	BHRTOR-500206	19.0		10.0 k	36.0 *	500.0	5.0 k	2.0 k							100.0
637 - 75	BHRTOR-500205	16.0		10.0 k	5.0 k	550.0	5.0 k	2.0 k							21.0
638 - 75	BHRTOR-500204	10.0		10.0 k	5.0 k	3900.0	10.0	2.0 k							110.0
640 - 74	CRMC-C	10.0 k	10.0 k			860.0	10.0 k	U							40.0
640 - 75	CRMC-C	6.7	7.0			1450.0	7.0	U							27.7
640 - 76	CRMC-C	U	U			U	U	U							U
640 - 78	CRMC-C	12.5	24.0			700.0	31.0	U							202.5
640 - 79	CRMC-C	7.5	15.0			1030.0	21.5	U							111.5

* Value exceeds Long Term Safe (LTS) criteria.
** Value exceeds Acute Toxic Criteria (96 Hour LC 50).
U=Unreliable data.
k=Actual concentration is less than the value shown.

Table 4.4. continued.

MAP ID NUMBER-YEAR	STATION CODE	Total Copper	Total Chromium	Total Hex-Cr	Total Lead	Total Iron	Total Nickel	Total Cadmium	Total Aluminum	Total Mercury	Total Silver	Total Arsenic	Total Selenium	Total Cyanide	Total Zinc
						SECTION 7. LAKE ST. CLAIR IN THE VICINITY OF THE CLINTON RIVER MOUTH AND SPILLWAY.									
744 - 71	423230000251000					360.0									
744 - 72	423230000251000					600.0									
744 - 73	423230000251000	20.0 k	20.0 k		50.0 k	750.0	30.0 k	10.0 k		1.6					55.0
744 - 74	423230000251000	5.0 k	5.0 k		5.0 k	100.0	15.0 k	1.0 k					5.0 k	5.0 k	10.0
745 - 71	423400000249020					190.0									
745 - 72	423400000249020					370.0									
745 - 73	423400000249020	20.0 k	20.0 k		50.0 k	450.0	30.0 k	10.0 k		2.2					50.0 k
745 - 74	423400000249020	5.0 k	5.0 k		5.0 k	260.0	15.0 k	1.0 k					5.0 k	5.0 k	5.0
746 - 72	423500000245000					185.0									
746 - 73	423500000245000	20.0 k	20.0 k		50.0 k	120.0	30.0 k	10.0 k		1.5					85.0
746 - 74	423500000245000	5.0 k	5.0 k		5.0 k	70.0	15.0 k	1.0 k					5.0 k	5.0 k	5.0 k
747 - 72	423730000245000					230.0									
747 - 73	423730000245000	20.0 k	20.0 k		50.0 k	110.0	30.0 k	10.0 k		1.6					50.0 k
747 - 74	423730000245000	5.0 k	5.0 k		5.0 k	00.0	15.0 k	1.0 k					5.0 k	5.0 k	5.0 k
748 - 75	423730000247300	2.0 k	2.0 k		4.0 k	266.0		0.2 k	119.0						21.0
749 - 75	423524000244320	2.0 k	2.0 k		4.0 k	161.0		0.2 k	75.0						10.0
750 - 75	COE-7 $	0.0		10.0 k		33.0	10.0 k	5.0 k				10.0 k		25.0 k	6.0

$=This station is actually near the mouth of the Clinton River (Section 1).
k=Actual concentration is less than the value shown.

In the Main Branch, further downstream at station 310, metals decreased from 7 to 70% of what they were at station 302. Concentrations remained relatively similar or increased at station 201 during the 1970s. There was no clear pattern of increase (copper, zinc) or decrease (iron, nickel) at station 109, located in the natural channel east of the Mt. Clemens WWTP. This station may be either upstream or downstream of the WWTP effluent depending on the direction of flow as described in Chapter 3. Metals were generally an order of magnitude less at station 115 than at station 310.

Cyanide, selenium, arsenic, silver, mercury and aluminum did not follow these patterns. Mercury, silver and arsenic were barely detectable or undetectable over time throughout all river sections. Silver was detected once in 1979 at station 519 and once in 1980 at station 518 downstream of the Pontiac WWTP. Mercury was detected only once in 1978 at station 115. Selenium was reported three times in 1983 downstream of LDI at station 547, 548 and 549.

Arsenic was reported in the 1970s and early 1980s at stations 502, 519, 306 and 310. All values have been less than 3 ug/l except at station 519 in 1986 where arsenic was 5 ug/l. Aluminum has not been analyzed for in water over the years but was recently reported in elevated concentrations at stations 519 and 310, downstream of Pontiac and Red Run. Cyanide was detected near 3 to 5 ug/l in Sections 3 and 5. However, these concentrations are older data (1972-1980) and very near the detection level. All cyanide data reported in Table 4.4 are of questionable value.

Lead exceeded water quality criterion for aquatic life once in 1977 at station 502 but has been less than criterion since (Table 4.4, Appendix 4.6). There are no lead data between stations 502 and 518, but at station 518 the lead criterion was exceeded between 1977 and 1982 and also in 1986. There are six primarily automotive related industrial discharges and the Pontiac WWTP discharges to the Clinton River between these two stations. There are no lead data between station 519 and 306/310 during these years, but lead concentrations at stations 306/310 were greater than at station 519 and also exceeded Water Quality Criteria intermittently between 1974 and 1980. Red Run enters the Clinton River between stations 519 and 306. Unfortunately, there are no lead data for Red Run during these years, but it is likely that Red Run was a source of lead since it was a source of other metals.

The lead criterion was not exceeded in 1986 at any station throughout the basin except at station 518. All water samples collected in Section 4 (Red Run), which was a suspected metals source in earlier years contained less than 10 ug/l total lead during 1987 (City of Warren, 1987).

Zinc also exceeded the water quality criterion for aquatic life, primarily in Red Run at stations 403, 406 and 408, between 1974 and 1978 (Appendix 4.6). The impact on Section 3 zinc concentrations was not severe enough to exceed the zinc criterion there, but zinc concentrations did exceed this criterion in 1978 at station 201, further downstream in the spillway. Zinc did not exceed the criterion at any station after 1978.

Nickel was the only other metal to exceed the water quality criterion for aquatic life for more than one station during one year. During 1974, 1976 and 1978, the nickel criterion was exceeded in Red Run at station 406, and in 1978 this criterion was also exceeded at stations 408, 302, 309 and 201.

In 1978, Red Run contained 1,330 and 1,260 ug/l, total nickel at stations 406 and 408, respectively. These high nickel concentrations in water continued into Sections 3 and 2 where stations 302, 309, and 201 contained 240, 212, and 200 ug/l total nickel, respectively. Compared to other years, Section 1 1978 nickel concentrations were only slightly higher (61 ug/l). Total nickel in Section 5 and 6 ranged from less than 20 to 50 ug/l throughout the period. The nickel criterion has not been exceeded at any stations since 1978.

Samples from other stations exceeded water quality criteria for various metals, but only sporadically (Table 4.4, Appendix 4.6). Elevated lead levels in water in Taft Drain, station 636, are unexplained. Neither of the dischargers in the vicinity discharge near the sampling location. It may be that the drain was impacted by road runoff containing lead from leaded gasoline (MDNR 1976).

Elevated zinc in water at station 630 in McBride Drain suggests that some metals had leached from the SMDA Landfill 9 and 9A. The drain is frequently stagnant and was at the time of collection. Landfill leachate is being pumped from a leachate collection tank at this facility and transported to a local WWTP. However, there have been spills from SMDA 9 and 9A (Section 5.3.3).

Elevated copper concentrations at station 618 are also unexplained. Possibly, the Bruce Township WWTP was the source of this elevated copper, but copper was not noted further downstream. The Bruce Township WWTP was decommissioned in the late 1970s.

The elevated zinc at station 531 in Paint Creek during 1973 was the result of elevated discharges of zinc (up to 6,000 ug/l) from Avon Industries at Goodison. Avon Industries went out of business prior to 1975 (MDNR 1975).

Cadmium concentrations at station 518 are likely the result of one of the six industrial or the two municipal discharges to the Clinton River at Pontiac during 1977 and 1978. Results of later sampling indicated that cadmium was either less than detection (0.2 ug/l) or very low (0.5 ug/l) and did not exceed the Water Quality criterion for the protection of aquatic life at any station.

Metal concentrations in Lake St. Clair are sparse and rather old, but these data suggest that mercury was present in the lake water at concentrations of 1.5 to 2.2 ug/l in 1973, which may explain the mercury found at station 115. Copper, chromium, lead, nickel, cadmium, selenium and cyanide were all less than detection in nearshore Lake St. Clair between 1971 and 1975. Zinc concentrations ranged from 5 to 85 ug/l, likely depending on river flow and wind direction. Iron was also extremely variable, ranging from 33 to 750 ug/l. Highest iron concentrations were found at station 744 in 1972 and 1973, followed by station 745 in the same years.

4.3.3 Organic Contaminants in Clinton River Water

Compared to conventional and metals data for water, organic data for the Clinton River are relatively sparse. Analyses have been completed for over 90 organic chemicals and pesticides in the Clinton River watershed between 1970 and 1986 as given in Table 4.5. This table also includes station locations which correspond to Map 6.1 and station codes for all water sampling stations. These analyses were completed at one or more of the 25 stations where organics were sampled. Most analyses revealed that organic constituents were less than the detection levels. Other organic chemical constituents were detected but they were found at concentrations less than the Rule 57(2) allowable levels. These criteria developed by the the MDNR using Rule 57(2) procedures for the Clinton River are shown in Table 4.6. Appendix 4.7 gives the references to the background documents which describe the conditions under which these criteria apply and the assumptions made in their development.

There were no organic analyses for Sections 2 or 4. There were no exceedences of any Rule 57(2) allowable levels in sections 6 and 7. PCB exceeded Rule 57(2) allowable levels at station 106 in 1971, 1972 and 1974, station 310 in 1976 and stations 509, 511 and 518 in 1980. More recent water samples collected in 1983 revealed no PCB above the detection level (0.05 ug/l PCB). The manufacture and sale of PCB was banned in the early 1970s, but PCB is still in use in some products and is a particularly persistant environmental compound.

One analysis for 1,1,1-trichloroethane in 1980 at station 109 was above the 0.012 ug/l Rule 57(2) allowable levels. The source of this is unknown, but it is located "downstream" of the Mt. Clemens WWTP outfall, which is the only point source discharge in Section 1.

The pesticide p,p' DDT in Section 1 exceeded the Rule 57(2) allowable level in 1974. Diazinon in Section 3 in 1982 and dieldrin in Section 5 in 1983 both exceeded the Rule 57(2) allowable level. More recent work in 1982 at station 306 revealed that DDT was less than the detection level (0.01 ug/l), but no resampling for diazinon has occurred. This reduction in p,p' DDT concentrations in water may be due to the ban of DDT in the early 1970s. Dieldrin was reported as less than detection at station 306 in 1982 and station 310 in 1976 and 1979.

4.4 HISTORICAL SUMMARY OF CHEMICAL ANALYSIS OF CLINTON RIVER SEDIMENTS

Clinton River sediment data has been assembled from 64 stations between 1970 and 1987 (Map 6.2). Data are arranged like the water data, ordered from upstream to downstream within each river section. Within each station, the data are ordered by year. Section 1 has the greatest amount of data because of the periodic recreational navigation channel dredging by the COE. Other data in the basin are sparse.

TABLE 4.5. SELECTED ORGANIC AND PESTICIDE CONSTITUIENTS IN CLINTON RIVER WATER. RESULTS ARE YEARLY AVERAGES IN UG/L.

******************************** S E C T I O N 1 ********************************

CHEMICAL NAME	MAP ID NUMBER :	104	109	116	116	116
	STATION #-YEAR :	500213-80	500214-80	500189-71	500189-72	500189-74
1,1-Dichloroethane		1.0 k	1.0 k			
1,2-Dichloroethane		1.0 k	1.0 k			
1,1-Dichloroethylene		1.0 k	1.0 k			
1,1,1-Trichloroethane		1.0 k	3.0			
1,1,2-Trichloroethane		1.0 k	1.0 k			
1,2-Trans-Dichloroethylene		1.0 k	1.0 k			
1,1,2,2-Tetrachloroethane		1.0 k	1.0 k			
1,3-Dichloropropene		1.0 k	1.0			
Trichloroethylene		1.0 k	1.0 k			
Tetrachloroethylene		4.0	2.0			
Ethylbenzene		50.0 k	50.0 k			
Benzene		50.0 k	50.0 k			
Toluene		50.0 k	50.0 k			
Carbon tetrachloride		1.0 k	1.0 k			
Methylene chloride		1.0 k	1.0 k			
Vinyl chloride		1.0 k	1.0 k			
Chloroform		6.0	1.0 k			
Aniline		100.0 k	100.0 k			
Styrene		50.0 k	50.0 k			
P-Xylene		50.0 k	50.0 k			
M-Xylene		50.0 k	50.0 k			
O-Xylene		50.0 k	50.0 k			
Dieldrin				0.002	0.001	0.003 k
DDD				0.009	0.006	0.005
DDE				0.001 k	0.002	0.006
P,P' DDT				0.004	0.001 k	0.016
O,P' DDT				0.001 k	0.001 k	0.010 k
DDT				0.031	0.008	
PCB-1248						0.170
PCB-1254				0.218	0.320	

k = Actual concentration is less than the value given.

Table 4.5. continued.

SECTION 1

CHEMICAL NAME	MAP ID NUMBER : / STATION #-YEAR :	104 500213-80	109 500214-80	116 500189-71	116 500189-72	116 500189-74
1,1-Dichloroethane		1.0 k	1.0 k			
1,2-Dichloroethane		1.0 k	1.0 k			
1,1-Dichloroethylene		1.0 k	1.0 k			
1,1,1-Trichloroethane		1.0 k	3.0			
1,1,2-Trichloroethane		1.0 k	1.0 k			
1,2-Trans-Dichloroethylene		1.0 k	1.0 k			
1,1,2,2-Tetrachloroethane		1.0 k	1.0 k			
1,3-Dichloropropene		1.0 k	1.0			
Trichloroethylene		1.0 k	1.0 k			
Tetrachloroethylene		4.0	2.0			
Ethylbenzene		50.0 k	50.0 k			
Benzene		50.0 k	50.0 k			
Toluene		50.0 k	50.0 k			
Carbon tetrachloride		1.0 k	1.0 k			
Methylene chloride		1.0 k	1.0 k			
Vinyl chloride		1.0 k	1.0 k			
Chloroform		6.0	1.0 k			
Aniline		100.0 k	100.0 k			
Styrene		50.0 k	50.0 k			
P-Xylene		50.0 k	50.0 k			
M-Xylene		50.0 k	50.0 k			
O-Xylene		50.0 k	50.0 k			
Dieldrin				0.002	0.001	0.003 k
DDD				0.009	0.006	0.005
DDE				0.001 k	0.002	0.006
P,P' DDT				0.004	0.001 k	0.016
O,P' DDT				0.001 k	0.001 k	0.010 k
DDT				0.031	0.008	
PCB-1248						0.170
PCB-1254				0.218	0.320	

k = Actual concentration is less than the value given.

Table 4.5. continued.

S E C T I O N 3

CHEMICAL NAME	MAP ID NUMBER : / STATION 8-YEAR :	306 / 04165500-78-81	306 / 04165500-82	310 / 500233-76	310 / 500233-77	310 / 500233-79	310 / 500233-80	310 / BAKER-500233-85
1,3 Dichloropropene							5.0	
Aniline							100.0 k	
Styrene							50.0 k	
P-Xylene							50.0 k	
M-Xylene							50.0 k	
O-Xylene							50.0 k	
Aldrin		U	0.01 k					
Dieldrin		U	0.01 k	0.02 k		0.02 k		
Endrin		U	0.01 k					
Heptachlor		U	0.01 k	0.02 k	0.02 k		0.02 k	
Heptachlor epoxide		U	0.01 k	0.02 k	0.02 k		0.02 k	
Methoxychlor		U	0.01 k		5.00 k		0.10 k	
Malathion		U	0.01 k					
Parathion		U	0.01 k					
Diazinon		U	0.02					
Methyl parathion		U	0.01 k					
Ethion		U	0.01 k					
Trithion		U	0.01 k					
Methyl trithion		U	0.01 k					
Atrazine		0.20	-					0.532
Simazine		U	-					0.235
2,4 D		0.21	0.71					
2,4,5-T		U	0.01 k					
Mirex		0.10 k	0.01 k					
Silvex		U	0.25					
Chlordane		U	0.10 k	0.10 k	0.10 k		0.10 k	
Toxaphene		U	0.55 k	1.00 k	1.00 k		1.00 k	
DDD		U	0.01 k					
DDE		U	0.01 k					
DDT		U	0.01 k					
PCB-1242				0.10 k	0.10 k	0.10 k	0.10 k	
PCB-1254				0.10 k	0.10 k	0.10 k	0.10 k	
PCB-1260				0.62	0.10 k	0.10 k	0.10 k	
Bis (2-Ethylhexyl) Phthalate				1.00 k	1.00 k	6.70	39.00 a	
Di-N-Butyl Phthalate				1.00 k	1.00 k	1.00 k	15.00 b	
Carbofuran								0.063
Terbufos								0.000
Fonofos								0.022
Metribuzin								0.000
Alachlor								0.105
Linuron								0.260
Metolachlor								0.006
Cyanazine								0.106

a = The 3 samples averaged were 110.0, 4.0, and 3.1, therefore the average is misleading.
b = The 3 samples averaged were 1.0 k, 1.0 k, and 43.0, therefore the average is misleading.
k = less than value shown
U = Material was analyzed for but not detected (Detection level not given).

Table 4.5. continued.

** S E C T I O N 5 **

CHEMICAL NAME	MAP ID NUMBER :	509	511	510	524	525	530	533	535	547
	STATION 8-YEAR :	630632-80	630720-80	630252-80	630613-73	630614-73	630619-73	630621-73	630622-73	500201-80
1,1-Dichloroethane		1.0 k	1.0 k	1.0 k						20.0 k
1,2-Dichloroethane		1.0 k	1.0 k	1.0 k						20.0 k
1,2-Dichlorobenzene										0.1 k
1,1-Dichloroethylene		1.0 k	1.0 k	1.0 k						
1,1,1-Trichloroethane		1.0 k	1.0 k	1.0 k						1.0 k
1,1,2-Trichloroethane		1.0 k	1.0 k	1.0 k						
1,2-Trans-Dichloroethane		1.0 k	1.0 k	1.0 k						
2,4,6-Trichlorophenol		0.35	0.1 k	0.1 k						
2,4,5-Tri Iso Octyl Ester					3060.0	500.0 k	1640.0	500.0 k	6050.0	
Trichloroethylene		1.0 k	1.0 k	1.0 k						2.0
Tetrachloroethylene		1.0 k	1.0 k	1.0 k						1.0 k
Bis (2-Ethylhexyl) Phthalate		2.0 k	2.0 k	2.0 k						1.0 k
N-Butyl Benzyl Phthalate		1.0 k	1.0 k	1.0 k						1.0 k
Di-N-Butyl Phthalate		1.0 k	1.0 k	1.0 k						1.0 k
Di-N-Octyl Phthalate		6.9	1.0 k	3.2						
Diethylphthalate		1.0 k	1.0 k	1.0 k						
Chloroethane		1.0 k	1.0 k	1.0 k						
Benzene		50.0 k	50.0 k	50.0 k						50.0 k
Ethylbenzene		50.0 k	50.0 k	50.0 k						50.0 k
Napthalene		10.0 k	10.0 k	10.0 k						
Toluene		50.0 k	50.0 k	50.0 k						50.0 k
PCP		0.2 k	0.6	0.2 k						
PCB-1242		7.1	0.1	2.2						0.1 k
PCB-1248		0.0	0.0	0.0						
PCB-1254		0.1 k	0.1 k	0.1 k						0.1 k
PCB-1260		0.1 k	0.1 k	0.1 k						0.1 k
Methylene Chloride										1.0 k
Carbon Tetrachloride										1.0 k
Chloroform										1.0 k

Table 4.5. continued.

CHEMICAL NAME	MAP ID NUMBER : / STATION #-YEAR :	542 LDI-1-83	543 LDI-2-83	544 LDI-3-83	545 LDI-4-83	546 LDI-5-83	547 LDI-6-83	548 LDI-7-83	549 LDI-8-83	550 LDI-9-83
N-nitrosodiphenylamine		2.0 k		2.0 k		2.0 k				
Bis (2-Ethylhexyl) Phthalate		7.0	10.0	78.0	132.0	9.0				
Benzyl butyl phthalate		10.0	14.0	26.0	7.0	7.0				
Di-N-Butyl Phthalate		3.0 k	2.0 k	4.0	3.0 k	3.0 k				
Di-N-Octyl Phthalate		1.0 k	6.0	25.5	55.0	9.0				
Diethylphthalate				1.0 k	2.0 k	1.0 k				
Chlorobenzene		3.0 k	1.0 k							
1,1,2-Trichloroethane		1.0 k								
1,1,2,2-Tetrachloroethane		7.0								
Ethylbenzene		3.0 k	1.0 k							
Methylene Chloride		2.0 k	2.0 k		2.0 k	2.0 k				
Bromoform		6.0	2.0 k							
Chlorodibromomethane		2.0 k								
Tetrachloroethane		2.0 k	1.0 k							
Toluene		2.0 k	1.0 k	1.0 k	1.0 k	1.0 k				
2-Butanone		3.0 k								
2-Hexanone		5.0								
Styrene			2.0 k	1.0 k	1.0 k					
Total Xylenes		8.0	2.0 k	1.0 k	1.0 k					
Dieldrin							0.24			
Heptachlor Epoxide							0.29 k	0.46 k	0.38 k	0.23 k
2,4-D							0.60	6.20	5.70	5.50
Endosulfan Sulfate										0.75 k
Endrin aldehyde										0.30 k
2,4,5-T							0.10	0.05 k	0.05 k	0.05 k

k = Actual concentration is less than the value shown.

Table 4.5. continued.

******************************** S E C T I O N 6 ********************************

CHEMICAL NAME		629	630	631
	MAP ID NUMBER :	629	630	631
	STATION #-YEAR :	DNRMDR-1-83	DNRMDR-2-83	DNRMDR-3-83
1,1-Dichloroethane		1.00 k	1.00 k	10.00 k
1,2-Dichloroethane		1.00 k	1.00 k	10.00 k
1,1-Dichloroethene		1.00 k	1.00 k	10.00 k
1,2-Dichloroethene		1.00 k	1.00 k	10.00 k
1,2-Dichloroprpoane		1.00 k	1.00 k	10.00 k
1,1,1-Trichloroethane		1.00 k	1.00 k	10.00 k
1,1,2-Trichloroethane		1.00 k	1.00 k	10.00 k
1,1,2,2-Tetrachloroethane		1.00 k	1.00 k	10.00 k
1-Bromo-3-Chloropropane		1.00 k	1.00 k	10.00 k
Bromoform		1.00 k	1.00 k	10.00 k
Bromodichloromethane		1.00 k	1.00 k	10.00 k
Chlorodibromomethane		1.00 k	1.00 k	10.00 k
Chloroform		1.00 k	1.00 k	10.00 k
Carbon Tetrachloride		1.00 k	1.00 k	10.00 k
Dichloromethane		1.00 k	1.00 k	10.00 k
Methylene Chloride		1.00 k	1.00 k	10.00 k
Trichloroethane		1.00 k	1.00 k	10.00 k
Tetrachloroethene		1.00 k	1.00 k	10.00 k
Chlorobenzene		1.00 k	1.00 k	10.00 k
Benzene		5.00 k	5.00 k	5.00 k
Toluene		5.00 k	5.00 k	5.00 k
O-Xylene		5.00 k	5.00 k	5.00 k
M-Xylene		5.00 k	5.00 k	5.00 k
P-Xylene		5.00 k	5.00 k	5.00 k
Ethylbenzene		5.00 k	5.00 k	5.00 k
Styrene		5.00 k	5.00 k	5.00 k
Hexachlorobutadiene		0.05 k	0.05 k	0.05 k
Hexachlorocyclopentadiene		0.05 k	0.05 k	0.05 k
Hexachlorobenzene		0.05 k	0.05 k	0.05 k
Dichlorobenzene		0.05 k	0.05 k	0.05 k
Octachlorocyclopentene		0.05 k	0.05 k	0.05 k
Pentachloronitrobenzene		0.05 k	0.05 k	0.05 k
PCB-1016		0.10 k	0.10 k	0.10 k
PCB-1221		0.10 k	0.10 k	0.10 k
PCB-1232		0.10 k	0.10 k	0.10 k
PCB-1242		0.10 k	0.10 k	0.10 k
PCB-1248		0.10 k	0.10 k	0.10 k
PCB-1254		0.10 k	0.10 k	0.10 k
PCB-1260		0.10 k	0.10 k	0.10 k
PCB-1262		0.10 k	0.10 k	0.10 k
DDE		0.05 k	0.05 k	0.05 k
DDD		0.05 k	0.05 k	0.05 k
DDT		0.05 k	0.05 k	0.05 k
Hexabromobenzene		0.05 k	0.05 k	0.05 k
Heptachlor		0.05 k	0.05 k	0.05 k
Heptachlor epoxide		0.05 k	0.05 k	0.05 k
Toxaphene		0.05 k	0.05 k	0.05 k
Chlordane		0.05 k	0.05 k	0.05 k
Lindane		0.05 k	0.05 k	0.05 k
Mirex		0.05 k	0.05 k	0.05 k
Methoxychlor		0.05 k	0.05 k	0.05 k
Aldrin		0.05 k	0.05 k	0.05 k

Table 4.5. continued.

CHEMICAL NAME	MAP ID NUMBER : / STATION #-YEAR :	629 / BNRMDR-1-83	630 / BNRMDR-2-83	631 / BNRMDR-3-83
Bis(2-Ethylhexyl)Phthalate		0.50 k	0.50 k	0.50 k
Butyl Benzyl Phthalate		0.50 k	0.50 k	0.50 k
Di-N-Butyl Phthalate		0.50 k	0.50 k	0.50 k
Diethyl Phthalate		0.50 k	0.50 k	0.50 k
Di-N-Octyl Phthalate		0.50 k	10.00	0.50 k
Dieldrin		0.03 k	0.03 k	0.03 k
Endosulfan I		0.03 k	0.03 k	0.03 k
Endrin		0.03 k	0.03 k	0.03 k
Diethylhexyl Phthalate		9.30	11.00	4.20
2,4-Dichlorophenol		2.50 k	2.50 k	2.50 k
2,3,5-Trichlorophenol		2.50 k	2.50 k	2.50 k
2,4,5-Trichlorophenol		2.50 k	2.50 k	2.50 k
2,4,6-Trichlorophenol		2.50 k	2.50 k	2.50 k
Pentachlorophenol		2.50 k	2.50 k	2.50 k

k = Actual concentration is less than value given.

Table 4.5. continued.

************************************ S E C T I O N 7 ************************************

CHEMICAL NAME	MAP ID NUMBER : / STATION #-YEAR :	744 / 423238008251080	745 / 423408008249020	746 / 423500008245000	747 / 423730008245000
PCB-1221		0.001 k	0.001 k	0.001 k	0.001 k
PCB-1232		0.001 k	0.001 k	0.001 k	0.001 k
PCB-1242		0.001 k	0.001 k	0.001 k	0.001 k
PCB-1248		0.001 k	0.001 k	0.001 k	0.001 k
PCB-1254		0.001 k	0.001 k	0.001 k	0.001 k
PCB-1260		0.001 k	0.001 k	0.001 k	0.001 k
Aldrin		0.001 k	0.001	0.003	0.002
Dieldrin		0.001 k	0.001 k	0.002	0.002
Endrin		0.001 k	0.001 k	0.001 k	0.001 k
Heptachlor		0.001 k	0.001	0.001	0.001
Heptachlor Epoxide		0.001 k	0.002	0.002	0.002
Methoxychlor		0.001 k	0.001 k	0.001 k	0.001 k
Lindane		0.001 k	0.001 k	0.001 k	0.001 k

k = Actual concentration is less than value given.

Table 4.5. continued. Station code listing for all water sampling sites.

STATION CODE	REPORT FROM WHICH DATA WAS EXTRACTED
COE	Maintenance dredging of the federal navigation channel at Clinton River (Final environmental statement). COE 1976.
COECDF	Confined disposal facility for maintenance dredging at Clinton River (Final environmental statement). COE 1976.
CTYWAR	I.P.P. Annual report (by City of Warren WWTP). 1987.
ERG	Field methodology, Clinton River collections for COE. Environmental Reasearch Group 1983.
DNRGDR	Biological survey of Greiner Drain and North Branch Clinton River, Macomb County, Michigan. MDNR. Saalfeld 1980.
DNRLDI	Report on the impact of Liquid Disposal, Inc. on the Clinton River, Macomb County, Michigan. MDNR. Kenaga and Jones 1986.
DNRLSC	Evaluation of bacterial pollution in Lake St. Clair in the vicinity of the Clinton River. MDNR. Horvath et al. 1981.
DNRMDR	A water, sediment, and benthic macroinvertebrate survey of McBride Drain in the vicinity of South Macomb disposal authority landfill 9a, Macomb County, Mich. MDNR. Kenaga 1984.
DNRMTC	Clinton River study at Mt. Clemens. MDNR. Allen and Buda 1980.
DNRNBA	North Branch of the Clinton River at Almont. MDNR. Staff Report 1975.
DNRNBB	Biological survey of the North Branch of the Clinton River. MDNR. Grant 1975.
DNRPCK	Paint Creek study: Lake Orion to Mouth. MDNR 1973.
DNRPTM	Clinton River study: Rochester to Mouth. MDNR 1973.
DNRPTR	Clinton River study: Pontiac to Rochester. MDNR 1973.
DNRTDR	Taft Drain study. MDNR. Staff Report 1976.
LTICRS	Clinton River and spillway water quality and hydraulics surveys of 1984 (draft, for Mt. Clemans). Limno-Tech Inc. 1985.
SEMCOG	Water quality in southeast Michigan: The Clinton River basin. SEMCOG 1978.
USFWS	Fisheries report, Red Run Drain and lower Clinton River. U.S. Fish and Wildlife Service 1981.

Table 4.5. continued.

CLINTON RIVER WATER SAMPLING STATIONS. (LOCATIONS)

Corrected Coordinates			Matching Stations with correct coordinates				
CODE NUMBER	LATITUDE	LONGITUDE	CODE NUMBER	STATION NUMBER	LATITUDE	LONGITUDE	DESCRIPTION
	SECTION 1			SECTION 1			
101	42 35 03.0	082 52 27.0	101	LTI-3	42 35 03.0	082 52 27.0	Cl. R. @ CL. R. Drive & Inches St.
			101	500366	42 35 03.0	082 52 27.0	CLINTON R 1300 FT DNST OF SPILLW
102	42 35 26.0	082 52 27.0	102	LTI-4	42 35 26.0	082 52 27.0	Cl. R. @ Cl. R. Drive & Meadle St.
103	42 35 29.0	082 52 35.0	103	500365	42 35 29.0	082 52 35.0	CLINTON R 2700 FT ABV CASS AVE B
			102	LTI-5	42 35 29.0	082 52 35.0	Clinton River at Cass Ave. bridge
104	42 35 47.0	082 52 36.0	104	500213	42 35 47.0	082 52 36.0	CLINTON R AT CROCKER ST BR; CITY
105	42 35 48.0	082 52 04.0	105	ERG-8	42 35 48.0	082 52 04.0	Cl. R. just east of Gratiot Ave.
106	42 35 44.0	082 51 50.0	106	LTI-6	42 35 44.0	082 51 50.0	Clinton River at Trailer Park
107	42 35 39.0	082 51 52.5	107	500375	42 35 39.0	082 51 52.5	CLINTON RIVER 2300 FT ABV I-94 B
108	42 35 23.0	082 51 32.0	108	ERG-7	42 35 23.0	082 51 32.0	Cl. R. just west of I-94
109	42 35 26.0	082 51 27.0	109	500214	42 35 26.0	082 51 27.0	CLINTON R AT I-94 BRIDGE; HARRIS
			109	CRWC-B	42 35 26.0	082 51 27.0	CLINTON R AT I-94 BRIDGE; HARRIS
			109	LTI-7	42 35 26.0	082 51 27.0	CLINTON R AT I-94 BRIDGE; HARRIS
110	42 35 34.0	082 50 42.0	110	LTI-8	42 35 34.0	082 50 42.0	Cl. R. @ Clintonview & Cl. Shore Rd
			110	ERG-6	42 35 34.0	082 50 42.0	Cl. R. off N. end of Chartier Rd.
111	42 35 32.0	082 50 43.0	111	500364	42 35 32.0	082 50 43.0	CLINTON R 3600 FT DNST OF I94 BR
112	42 35 22.0	082 50 16.0	112	500363	42 35 22.0	082 50 16.0	CLINTON R 7200 FT DNST OF I94 BR
113	42 35 23.0	082 50 13.0	113	LTI-9	42 35 23.0	082 50 13.0	Cl. R. at 28725 S. River Road
114	42 35 45.0	082 50 03.0	114	ERG-5	42 35 45.0	082 50 03.0	Cl. R. west of Bridgeview Rd.
115	42 35 45.0	082 49 30.5	115	COECDF-500008	42 35 45.0	082 49 30.5	CLINTON R BRIDGEVIEW RD AT MOUTH
			115	LTI-10	42 35 45.0	082 49 30.5	CLINTON R BRIDGEVIEW RD AT MOUTH
			115	500008	42 35 45.0	082 49 30.5	CLINTON R BRIDGEVIEW RD AT MOUTH
116	42 35 25.0	082 49 20.0	116	500189	42 35 25.0	082 49 20.0	CLINTON RIVER AT S RIVER ROAD; I
			116	COE-4	42 35 25.0	082 49 20.0	CLINTON RIVER AT S RIVER ROAD; I
117	42 35 22.0	082 49 17.0	117	ERG-4	42 35 22.0	082 49 17.0	Cl. R. east of Bridgeview Rd.
118	42 35 24.0	082 49 14.0	118	LTI-11	42 35 24.0	082 49 14.0	Cl. R. 2500 ft downstr. Bridgeview
119	42 35 54.0	082 48 51.0	119	LTI-12	42 35 54.0	082 48 51.0	Cl. R. 6500 ft downstr. Bridgeview
120	42 35 49.0	082 48 37.0	120	ERG-3	42 35 49.0	082 48 37.0	Cl. R. at end of Jefferson Ave.
121	42 35 41.0	082 48 14.0	121	500215	42 35 41.0	082 48 14.0	CLINTON R AT ISLAND NEAR MOUTH.;
122	42 35 32.0	082 47 58.0	122	LTI-13	42 35 32.0	082 47 58.0	Clinton R. at Markley Marine
123	42 35 39.0	082 46 58.0	123	ERG-2	42 35 39.0	082 46 58.0	Cl. R. near mouth; upstr. ERG-1
124	42 35 46.0	082 46 05.0	124	ERG-1	42 35 46.0	082 46 05.0	Cl. R. At mouth; tip of earthfill
	SECTION 2			SECTION 2			
201	42 34 35.0	082 52 15.0	201	500188	42 34 35.0	082 52 15.0	CLINTON R SPILL@ HARPER AVE; CLIN
				LTI-2	42 34 35.0	082 52 15.0	CLINTON R SPILL@ HARPER AVE; CLIN
				CRWC-A	42 34 35.0	082 52 15.0	CLINTON R SPILL@ HARPER AVE; CLIN
202	42 34 14.0	082 51 44.0	202	LTI-14	42 34 14.0	082 51 44.0	Cl. R. @ Metropol. Parkway/Spillway
203	42 33 43.5	082 50 51.5	203	500229	42 33 43.5	082 50 51.5	CLINTON R. SPILLWAY @ JEFFERSON
204	42 33 42.0	082 50 51.0	204	LTI-15	42 33 42.0	082 50 51.0	Cl. R. @ I-94 bridge over spillway
205	42 33 34.0	082 50 32.0	205	500333	42 33 34.0	082 50 32.0	LAKE ST.CLAIR @ CLINTON R. SPILLWAY

Table 4.5. continued.

	SECTION 3			SECTION 3			
301	42 34 25.0	082 57 36.0	301	USFWS-7	42 34 25.0	082 57 36.0	Clinton River below Red Run
302	42 34 39.0	082 57 12.0	302	CRWC-E	42 41 44.0	082 39 13.0	Clinton River at Garfield Rd. bridge
			302	SEMCOG-10	42 41 44.0	082 39 13.0	Clinton River at Garfield Rd. bridge
			302	CITYWAR-GARFIEL	42 41 44.0	082 39 13.0	Clinton River at Garfield Rd. bridge
			302	500208	42 34 39.0	082 57 12.0	CLINTON R AT GARFIELD RD BR; CLI
303	42 34 40.0	082 57 06.0	303	500231	42 34 40.0	082 57 06.0	CLINTON R 100YD UPST GARFLD R; C
304	42 35 16.0	082 55 40.0	304	500209	42 35 16.0	082 55 40.0	CLINTON R OFF CLINTON R RD; CLIN
305	42 35 35.0	082 55 01.0	305	500225	42 35 35.0	082 55 01.0	CLINTON R@ R. RD PUMPHOUSE; CLIN
306	42 35 45.0	082 54 35.0	306	04165500 112WRD	42 35 45.0	082 54 35.0	CLINTON R@ MORAVIAN DRV; N. SIDE
			306	500010	42 35 45.0	082 54 35.0	CLINTON R@ MORAVIAN DRV; N. SIDE
307	42 35 26.0	082 54 09.0	307	500211	42 35 26.0	082 54 09.0	CLINTON R AT GOLF COURSE BRIDGE;
308	42 35 21.0	082 54 15.0	308	500212	42 35 21.0	082 54 15.0	HARRINGTON DRN @ HARRINGTON BLVD
			308	SEMCOG-23	42 35 16 [illegible]	[illegible] 54 04.0	HARRINGTON DRN @ HARRINGTON BLVD
309	42 35 21.0	082 53 57.5	309	CRWC-D	42 35 2[illegible]	[illegible] 57.5	Clinton River at M-97
310	42 35 03.0	082 52 58.0	310	SEMCOG-22	42 35 0[illegible]	[illegible] 58.0	CLINTON R@ NO. BOUND GRATIOT AVE
			310	COECDF-500233	42 35 03.0	082 52 58.0	CLINTON R@ NO. BOUND GRATIOT AVE
			310	LTI-1	42 35 03.0	082 52 58.0	CLINTON R@ NO. BOUND GRATIOT AVE
			310	500233	42 35 03.0	082 52 58.0	CLINTON R@ NO. BOUND GRATIOT AVE
	SECTION 4			SECTION 4			
401	42 31 27.0	083 05 11.0	401	USFWS-1	42 31 27.0	083 05 11.0	Red Run at Dequindre Road
402	42 31 44.0	083 02 52.0	402	USFWS-2	42 31 44.0	083 02 52.0	Red Run at Mound Road
403	42 31 32.0	083 01 45.0	403	USFWS-3	42 31 32.0	083 01 45.0	Red Run at Van Dyke bridge
			403	CRWC-P	42 31 32.0	083 01 45.0	Red Run at Van Dyke bridge
			403	CITYWAR-VANDYKE	42 31 32.0	083 01 45.0	Red Run at Van Dyke bridge
			403	SEMCOG-15	42 31 32.0	083 01 45.0	Red Run at Van Dyke bridge
404	42 31 24.0	083 01 24.0	404	SEMCOG-14	42 31 24.0	083 01 24.0	Bear Creek n. of Chicago Rd. bridge
405	42 32 31.0	083 02 52.0	405	SEMCOG-13	42 32 31.0	083 02 52.0	Big Beaver Creek @ Mound Rd. bridge
406	42 32 14.3	083 00 23.1	406	CRWC-O	42 32 14.3	083 00 23.1	RED RUN AT 14 MILE RD BRIDGE; CI
			406	500011	42 32 14.3	083 00 23.1	RED RUN AT 14 MILE RD BRIDGE; CI
			406	CITYWAR-14 MILE	42 32 14.3	083 00 23.1	RED RUN AT 14 MILE RD BRIDGE; CI
407	42 33 10.0	082 59 07.0	407	500227	42 33 10.0	082 59 07.0	RED RUN AT 15 MILE ROAD; STERLIN
			407	USFWS-4	42 33 10.0	082 59 07.0	RED RUN AT 15 MILE ROAD; STERLIN
			407	SEMCOG-16	42 33 10.0	082 59 07.0	RED RUN AT 15 MILE ROAD; STERLIN
			407	CITYWAR-15 MILE	42 33 07.0	082 59 00.0	RED RUN AT 15 MILE ROAD; STERLIN
408	42 34 00.0	082 58 16.0	408	500207	42 34 00.0	082 58 16.0	RED RUN AT 16 MI RD BR; CITY OF
			408	USFWS-5	42 34 00.0	082 58 16.0	RED RUN AT 16 MI RD BR; CITY OF
			408	CRWC-N	42 34 00.0	082 58 16.0	RED RUN AT 16 MI RD BR; CITY OF
409	42 36 02.0	083 04 18.0	409	SEMCOG-11	42 36 02.0	083 04 18.0	PLUM BROOK AT RYAN ROAD BRIDGE
410	42 34 21.0	082 59 25.0	410	500046	42 34 21.0	082 59 25.0	PLUM BROOK AT SCHOENHERR DR; STE
			410	SEMCOG-12	42 34 21.0	082 59 25.0	PLUM BROOK AT SCHOENHERR DR; STE
411	42 34 04.0	082 58 12.0	411	CITYWAR-UTICA R	42 34 04.0	082 58 12.0	Red Run at Utica Road
			411	USFWS-6	42 34 04.0	082 58 12.0	Red Run at Utica Road

Table 4.5. continued.

	S E C T I O N 5			S E C T I O N 5			
501	42 43 12.0	083 21 13.0	501	SEMCOG-1	42 43 12.0	083 21 13.0	SASHABAW CR@ MAYBEE RD; INDEPEND
				630680	42 43 12.0	083 21 13.0	SASHABAW CR@ MAYBEE RD; INDEPEND
502	42 39 37.0	083 23 25.0	502	630529	42 39 37.0	083 23 25.0	CLINTON R AT M-59 BRIDGE; WATERFORD
				SEMCOG-2	42 39 37.0	083 23 25.0	CLINTON R AT M-59 BRIDGE; WATERFORD
503	42 39 12.0	083 23 49.0	503	630629	42 39 12.0	083 23 49.0	CLINTON R AT PONTIAC LK RD; WATE
504	42 37 40.0	083 23 41.0	504	630630	42 37 40.0	083 23 41.0	CLINTON R. AT COOLEY LK RD; WATE
505	42 37 19.0	083 19 31.0	505	CRWC-M	42 37 19.0	083 19 31.0	Cl. R. at Telegraph Rd./Sylvan Lk.
506	42 37 27.0	083 18 57.0	506	630631	42 37 27.0	083 18 57.0	CLINTON R. AT ORCHARD LK RD; PON
507	42 37 33.0	083 17 52.0	507	630600	42 37 33.0	083 17 52.0	CLINTON R. AT GILLESPIE STREET;
508	42 38 48.0	083 16 08.0	508	630599	42 38 48.0	083 16 08.0	CLINTON R ABV PONTIAC STP NO1 IN
509	42 38 33.0	083 15 37.0	509	630632	42 38 33.0	083 15 37.0	CLINTON R @ M-59 BRIDGE; PONTIAC
				SEMCOG-4	42 38 33.0	083 15 37.0	CLINTON R @ M-59 BRIDGE; PONTIAC
510	42 38 23.0	083 15 25.0	510	630598	42 38 23.0	083 15 25.0	CLINTON R ABV PONTIAC STP NO2 IN
511	42 38 11.0	083 15 05.0	511	630728	42 38 11.0	083 15 05.0	CLINTON R 50 FT DWNSTR AUBURN WW
512	42 38 01.0	083 14 46.0	512	630597	42 38 01.0	083 14 46.0	CLINTON R AT AUBURN RD; PONTIAC
513	42 37 56.0	083 14 17.0	513	630717	42 37 56.0	083 14 17.0	CLINTON R AT I-75 BR; PONTIAC TW
514	42 38 02.0	083 13 27.0	514	630633	42 38 02.0	083 13 27.0	CLINTON R. AT AUBURN RD; PONTIAC
515	42 38 14.0	083 13 14.0	515	630596	42 38 14.0	083 13 14.0	CLINTON R AT SQUIRREL RD; PONTIA
516	42 38 38.0	083 12 52.0	516	630725	42 38 38.0	083 12 52.0	CLINTON RIVER AT M-59 BR; PONTIA
517	42 39 14.0	083 11 35.0	517	CRWC-L	42 39 14.0	083 11 35.0	CLINTON R AT ADAMS RD BRIDGE; AVON
			517	SEMCOG-5	42 39 14.0	083 11 35.0	CLINTON R AT ADAMS RD BRIDGE; AVON
			517	630595	42 39 14.0	083 11 35.0	CLINTON R AT ADAMS RD BRIDGE; AVON
518	42 39 02.5	083 10 40.0	518	630252	42 39 02.5	083 10 40.0	CLINTON R AT HAMLIN RD BR; AVON
519	42 39 03.0	083 10 26.0	519	630067	42 39 03.0	083 10 26.0	CLINTON R. AT CROOKS RD; AVON TO
520	42 39 57.0	083 09 13.0	520	630594	42 39 57.0	083 09 13.0	CLINTON R AT AVON RD; AVON TWP,
521	42 40 32.0	083 08 05.0	521	630602	42 40 32.0	083 08 05.0	CLINTON R AT DIVERSION RD IN CIT
522	42 40 31.0	083 07 59.0	522	CRWC-K	42 40 31.0	083 07 59.0	Clinton River at Rochester Road
523	42 40 37.0	083 07 46.0	523	630635	42 40 37.0	083 07 46.0	CLINTON R. UPSTREAM PAINT CR; AV
524	42 47 00.0	083 14 35.0	524	630613	42 47 00.0	083 14 35.0	PAINT CREEK AT M-24 BRIDGE; ORIO
525	42 46 53.0	083 13 52.0	525	630614	42 46 53.0	083 13 52.0	PAINT CR AT ATWATER ST; CITY OF
526	42 46 03.0	083 13 06.0	526	630615	42 46 03.0	083 13 06.0	PAINT CREEK AT KERN RD; ORION TW
527	42 44 50.0	083 11 50.0	527	630617	42 44 50.0	083 11 50.0	TROUT CREEK AT ADAMS RD; OAKLAND
528	42 45 03.0	083 11 50.0	528	630616	42 45 03.0	083 11 50.0	PAINT CR AT ADAMS RD; OAKLAND TW
529	42 44 23.0	083 10 11.0	529	630618	42 44 23.0	083 10 11.0	PAINT CREEK AT GUNN RD; OAKLAND
530	42 43 52.0	083 09 35.0	530	630619	42 43 52.0	083 09 35.0	PAINT CREEK AT ORION RD; OAKLAND
531	42 42 40.0	083 09 26.0	531	630620	42 42 40.0	083 09 26.0	PAINT CREEK AT DUTTON ROAD; AVON
532	42 41 43.0	083 08 47.0	532	630004	42 41 43.0	083 08 47.0	PAINT CREEK AT TIENKEN RD; AVON
533	42 41 19.0	083 08 32.0	533	630621	42 41 19.0	083 08 32.0	PAINT CREEK AT WOODWARD ST; AVON
534	42 41 00.0	083 08 06.0	534	SEMCOG-6	42 41 00.0	083 08 06.0	PAINT CREEK AT ROCHESTER ROAD BRIDGE
535	42 40 41.0	083 07 42.0	535	630622	42 40 41.0	083 07 42.0	PAINT CR AT GTW RAILROAD BR.; AV
536	42 40 36.0	083 07 37.0	536	630636	42 40 36.0	083 07 37.0	CLINTON R 100 YDS BELOW PAINT CR
537	42 40 46.0	083 07 11.0	537	630604	42 40 46.0	083 07 11.0	CLINTON R AT ROCHESTER WWTP,; AV
538	42 40 58.0	083 06 30.0	538	630637	42 40 58.0	083 06 30.0	CLINTON R @ PARK DAVIS PICNIC AREA
539	42 48 03.0	083 05 30.0	539	500012	42 48 03.0	083 05 30.0	STONY CREEK AT 32 MILE RD; WASHI
540	42 41 08.0	083 06 26.0	540	630605	42 41 08.0	083 06 26.0	STONY CREEK AT PARKDALE RD; AVON TO
			540	SEMCOG-7	42 41 08.0	083 06 26.0	STONY CREEK AT PARKDALE RD; AVON TO
541	42 40 19.0	083 05 50.0	541	630606	42 40 19.0	083 05 50.0	CLINTON R AT AVON RD. BRIDGE; AV
			541	CRWC-J	42 40 19.0	083 05 50.0	CLINTON R AT AVON RD. BRIDGE; AV
			541	SEMCOG-8	42 40 19.0	083 05 50.0	CLINTON R AT AVON RD. BRIDGE; AV
542	42 40 12.0	083 05 46.0	542	LDI-1	42 40 12.0	083 05 46.0	Cl. R. just downstr. Yates Park Dam
543	42 40 08.0	083 05 31.0	543	LDI-2	42 40 08.0	083 05 31.0	Cl. R. downstr. of LDI-1
544	42 39 58.0	083 05 10.0	544	LDI-3	42 39 58.0	083 05 10.0	Cl. R. downstream of LDI-2
545	42 39 30.0	083 04 57.0	545	LDI-4	42 39 30.0	083 04 57.0	Cl. R. downstream of LDI-3

Table 4.5. continued.

546	42 39 20.0	083 04 36.0	546	LDI-5	42 39 20.0	083 04 36.0	Cl. R. downstream of LDI-4
547	42 39 24.0	083 04 25.0	547	LDI-6	42 39 24.0	083 04 25.0	CLINTON R AT RYAN RD BR; SHELBY
			547	500201	42 39 24.0	083 04 25.0	CLINTON R AT RYAN RD BR; SHELBY
548	42 39 21.0	083 04 07.0	548	LDI-7	42 39 21.0	083 04 07.0	Cl. R. downstream of LDI-6
549	42 39 05.0	083 03 35.0	549	LDI-8	42 39 05.0	083 03 35.0	Cl. R. downstream of LDI-7
550	42 38 46.0	083 03 23.0	550	LDI-9	42 38 46.0	083 03 23.0	Cl. R. downstream of LDI-8
551	42 37 34.0	083 02 18.0	551	500202	42 37 34.0	083 02 18.0	CLINTON R AT AUBURN RD; CITY OF
552	42 37 14.0	083 01 55.0	552	CRWC-6	42 37 14.0	083 01 55.0	CLINTON R AT VAN DYKE RD; CITY O
			552	SEMCOG-9	42 37 14.0	083 01 55.0	CLINTON R AT VAN DYKE RD; CITY O
			552	500203	42 37 14.0	083 01 55.0	CLINTON R AT VAN DYKE RD; CITY O
553	42 36 15.0	083 01 12.0	553	500204	42 36 15.0	083 01 12.0	CLINTON R AT M-53 BR; CITY OF ST
554	42 35 11.0	082 59 49.0	554	500205	42 35 11.0	082 59 49.0	CLINTON R AT KLEINO RD; CITY OF
555	42 34 45.0	082 59 14.0	555	500206	42 34 45.0	082 59 14.0	CLINTON R@ RAMMLER GOLF COURSE I
556	42 34 13.0	082 58 16.0	556	500047	42 34 13.0	082 58 16.0	CLINTON R AT HAYES RD BR; CLINTO
			556	CRWC-F	42 43 13.0	082 58 16.0	Clinton River at Hayes Road
			556	CITYWAR-HAYES R	42 43 13.0	082 58 16.0	Clinton River at Hayes Road
	SECTION 6			SECTION 6			
601	42 53 02.0	083 04 41.0	601	DNRNBB-1	42 53 02.0	083 04 41.0	N. Branch at Fisher Road
602	42 53 21.0	083 04 27.0	602	DNRNBB-2	42 53 21.0	083 04 27.0	N BR CLINTON R ABV BORDMAN RD;AL
603	42 54 17.0	083 03 36.0	603	DNRNBB-3	42 54 17.0	083 03 36.0	N. Branch at Hough Road N. of Almont
604	42 54 59.0	083 02 42.0	604	DNRNBB-4	42 54 59.0	083 02 42.0	N BR CLINTON R AT M-53 BR; ALMON
			604	440059	42 54 59.0	083 02 42.0	N BR CLINTON R AT M-53 BR; ALMON
605	42 55 16.0	083 02 08.0	605	DNRNBB-6	42 55 16.0	083 02 08.0	N BR CLINTON R AT KIDDER RD; ALMONT
			605	440060	42 55 16.0	083 02 08.0	N BR CLINTON R AT KIDDER RD; ALMONT
606	42 55 17.0	083 01 46.0	606	440084	42 55 17.0	083 01 46.0	N.BR. CLINTON R. AT ALMONT RD; ALMON
607	42 55 28.0	083 00 30.0	607	440061	42 55 28.0	083 00 30.0	N BR CLINTON R AT HOUGH ROAD; ALMONT
			607	DNRNBB-7	42 55 28.0	083 00 30.0	N BR CLINTON R AT HOUGH ROAD; ALMONT
608	42 53 37.0	083 00 12.0	608	440102	42 53 37.0	083 00 12.0	N BR CLINTON R ABV BORDMAN RD;AL
609	42 53 45.0	083 00 04.0	609	440101	42 53 45.0	083 00 04.0	UNAMED TRIB, N OF BORDMAN RD; AL
610	42 53 28.5	083 00 58.5	610	500361	42 53 28.5	083 00 58.5	UNNAMED TRIB OFF BORDMAN RD; BRU
611	42 52 41.5	083 00 02.5	611	500362	42 52 41.5	083 00 02.5	N BR CLINTON R AT MCKAY RD, BRUC
612	42 50 52.0	082 58 43.0	612	DNRNBB-10	42 50 52.0	082 58 43.0	N. Branch at Armada Center Road
613	42 49 58.0	082 58 50.0	613	DNRNBB-11	42 49 58.0	082 58 50.0	N. Branch at 34 Mile Road
614	42 49 10.0	082 58 34.0	614	DNRNBB-12	42 49 10.0	082 58 34.0	N BR CLINTON R AT 33 MILE RD; AR
			614	500241	42 49 10.0	082 58 34.0	N BR CLINTON R AT 33 MILE RD; AR
615	42 50 29.0	083 04 39.0	615	500289	42 50 29.0	083 04 39.0	EAST POND CR. AT UNNAMED RD; BRU
616	42 49 53.0	083 04 13.0	616	500288	42 49 53.0	083 04 13.0	EAST POND CR. AT 34 MILE RD; BRU
617	42 48 58.0	083 04 11.0	617	500287	42 48 58.0	083 04 11.0	EAST POND CR. AT 33 MILE RD; BRU
618	42 49 22.0	083 01 12.0	618	500290	42 49 22.0	083 01 12.0	EAST POND CR. AT M-53 BR; BRUCE
619	42 49 03.0	083 00 35.0	619	500291	42 49 03.0	083 00 35.0	EAST POND CR. AT 33 MILE RD; BRU
620	42 48 18.0	082 59 17.0	620	500292	42 48 18.0	082 59 17.0	EAST POND CR. AT UNNAMED RD; BRU
621	42 48 16.0	082 58 48.0	621	500110	42 48 16.0	082 58 48.0	EAST POND CR. AT POWELL ROAD; RA
622	42 48 18.0	082 58 05.0	622	CRWC-H	42 48 18.0	082 58 05.0	N BR CLINTON R AT 32 MILE RD; RA
			622	500242	42 48 18.0	082 58 05.0	N BR CLINTON R AT 32 MILE RD; RA
			622	SEMCOG-17	42 48 18.0	082 58 05.0	N BR CLINTON R AT 32 MILE RD; RA
			622	DNRNBB-13	42 48 18.0	082 58 05.0	N BR CLINTON R AT 32 MILE RD; RA
623	42 47 44.0	082 57 45.0	623	500243	42 47 44.0	082 57 45.0	N BR CLINTON R AT ROMEO PLANK RD
			623	DNRNBB-14	42 47 44.0	082 57 45.0	N BR CLINTON R AT ROMEO PLANK RD
624	42 50 45.0	082 53 05.0	624	500293	42 50 45.0	082 53 05.0	E.BR. COON CR. AT PROSPECT ROAD;
625	42 50 01.0	082 53 04.0	625	SEMCOG-20	42 50 01.0	082 53 04.0	E.BR. COON CR. AT NORTH AVE.; AR
			625	500294	42 50 01.0	082 53 04.0	E.BR. COON CR. AT NORTH AVE.; AR
626	42 49 17.0	082 52 40.0	626	500295	42 49 17.0	082 52 40.0	E.BR. COON CR. AT 33 MILE RD; AR
627	42 48 18.0	082 52 18.0	627	CRWC-I	42 48 18.0	082 52 18.0	E. BRANCH COON CREEK AT 32 MILE ROAD
628	42 43 06.0	082 52 55.0	628	SEMCOG-21	42 43 06.0	082 52 55.0	Coon Cr. @ 26 Mile Rd. bridge
629	42 41 13.0	082 55 15.0	629	DNRMDR-1	42 41 13.0	082 55 15.0	McBride Drain at 24 Mile Road
630	42 40 45.0	082 54 40.0	630	DNRMDR-2	42 40 45.0	082 54 40.0	McBride Drain between 24 & 23 Mi. Rd
631	42 40 24.0	082 54 05.0	631	DNRMDR-3	42 40 24.0	082 54 05.0	McBride Drain 23 Mile Road

Table 4.5. continued.

632	42 37 45.0	082 53 21.0	632	500045	42 37 45.0	082 53 21.0	N BR CLINTON R AT M59 BRIDGE; MA
			632	SEMCOG-19	42 37 45.0	082 53 21.0	North Branch @ Hall Rd. bridge
633	42 37 11.0	082 53 53.0	633	DNRGDR-1	42 37 11.0	082 53 53.0	N. Branch above inlet of Greiner Dr.
634	42 36 45.0	082 53 25.0	634	DNRGDR-3	42 36 45.0	082 53 25.0	Greiner Drain at M-97
635	42 37 07.0	082 53 54.0	635	DNRGDR-2	42 37 07.0	082 53 54.0	N. Branch below inlet of Greiner Dr.
636	42 44 32.0	083 01 40.0	636	500286	42 44 32.0	083 01 40.0	TAFT DRAIN AT M-53 BR; WASHINGTO
637	42 44 21.0	083 01 04.0	637	500285	42 44 21.0	083 01 04.0	TAFT DRAIN AT JEWELL RD; WASHING
638	42 43 45.0	083 01 00.0	638	500284	42 43 45.0	083 01 00.0	YATES DRAIN AT 27 MILE RD; WASHI
639	42 36 20.0	082 55 04.0	639	SEMCOG-18	42 36 20.0	082 55 04.0	Middle Cl. at Heydereich Rd. bridge
640	42 36 04.0	082 54 34.0	640	500210	42 36 04.0	082 54 34.0	N BR CLINTON AT CASS AVE BRIDGE;
			640	CRWC-C	42 36 04.0	082 54 34.0	N BR CLINTON AT CASS AVE BRIDGE;
	SECTION 7			SECTION 7			
701	42 28 11.0	082 52 58.0	701	500007	42 28 11.0	082 52 58.0	L ST CLAIR, IN ST CLAIR SHORES;
702	42 30 13.0	082 50 04.0	702	500411	42 30 13.0	082 50 04.0	L ST CLAIR 2.5MI OFF FOOT SOCIA
703	42 30 47.0	082 51 09.0	703	500410	42 30 47.0	082 51 09.0	L ST CLAIR 1.25MI OFF FOOT SOCIA
704	42 31 14.0	082 52 12.0	704	500409	42 31 14.0	082 52 12.0	L ST CLAIR 0.25MI OFF FOOT SOCIA
705	42 31 36.0	082 52 15.0	705	500006	42 31 36.0	082 52 15.0	L ST CLAIR, IN ST CLAIR SHORES;
706	42 31 44.0	082 54 43.0	706	500005	42 31 44.0	082 54 43.0	L ST CLAIR, IN ST CLAIR SHORES;
707	42 32 02.0	082 49 21.0	707	500408	42 32 02.0	082 49 21.0	L ST CLAIR 1.75MI OFF FOOT ORCHI
708	42 32 04.0	082 48 00.0	708	500403	42 32 04.0	082 48 00.0	L ST CLAIR 3.0MI OFF CUTOFF, BEA
709	42 32 17.0	082 49 51.0	709	500407	42 32 17.0	082 49 51.0	L ST CLAIR 1.25MI OFF FOOT ORCHI
710	42 32 23.0	082 48 15.0	710	500399	42 32 23.0	082 48 15.0	L ST CLAIR 2.0MI OFF METRO BEACH
711	42 32 31.0	082 50 22.0	711	500406	42 32 31.0	082 50 22.0	L ST CLAIR 0.75MI OFF FOOT ORCHI
712	42 32 37.0	082 48 57.0	712	500402	42 32 37.0	082 48 57.0	L ST CLAIR 2.0MI OFF CUTOFF, BEA
713	42 32 38.0	082 50 37.0	713	500405	42 32 38.0	082 50 37.0	L ST CLAIR 0.5MI OFF FOOT ORCHID
714	42 32 45.0	082 50 52.0	714	500404	42 32 45.0	082 50 52.0	L ST CLAIR 0.25MI OFF FOOT ORCHI
715	42 32 58.0	082 48 08.0	715	500398	42 32 58.0	082 48 08.0	L ST CLAIR 1.5MI OFF METRO BEACH
716	42 33 10.0	082 49 54.0	716	500401	42 33 10.0	082 49 54.0	L ST CLAIR 1.0MI OFF CUTOFF, BEA
717	42 33 23.0	082 48 02.0	717	500397	42 33 23.0	082 48 02.0	L ST CLAIR 1.0MI OFF METRO BEACH
718	42 33 26.0	082 50 23.0	718	500400	42 33 26.0	082 50 23.0	L ST CLAIR 0.5MI OFF CUTOFF, BEA
719	42 33 31.0	082 45 40.0	719	500391	42 33 31.0	082 45 40.0	L ST CLAIR 1.35 MI OFF BLACK CRK
720	42 33 36.0	082 47 58.0	720	500396	42 33 36.0	082 47 58.0	L ST CLAIR 0.75MI OFF METRO BEAC
721	42 33 43.0	082 46 12.0	721	500390	42 33 43.0	082 46 12.0	L ST CLAIR 0.85MI OFF BLACK CR B
722	42 33 49.0	082 46 27.0	722	500389	42 33 49.0	082 46 27.0	L ST CLAIR 0.6MI OFF BLACK CRK B
723	42 33 49.0	082 47 55.0	723	500395	42 33 49.0	082 47 55.0	L ST CLAIR 0.5 MI OFF METRO BEAC
724	42 33 54.0	082 46 43.0	724	500388	42 33 54.0	082 46 43.0	L ST CLAIR, 0.35MI OFF BLACK CRK
725	42 33 58.0	082 46 53.0	725	500387	42 33 58.0	082 46 53.0	L ST CLAIR 0.2MI FROM BLACK CRK
726	42 34 02.0	082 47 51.0	726	500394	42 34 02.0	082 47 51.0	L ST CLAIR .25 MI OFF METRO BEAC
727	42 34 03.0	082 47 04.0	727	500386	42 34 03.0	082 47 04.0	L ST CLAIR@ MOUTH BLACK CREEK BT
728	42 34 06.0	082 47 21.0	728	500001	42 34 06.0	082 47 21.0	L ST CLAIR, NEAR MT CLEMENS; HAR
729	42 34 06.0	082 49 53.0	729	500004	42 34 06.0	082 49 53.0	L ST CLAIR, NEAR MT CLEMENS; HAR
730	42 34 14.0	082 47 21.0	730	500002	42 34 14.0	082 47 21.0	L ST CLAIR, NEAR MT CLEMENS; HAR
731	42 34 15.0	082 48 03.0	731	500003	42 34 15.0	082 48 03.0	L ST CLAIR, NEAR MT CLEMENS; HAR
732	42 34 16.0	082 47 47.0	732	500393	42 34 16.0	082 47 47.0	L ST CLAIR L'ANSE CREUSE BAY AT
733	42 35 38.0	082 45 12.0	733	500384	42 35 38.0	082 45 12.0	L ST CLAIR CLINTON R CHANNEL 0.8
734	42 35 39.0	082 45 45.0	734	500383	42 35 39.0	082 45 45.0	L ST CLAIR CLINTON R CHANNEL 0.3
735	42 35 40.0	082 46 10.0	735	500382	42 35 40.0	082 46 10.0	L ST CLAIR, CLINTON RIVER MOUTH,
736	42 36 07.0	082 47 33.0	736	500379	42 36 07.0	082 47 33.0	L ST CLAIR@BELVIDERE BAY INLET B
737	42 36 10.0	082 47 13.0	737	500380	42 36 10.0	082 47 13.0	L ST CLAIR BELVIDERE BAY 0.25MI
738	42 36 16.0	082 46 22.0	738	500381	42 36 16.0	082 46 22.0	L ST CLAIR BELVIDERE BAY 1MI ENE
739	42 36 18.0	082 47 38.0	739	500376	42 36 18.0	082 47 38.0	LK ST CLAIR @ INLET TO BLUE LAGO
740	42 36 49.0	082 47 31.0	740	500377	42 36 49.0	082 47 31.0	L ST CLAIR .25MI NE OF INLET BLU
741	42 37 10.0	082 47 10.0	741	500378	42 37 10.0	082 47 10.0	L ST CLAIR 1MI NE OF INLET TO BL
742	42 33 13.0	082 44 53.0	742	500392	42 33 13.0	082 44 53.0	L ST CLAIR 2.1MI OFF BLACK CRK B
743	42 35 38.0	082 44 45.0	743	500385	42 35 38.0	082 44 45.0	L ST CLAIR 1.2 MI E OF CLINTON R

Table 4.5. continued.

744	42 32 38.0	082 51 08.0	744	423238008251080	42 32 38.0	082 51 08.0	L. ST. CLAIR
745	42 34 08.0	082 49 02.0	745	423408008249020	42 34 08.0	082 49 02.0	L. ST. CLAIR
746	42 35 00.0	082 45 00.0	746	423500008245000	42 35 00.0	082 45 00.0	L. ST. CLAIR
747	42 37 30.0	082 45 00.0	747	423730008245000	42 37 30.0	082 45 00.0	L. ST. CLAIR
748	42 37 30.0	082 47 30.0	748	423730008247300	42 37 30.0	082 47 30.0	L. ST. CLAIR
749	42 35 24.0	082 44 32.0	749	423524008244320	42 35 24.0	082 44 32.0	L. ST. CLAIR
750	42 35 39.0	082 46 04.0	750	500329	42 35 39.0	082 46 04.0	L. ST. CLAIR @ CLINTON RIVER MOUTH
			750	COE-7	42 35 39.0	082 46 04.0	L. ST. CLAIR @ CLINTON RIVER MOUTH
751	42 36 21.0	082 45 57.0	751	500327	42 36 21.0	082 45 57.0	L. ST. CLAIR .5 MI NNE CLINTON R.
752	42 34 50.0	082 46 23.0	752	500331	42 34 50.0	082 46 23.0	L. ST. CLAIR .5 MI SOUTH CLINTON R.
753	42 33 08.0	082 47 02.0	753	500332	42 33 08.0	082 47 02.0	L. ST. CLAIR 0.8 MI SOUTH PT. HURON
754	42 33 31.0	082 49 23.0	754	500334	42 33 31.0	082 49 23.0	L. ST. CLAIR .5 MI E. CLINTON SPILLW
755	42 33 13.0	082 50 20.0	755	500336	42 33 13.0	082 50 20.0	L. ST. CLAIR 0.7 MI SOUTH LAKESIDE
756	42 33 09.0	082 49 17.0	756	500338	42 33 09.0	082 49 17.0	L. ST. CLAIR 2 MI SE SPILLWAY MOUTH
757	42 32 49.0	082 50 03.0	757	500339	42 32 49.0	082 50 03.0	L. ST. CLAIR 2 MI S SPILLWAY MOUTH
758	42 31 24.0	082 47 45.0	758	500340	42 31 24.0	082 47 45.0	L ST. CLAIR 2 MI E MEMORIAL PARK

Table 4.6 Chemicals Having a Final Rule 57(2) Guideline (in ug/l).

CHEMICAL	RULE 57(2) ALLOWABLE LEVELS (with dates)
DDT 50-29-3	1.3×10^{-4} 2/84
PCBs Class 07-9	2×10^{-5} 11/86
CHLOROFORM 67-66-3	4.3×10^{1} 1/87
TETRACHLOROETHYLENE 127-18-4	1.59×10^{1} 10/87
TRICHLOROETHYLENE 79-01-6	9.4×10^{1} 6/86
PENTACHLOROPHENOL 87-86-5	@ exp. (1.0051 ph-38604) 6/87
SILVEX 93-72-1	3 5/85
LINDANE 58-89-9	9.7×10^{-2} 10/87
1,1,1-TRICHLOROETHANE 71-55-6	1.17×10^{-2} 9/87
DEHP 117-81-7	2.4×10^{1}
ALDRIN 309-00-2	9.5×10^{-2}
HEPTACHLOR 76-44-2	1.1×10^{-3} 10/82
DIELDRIN 60-57-1	1.1×10^{-2}
trans-1,2-DICHLOROETHYLENE 7156-60-5	1.4×10^{3} 2/85
MALATHION 121-75-5	2×10^{2}
DIAZINON 333-41-5	2×10^{-3}
2,4-D 94-75-7	3.6×10^{1}

NOTE: A list of references to the background development documents and the assumptions for these Clinton River Water Quality Criteria are presented in Appendix 4.7.

4.4.1 Clinton River Sediment Conventional Constituents

Results of sediments analyzed for the conventional constituents are shown in Table 4.7. Total solids are the percent of the total sediments left after low temperature moisture removal. The greater the total solids value, the less oxygen the sediment will usually demand. The total volatile solids (TVS) are the combustible percent of the sediments. The greater the TVS value, the higher the sediment oxygen demand.

In Section 1, total solids ranged from 25 to 75% with most values between 40 and 60%, indicating relatively high water content. Sediments contained less water near the mouth in Section 1 than upstream. TVS ranged from less than 1 to 24% with greater TVS upstream and the lowest amount near the mouth, reflecting the depositional pattern of organic material in Section 1.

The total organic carbon (TOC) and the chemical oxygen demand (COD) are a measure of the organic carbon content of sediments with the COD method using stronger oxidants than the TOC method. Both are a measure of the sediment oxygen demand which removes oxygen from the overlaying water. In Section 1, COD was generally highest near the upstream stations and decreased near the River Mouth. There was also a decrease in sediment COD values from 1970 to 1985 at each station. COD results reported as COE-1975-1 through COE-1975-7 appear to be significantly higher than other analyses and probably should be disregarded.

The total phosphorus concentration represents the phosphorus reservoir in the sediments. While phosphorus is generally bound to the sediment particles, it may become available to the overlaying water under certain anaerobic conditions.

In Section 1, the highest total phosphorus concentrations were found at the most upstream stations (i.e., stations upstream of station 123). At each station, sediment total phosphorus concentrations decreased from 1970 to 1983.

Conventional sediment contaminant data from the rest of the watershed is sparse with none at all for Section 6. Over the years, TVS concentrations in the remaining sections were similar to TVS concentrations at the Clinton River/Lake St. Clair interface containing approximately one half to one third of the TVS present in Section 1. Total solids in Sections 2, 3, and 4 were very similar to Section 1, but Section 5 contained approximately one third less total solids than other river sections. Sediment total phosphorus concentrations in Section 4 were well above the average total phosphorus concentrations in Section 1, while Sections 2, 3 and 5 sediments contained about two-thirds of the total phosphorus found in Section 1 sediments.

Total Kjeldahl nitrogen concentrations in Sections 2, 3 and 4 were approximately one third of concentrations found in Section 1, while TKN in Section 5 were one tenth those found in Section 1 sediments.

4.4.2 Clinton River Sediment Heavy Metals Contaminants

Sediment heavy metal concentrations for all sections of the Clinton River are shown in Table 4.8. Sediment metals data are reviewed from upstream

Table 4.7 Selected conventional contaminant constituents in Clinton River sediments, 1970 - 1985. Results in mg/kg dry weight unless noted.

MAP ID & YEAR	STATION	Total Volatile Solids*	Total Solids**	Total Organic C	COD	NH3	Total Kjeld Nitro	Phosphorus
SECTION 1. NATURAL CHANNEL, CLINTON RIVER, DOWNSTREAM OF THE SPILLWAY.								
102-70	EPA-1970-A	18.6●	30.2		200,000●	960.0		4,600●
102-73	EPA-1973-A	12.1●	38.1		110,000●		4,530	1,840●
102-83	COE-1983-8	8.0♦	52.0	27,000	63,000♦	310.0	18,000	1,400●
103-75	COE-1975-1	10.5●	36		389,000●		2,861	
104-81	EPA-1981-5	10.1●			120,000●		3,500	2,000●
105-75	COE-1975-2	24.2●	32		475,000●		2,675	
105-83	COE-1983-7	10.0●	47.0	52,000	65,000♦	280.0	6,200	1,400●
106-76	DNR-500214-76	3.2	48 52.9***				2,800	920●
107-81	EPA-1981-4	18.2●	26.2		250,000●		5,000	2,100●
108-73	EPA-1973-B	14.3●	48.1		158,000●		3,460	1,540●
108-83	COE-1983-6	8.0♦	46.0	37,000	53,000♦	220.0	36,000	1,200●
109-75	COE-1975-3	10.7●	37		405,000●		2,535	
110-83	COE-1983-5	8.0♦	50.0	26,000	51,000♦	200.0	4,500	1,200●
112-81	EPA-1981-3	8.3●	59.7		110,000●		3,200	3,600●
113-70	EPA-1970-C	14.4●	32.2		130,000●	710.0		2,600●
113-73	EPA-1973-C	14.9●	39.0		160,000●		4,180	1,540●
113-75	COE-1975-4	10.5●	39		331,000●		2,154	
113-83	COE-1983-4	9.0●		30,000	58,000♦	230.0	38,000	1,500●
114-81	EPA-1981-2	7.3♦	65.0		75,000♦		2,500	2,400●
115-83	COE-1983-3	6.0♦	61.6	26,000	44,000♦	150.0	27,000	1,200●
116-81	EPA-1981-1	3.5	61.6		41,000♦		1,100	1,500●
117-73	EPA-1973-D	13.8●	45.8		131,000●		2,620	2,320●
117-83	COE-1983-2	6.0♦	52.0	17,000	33,000	120.0	49,000	670●
117-85	EPA-1985-15A	7.8♦	41.1		38,000	230.0	2,900	3,100●
118-75	EPA-1975-1	8.9●	39.7		120,000●	230.0	3,400	2,900●
119-75	COE-1975-5	6.8♦	44		264,000●		1,427	
119-75	EPA-1975-2	7.5♦	42.2		96,000●	200.0	3,100	2,000●
119-85	EPA-1985-15	8.4●	29.1		81,000●	310.0	2,200	1,300●
120-75	EPA-1975-3	7.2♦	40.5		71,000♦	150.0	2,300	850●
121-75	EPA-1975-4	7.6♦	40.9		80,000♦	140.0	2,300	1,000●
122-75	EPA-1975-5	5.4♦	51.4		75,000♦	130.0	2,200	2,500●
123-70	EPA-1970-E	8.2●	45.2		91,000●	330.0		1,100●
123-73	EPA-1973-E	3.5	69.0		27,700		853	218
123-75	COE-1975-6	1.7	73		10,000		327	
124-83	COE-1983-1	4.0	52.0	20,000	29,000	54.0	6,800	410♦
125-70	EPA-1970-F	0.9	81.4		5,900	53.0		140
125-73	EPA-1973-F	1.5	83.8		7,060		298	102
125-75	COE-1975-7	2.4	69		12,000		623	

* = In percent.
** = Percent heavy metals.
*** = Percent chlorinated hydrocarbons (ug/kg).
♦ = In moderately polluted range, U.S. EPA, 1977.
● = Exceeds heavily polluted range, U.S. EPA, 1977.

Table 4.7. Selected conventional contaminant constituents in Clinton River sediments, 1970 - 1985. Results in mg/kg dry weight unless noted.

MAP ID & YEAR	STATION	Total Volatile Solids*	Total Solids**	Total Organic C	COD	NH3	Total Kjeld Nitro	Phosphorus
S E C T I O N 2.		**CLINTON RIVER SPILLWAY**						
201-76	DNR-500188	1.4	48 52.8***				22000●	1210●
202-85	EPA-85-13A	8+	77.1			75		
S E C T I O N 3		**MAIN BRANCH CLINTON RIVER BETWEEN RED RUN AND THE SPILLWAY**						
301-76	DNRPN-500208	2.8	51 50.4***				16800●	740●
302-76	DNRPN-500010	2.6	35 35.6***				27000●	1040●
S E C T I O N 4		**RED RUN**						
401-76	DNRPN-500227	3.6	52 55.6***				27000●	2400●
S E C T I O N 5		**MAIN BRANCH CLINTON RIVER AND ITS TRIBUTARIES UPSTREAM OF RED RUN**						
501-76	DNR-630630	7.9+	22.0 27.6***				14,100●	1,120
507-76	DNR-630599	3.4	47.0 41.8***				4,700●	1,410●
510-76	DNR-630633	5.9+	22.0 21.8***				7,700●	3,500●
513-76	DNR-630635	2.2	38.0 40.9***				3,600●	1,430●
521-76	DNRPN-630637-5	2.1	38.0 41.5***				1,830+	520+
531-76	DNR-500205	12.0+	48.0 44.7***				2,500●	930●

* = In percent.
** = Percent heavy metals.
*** = Percent chlorinated hydrocarbons <ug/kg>.
\+ = In moderately polluted range, U.S. EPA, 1977.
● = Exceeds heavily polluted range, U.S. EPA, 1977.

Table 4.8 Selected metal contaminant constituents in Clinton River sediments, 1970 - 1987. Results are in mg/kg dry weight.

MAP ID @ YEAR	STATION	As	Cd	Cr	Cu	CN	Fe	Pb	Mn	Hg	Ni	Zn
	S E C T I O N 1 NATURAL CHANNEL, CLINTON RIVER, DOWNSTREAM OF THE SPILLWAY.											
102-70	EPA-1970-A						33,000					
102-73	EPA-1973-A	11.0●	3.7	209.0●	151.0●		27,600	465.0●	466.0	0.2	196.0●	557 ●
102-81	COE-1983-8	10.0●	12.0●	230.0●	140.0●	1.4	12,000	340.0●	430.0	0.2	130.0●	390 ●
103-75	COE-1975-1							209 ●		1.0 ●		1499 ●
104-81	EPA-1981-5		6.9●	16.0	25.0		17,000	37.0	220.0	0.6	47.0+	69
105-75	COE-1975-2							251 ●		1.1 ●		2625 ●
105-81	COE-1983-7	11.0●	12.0●	280.0●	180.0●	1.4	16,000	360.0●	420.0	0.3	160.0●	520 ●
105-87	DNR-1987-2		3.5	95.4●	104.7●		24,150	193.5●	465.0		57.6●	433 ●
106-76	DNR500214-76	3.7+	4.0	47.0	64 ●			290 ●		0.4	52 ●	270 ●
107-81	EPA-1981-4		13.0●	110.0●	120.0●		24,000	290.0●	420.0	0.7	88.0●	500 ●
108-73	EPA-1973-B	10.0●	9.2●	2.4	142.0●		25,600	359.0●	398.0	0.7	162.0●	582 ●
108-81	COE-1983-6	9.0●	9.5●	180.0●	140.0●	0.8	31,000	300.0●	360.0	0.2	120.0●	470 ●
109-75	COE-1975-3							268 ●		2.5 ●		3500 ●
110-81	COE-1983-5	12.0●	15.0●	280.0●	180.0●	1.0	33,000	280.0●	430.0	0.2	140.0●	820 ●
112-81	EPA-1981-3		18.0●	280.0●	120.0●		30,000	220.0●	470.0	0.8	200.0●	590 ●
113-70	EPA-1970-C						40,000					
113-73	EPA-1973-C	8.1●	11.5●	278.0●	166.0●		34,600	405.0●	526.0	0.8	149.0●	862 ●
113-75	COE-1975-4							251 ●		3.3 ●		4000 ●
113-81	COE-1983-4	12.0●	14.0●	310.0●	160.0●	1.0	30,000	310.0●	480.0	0.2	140.0●	730 ●
113-87	DNR-1987-1		4.7	122.7●	129.5●		31,750	244.7●	558.7		68.4●	488 ●
114-81	EPA-1981-2		13.0●	280.0●	93.0●		31,000	160.0●	450.0	0.5	160.0●	500 ●
115-81	COE-1983-3	7.0●	5.4	110.0●	84.0●	0.4	26,000	200.0●	500.0	0.1	71.0●	380 ●
116-81	EPA-1981-1		1.1	35.0	130.0●		10,000	54.0+	240.0	0.3	34.0+	110 +
117-73	EPA-1973-D	6.8+	<2.0	48.2+	55.0●		7,700	41.4+	154.0	0.9	40.4●	109 +
117-81	COE-1983-2	7.0●	2.8	86.0●	51.0●	<0.4	28,000	47.0+	510.0	<0.1	56.0●	180 +
117-85	EPA-1985-15A		6.3●	140.0●	130.0●	0.7	32,000	240.0●	670.0		100.0●	430 ●
118-75	EPA-1975-1	7.0+	5.4	130.0●	120.0●		28,000	250.0●	600.0	<0.1	110.0●	410 ●
119-75	COE-1975-5							250 ●		2.1 ●		3700 ●
119-75	EPA-1975-2	7.0+	2.7	74.0+	71.0●		23,000	170.0●	530.0	0.2	88.0●	270 ●
119-75	EPA-1975-3	6.0+	1.7	59.0+	62.0●		20,000	140.0●	410.0	0.1	54.0●	210 ●
119-85	EPA-1985-15		1.3	45.0+	78.0●	0.4	24,000	110.0●	460.0		40.0+	190 ●
120-75	EPA-1975-4	7.0+	3.2	72.0+	100.0●		26,000	180.0●	500.0	0.1	68.0●	290 ●
121-75	EPA-1975-5	5.0+	4.3	86.0●	54.0●		19,000	150.0●	530.0	0.2	87.0●	240 ●
123-70	EPA-1970-E						22,000					
123-73	EPA-1973-E	1.9	5.6	141.0●	94.3●		20,300	167.0●	452.0	0.3	174.0●	413 ●
123-75	COE-1975-6							80 ●		0.9		48
124-73	EPA-1973-F	2.0	<2.0	7.8	23.8		3,450	17.0	66.0	0.4	3.6	17.5
124-81	COE-1983-1	4.0+	1.5	50.0+	30.0+	<0.4	22,000	46.0+	510.0	<0.1	42.0+	110 +
125-70	EPA-1970-F						5,800					
125-75	COE-1975-7							54 +		0.23		41

+ = In moderately polluted range, U.S. EPA, 1977.
● = Exceeds heavily polluted range, U.S. EPA, 1977.

Table 4.8 **Selected metal contaminant constituents in Clinton River sediments, 1970 - 1987. Results are in mg/kg dry weight.**

MAP ID & YEAR	STATION	As	Cd	Cr	Cu	CN	Fe	Pb	Mn	Hg	Ni	Zn
	SECTION 2	CLINTON RIVER SPILLWAY										
201-76	DNRPN-500188	5.1+	4.0	55.0+	60. +			160 ‡		0.22	84 ‡	270 ‡
202-85	EPA-85-13A		0.3	15.0	10.0		4,000	14.0	110.0		10.0	34.0
	SECTION 3	CLINTON RIVER FROM RED RUN TO SPILLWAY										
301-76	DNRPN-500208	5.2+	4.4	5.9	68 ‡			130 ‡		0.22	110 ‡	300 ‡
302-76	DNRPN-500010	9.0‡	7.2‡	100 ‡	110 ‡			270 ‡		0.12	150 ‡	480 ‡
	SECTION 4	RED RUN										
401-76	DNRPN-500227	5.6+	8.6‡	98 ‡	88 ‡			270 ‡		0.28	120 ‡	440 ‡

+ = In moderately polluted range, U.S. EPA, 1977.
‡ = Exceeds heavily polluted range, U.S. EPA, 1977.

Table 4.8 Selected metal contaminant constituents in Clinton River sediments, 1970 - 1987. Results are in mg/kg dry weight.

MAP ID & YEAR	STATION	As	Cd	Cr	Cu	CN	Fe	Pb	Mn	Hg	Ni	Zn
	S E C T I O N 5		MAIN BRANCH OF THE CLINTON RIVER AND ITS TRIBUTARIES UPSTREAM OF RED RUN									
501-76	DNRPN-630630	11 ●	1.4	11	16			110 ●		<0.01	30 +	120 +
502-73	DNRSTO-630631		0.4	12.0	17.0			190.0●		0.37	4.6	95.0+
503-73	DNRSTO-630704		0.4	10.0	12.0			110.0●		0.10	5.2	70.0
504-73	DNRSTO-630705		1.4	19.0	28.0+			210.0●		0.10	12.0	180.0+
505-73	DNRSTO-630703	6.5+	2.6	34.5+	83.0●			370.0●		0.13	38.5+	315.0●
506-73	DNRSTO-630600		2.6	50.0+	98.0●			480.0●		0.16	130.0●	280.0●
507-76	DNRPN-630599	6.5+	4.0	53 +	120 ●			600 ●		0.13	59 ●	500 ●
510-76	DNRPN-630633	12 ●	11.0●	200 ●	460 ●			750 ●		0.46	180 ●	1100 +
513-76	DNRPN-630635	9 ●	3.0	63 +	88 ●			160 ●		0.13	61 ●	260 ●
514-73	DNRPC2-630613		<0.2	16.3	37.4+		10,612	150.0●			17.0	176.9
515-73	DNRPC2-630614		<0.2	15.7	24.1		11,204	106.4●			16.8	112.0
516-73	DNRPC2-630619		<0.2	15.1	24.4		12,500	42.8+			13.8	171.0
517-73	DNRPC2-630621		<0.2	10.3	10.3		7,471	40.2+			8.6	80.4
518-73	DNRPC2-630622		<0.2	35.6+	123.3●		41,096	383.6●			46.6+	786.3●
521-73	DNRSTO-630637	7.2+	1.6	47 +	64 ●			110 ●		0.2	52 ●	180 +
522-83	DNRLDI-83-1*	2.4	0.10	27.0+	33.0+	<0.5	7,480	55.0+	286	<0.1	16.0	97.0+
523-83	DNRLDI-83-2	2.2	0.25	16.0	27.0+	<0.5	6,300	40.0+	221	<0.1	13.0	81.0
524-83	DNRLDI-83-3	0.6	<0.05	35.0+	5.4	<0.5	3,400	8.1	96	<0.1	5.2	22.0
524-83	DNRLDI-83-3D	0.9	<0.05	8.1	5.2	<0.5	3,170	8.8	91	<0.1	4.4	20.0
525-83	DNRLDI-83-4	<0.5	<0.05	32.0+	9.6	<0.5	2,910	15.0	92	<0.1	6.6	31.0
526-83	DNRLDI-83-5	<0.5	<0.05	5.6	6.7	<0.5	2,810	9.4	110	<0.1	5.2	22.0
527-83	DNRLDI-83-6	4.5+	0.37	19.0	34.0+	<0.5	7,090	49.0+	293	<0.1	17.0	95.0+
528-83	DNRLDI-83-7	1.4	<0.05	4.0	5.0	<0.5	2,240	7.2	86	<0.1	3.9	19.0
529-83	DNRLDI-83-8	2.8	0.09	6.6	7.6	<0.5	3,870	13.0	132	<0.1	6.5	28.0
530-83	DNRLDI-83-9	1.3	<0.05	4.5	5.2	<0.5	239	10.0	82	<0.1	4.3	23.0
531-76	DNRPN-500205	4.9+	1.6	36 +	46 +			76 ●		0.05	40 ●	160 +
	S E C T I O N 6		NORTH BRANCH CLINTON RIVER									
601-83	DNRMDR-83-1 &		<2.0	19.0	27.0+		13,800	14.0	320.0		23.0+	61.0
602-83	DNRMDR-83-2A		<2.0	12.0	16.0		13,600	6.4	310.0		16.0	59.3
602-83	DNRMDR-83-2B		<2.0	8.8	10.0		8,800	<5.0	210.0		9.7	25.0
602-83	DNRMDR-83-2C		<2.0	13.0	21.0		2,500	8.3	490.0		25.0+	51.9
603-83	DNRMDR-83-3A		<2.0	19.0	17.0		1,670	14.0	250.0		18.0	71.8
603-83	DNRMDR-83-3B		<2.0	7.1	6.6		5,050	<5.0	71.7		6.6	43.0
603-83	DNRMDR-83-3C		<2.0	<5.0	5.4		4,100	<5.0	68.6		5.4	22.0
604-79	DNRGDR-1		0.7			<0.8		12.0				
605-79	DNRGDR-3		4.0			<0.8		100.0●				
606-79	DNRGDR-2		<0.2			<0.8		9.0				

*** S E C T I O N 5 MAIN BRANCH UPSTREAM OF RED RUN: ADDITIONAL LDI REPORT PARAMETERS ***

MAP ID & YEAR	STATION	Al	B	Ba	Co	Se	Tl	Sn	V	Ag	Sb
522-83	DNRLD-83-1	2170	<5	<0.25	2.9	<1.0	<0.5	64.0	<10	0.98	<1.0
523-83	DNRLD-83-2	2010	<5	<0.25	2.5	8.5	<0.5	5.2	<10	1.20	<1.0
524-83	DNRLD-83-3	1190	<5	<0.25	2.5	<1.0	<0.5	253.0	<10	<0.50	<1.0
524-83	DNRLD-83-3D	1100	<5	<0.25	<2.5	<1.0	<0.5	41.0	<10	<0.50	<1.0
525-83	DNRLD-83-4	966	<5	<0.25	<2.5	<1.0	<0.5	313.0	<10	<0.50	<1.0
526-83	DNRLD-83-5	899	<5	<0.25	<2.5	<1.0	<0.5	4.2	<10	<0.50	<1.0
527-83	DNRLD-83-6	2360	<5	<0.25	2.9	<1.0	<0.5	3.1	<10	0.85	<1.0
528-83	DNRLD-83-7	797	<5	<0.25	<2.5	<1.0	<0.5	1.6	<10	<0.50	<1.0
529-83	DNRLD-83-8	1160	<5	<0.25	<2.5	<1.0	<0.5	1.1	<10	<0.50	<1.0
530-83	DNRLD-83-9	834	<5	<0.25	<2.5	<1.0	<0.5	<1.0	<10	<0.50	<1.0

+ = In moderately polluted range, U.S. EPA, 1977.
● = Exceeds heavily polluted range, U.S. EPA, 1977.
* = Additional metals sampled for in LDI report at bottom of table.
& = A coring tool was used to collect the samples in the McBride drain study; core depths were: A, 0-3"; B, 3-6"; C, 6-9".

(Section 5) to downstream (Section 1) (see Map 6.2). The sediments are compared to the USEPA dredge spoil guidelines for classification of Great Lakes Harbor sediments (Table 4.9) (USEPA 1977). This system classifies sediments as non-polluted, moderately or heavily polluted with respect to permitting open lake disposal if the sediments were to be dredged. Sediments that have many metals in the moderately polluted class and a few in the heavily polluted classification are placed in confined disposal facilities. The USEPA's dredge spoil guidelines are not based on the biological toxicity of metals to aquatic life. It should not be construed that if sediments exceed the EPA guidelines that these concentrations are harmful to aquatic life. The question of what impact sediment metals have on aquatic life is still not answered. Recent sediment bioassays in other systems may help in the interpretation of the impact of heavy metals on bottom dwelling aquatic organisms. These guidelines are used here only for comparison with other studies which have also used these guidelines.

All sediment metals data in Section 5 were collected in 1973, 1976, or 1983. Metals data for 1973 and 1976 are similar with many values exceeding the moderately and heavily polluted guidelines. No 1983 values exceed the heavily polluted guidelines, but five of the eleven metals exceed the moderately polluted guidelines. These five metals were the same metals which exceeded the heavily polluted guidelines in the 1970s. For several metals, there was an order of magnitude reduction between 1976 and 1983.

In Section 5, lead exceeded the heavily or moderately polluted guidelines at all stations in the 1970s. Sediment lead values increased from 110 mg/kg at station 501 to 370 mg/kg at station 505 in Pontiac. Sediment lead concentrations further increased to 750 mg/kg at station 510 downstream of the Pontiac WWTP #2 and then decreased to 160 mg/kg at station 513, just upstream of Paint Creek at Rochester. Lead also exceeded the heavily polluted criteria at three out of five stations in Paint Creek. Downstream of Paint Creek and the Rochester WWTP, sediment lead concentrations in 1973 were similar to those upstream of Pontiac in 1976.

The 1983 sediment lead concentrations exceeded the moderately polluted guidelines at four of nine stations upstream of Utica, but concentrations were considerably less than those reported further upstream in the 1970s.

In Section 5, sediment copper, nickel, and zinc concentrations followed a pattern similar to lead except these metals began to exceed the heavily polluted guidelines at station 505 in Pontiac rather than station 501 several miles upstream. In the 1970s, these metals exceeded the heavily polluted guidelines even downstream of Rochester (station 521), but only exceeded the moderately polluted guidelines at station 531 downstream of Utica. In 1983, these same metals only occasionally exceeded the moderately polluted guidelines between Dequindre Road and Utica, up and downstream of Ryan Road (station 527).

Arsenic exceeded the heavily polluted guidelines at stations 505, 507, and 521 in the 1970s. In 1983, only station 527 exceeded the moderately polluted guidelines. Sources of arsenic are unknown.

Table 4.9 April 1977 U.S. EPA Dredged Spoil Disposal Criteria Classification Guidelines for Great Lakes Harbors. Values in mg/kg dry weight, values otherwise noted.

Parameter	Non Polluted	Moderately Polluted	Heavily Polluted
Volatile solids %	<5	5-8	>8
COD	<40,000	40-80,000	>80,000
TKN	<1,000	1,000-2,000	>2,000
Oil & Grease (Hexane Solubles)	<1,000	1,000-2,000	>2,000
Lead	<40	40-60	>60
Zinc	<90	90-200	>200
Ammonia	<75	75-200	>200
Cyanide	<0.10	0.10-0.25	>0.25
Phosphorus	<420	420-650	>650
Iron	<17,000	17,000-25,000	>25,000
Nickel	<20	20-50	>50
Manganese	<300	300-500	>500
Arsenic	<3	3-8	>8
Cadmium	•	•	>6
Chromium	<25	25-75	>75
Barium	<20	20-60	>60
Copper	<25	25-50	>50
Mercury			≥1
Total PCB's **			≥10

• Lower limits not established

** The pollutional status of sediments with total PCB concentrations between 1 and 10 mg/kg dry weight will be determined on a case-by-case basis.

Cadmium exceeded 6 mg/kg only at station 510 (11 mg/kg) downstream of the Pontiac WWTP in 1976. Sediment concentrations in 1983 were all less than 0.4 mg/kg.

Chromium exceeded the moderately polluted guidelines in 1973 through 1976 at several stations between 506 and 513, and 521 and 531, basically throughout Section 5 downstream of the southwestern outskirts of Pontiac. Only one station (510 in 1976) immediately below the Pontiac WWTP exceeded the heavily polluted guidelines. In 1983, chromium exceeded the moderately polluted guidelines at three stations between Rochester and Utica.

Sediment metals data in the remainder of the river sections except Section 1 are sparse.

In Section 3, sediment samples collected in 1976 at stations 301 and 302, immediately downstream of Red Run, exceeded the heavily polluted guidelines for arsenic, cadmium, chromium, copper, lead, nickel, and zinc. Station 401 in Red Run also exceeded the heavily polluted guidelines for these same metals.

Concentrations were similar in Sections 4 and 3 and slightly less in Section 2. In Section 2 in 1976, arsenic, chromium, and copper exceeded the moderately polluted guidelines and lead, nickel, and zinc exceeded the heavily polluted guidelines in 1976, but not in 1985. The limited data for Section 6 revealed that only lead exceeded the heavily polluted guidelines at one station in Greiner Drain, and copper and nickel exceeded the moderately polluted guidelines in McBride Drain, both tributaries to the North Branch of the Clinton River.

Section 1, stations 101 to 125, were sampled most recently because the COE needed to classify the sediments for removal from the recreational navigation channel. The EPA, COE, or their contractors sampled Section 1 sediments in 1970, 1973, 1975, 1981, 1983, and 1985. The COE uses the EPA's dredge spoil guidelines to determine the appropriate disposal site for dredged sediments. The average concentrations of arsenic, cadmium, copper, chromium, lead, nickel and zinc exceeded EPA's heavily polluted guidelines for dredged sediments. Only mercury did not exceed these guidelines.

Sediment metals contaminants were elevated at station 102, increased downstream (station 105), and remained at these concentrations until they decreased precipitously near station 124.

There was no clear trend in sediment metals contaminants over the years. Some metals concentrations appeared to increase in the middle of Section 1 while other metals decreased (lead, nickel and zinc) and others (copper and chromium) remained similar across the years. Some metals concentrations seemed to have increased between 1970 and 1980 and then decreased in more recent years.

Sediment heavy metals contamination in Section 1 is due to the settling of fine particulate matter to which metals are physically and chemically bound. Sedimentation of these particle sizes does not occur to the same degree in other free flowing River Sections.

4.4.3 Clinton River Sediment Organic Contaminants

Data for organic sediment parameters are very sparse throughout the basin. Data were collected at nearly 60 stations between 1970 and 1985 for phenols, oil, and grease, PCB, pesticides, phthalates, and other organic chemicals (Table 4.10). Sediment organic results are generally described from upstream (Section 5) to downstream (Section 1). Extensive organic analyses were performed in 1981, 1983, and 1985 on selected stations in Sections 1, 2, 5 and 6 (Table 4.11). Table 4.11 also includes the station locations and codes for correlation with Map 6.2.

All analyses at the most upstream stations (501) in Section 5 were less than their respective detection levels except phthalates. Sediment phthalate concentrations at station 501 were 1790 ug/kg, increased to near 4,000 ug/kg at station 507 and further to 4440 ug/kg downstream of Pontiac (Table 4.11). In 1983, a variety of phthalates were found in Section 5 sediments in concentrations ranging from less than 14 to 3,054 ug/kg in the vicinity of Ryan Road (Table 4.12). In 1976, phthalates were reported as less than detectable (1000 ug/kg) at stations 301 and 302 in Section 3, station 201 in Section 2, station 401 in Section 4, and station 106 in Section 1.

Sediments from station 118 contained 1,281 ug/kg total phthalates in 1985. Phthalates were considerably higher in McBride Drain, a tributary to the North Branch of the Clinton River which contained 13,000 to 58,000 ug/kg diethylhexyl phthalates (DEHP). The upstream "control" sample contained 45,000 ug/kg DEHP.

Dieldrin was reported above detection levels from 4 to 47 ug/kg in stations 512 and 513 sediments in 1973, but nowhere else in the basin except Section 1 in 1981. Aldrin was less than detection (1 to 4 ug/kg) in all sections and in all years where aldrin analyses were performed.

Chlordane was less than detection or not analyzed for in all sections except Section 1, where concentrations ranged from 5 to 56 ug/kg. Concentrations were highest near the middle of Section 1 and decreased rapidly near the River/Lake confluence.

In 1973 sediments in Paint Creek ranged from 71 to 404 ug/kg total DDT. Section 5 sediment DDT concentrations in 1976 were below detection in the Main Branch. Between 1976 and 1980, total DDT concentrations ranged from 17 to 70 ug/kg at stations 303 and 304, but were less than detection in Sections 2 and 4 in 1976, and less than detection in Section 6 in 1980. Total DDT concentrations in Section 1 in 1981 and 1985 ranged between 113 and 929 ug/kg with concentration patterns similar to dieldrin.

Toxaphene was reported at 80 ug/kg in 1977 at station 303. No other toxaphene data were available.

There were no phenol analyses in Sections 5, 4, 3, or 2 and sediment phenol concentrations were less than the detection level (2500 ug/kg) in

Table 4.10 Selected organic contaminant constituents in the Clinton River, 1970 - 1987.
Results are in ug/kg dry weight unless noted.

MAP ID & YEAR	STATION	Oil and Grease*	PCBs	Phenol	Total** Solids	Aldrin	Dieldrin	Chlordane	Endrin	Heptaclor	Lindane	Phthalates	DBP	Phenanthrene	Anthracene	Total DDTs mean	DDTs max	min	Toxaphene	Diethyl Phthalate
	S E C T I O N 1 NATURAL CHANNEL, CLINTON RIVER, DOWNSTREAM OF THE SPILLWAY.																			
101-73	DNR-500213													9,220	24					
102-70	EPA-1970-A	270000		21000																
102-73	EPA-1973-A	142700		140																
102-81	COE-1983-8	51000	740	<200																
103-75	COE-1975-1	102220																		
104-81	EPA-1981-5		3490+				31.0	49						31,071		857.0				
105-75	COE-1975-2	73750																		
105-81	COE-1983-7	39000	6200+	<200																
106-76	DNR-500214	20800	1020+		50.4	<4.0	10.0	<20				<1000	<1000			<40				
106-80	DNR-500214											2000		5,290	61					
107-81	EPA-1981-4		5620+				24.0	37						19,100		107.0				
108-73	EPA-1973-B	97500		290																
108-81	COE-1983-6	37000	4600+	<200																
109-75	COE-1975-3	75670																		
110-81	COE-1983-5	29000	114000	<200																
112-81	EPA-1981-3		4790+				47.0	56						14,259		260.0				
113-70	EPA-1970-C	170000		960																
113-73	EPA-1973-C	96800		260																
113-75	COE-1975-4	62560																		
113-81	COE-1983-4	35000	1800+	<200																
114-81	EPA-1981-2		1019				14.0	20						12,816		113.0				
115-81	COE-1983-3	22000	1260+	60																
116-81	EPA-1981-1		195				4.0	5						1,285		120.0				
117-73	EPA-1973-D	93200		300																
117-81	COE-1983-2	620	340	<200																
117-85	EPA-1985-15A#	37000	190	100				0								929				
118-75	EPA-1975-1	44000	805																	
118-85	EPA-1985-15#	27000	230	100				13				609	1600	400		147				
119-75	EPA-1975-2	30000																		
119-75	COE-1975-5	27270																		
120-75	EPA-1975-3	30000																		
121-75	EPA-1975-4	27000																		
122-75	EPA-1975-5	27000																		
123-70	EPA-1970-E	29000		690																
123-73	EPA-1973-E	674		40																
123-75	COE-1975-6	876																		
124-73	EPA-1973-F	125		<10																
124-81	COE-1983-1	400	240	<200																
125-70	EPA-1970-F	320		170																
125-75	COE-1975-7	406																		

* = In mg/kg dry weight.
** = Total solids are in percent.
\+ = In moderately polluted range, U.S. EPA, 1977.
= Exceeds heavily polluted range, U.S. EPA, 1977.

Table 4.10 **Selected organic contaminant constituents in the Clinton River, 1970 - 1987. Results are in ug/kg dry weight unless noted.**

MAP ID & YEAR	STATION	Oil and Grease*	PCBs	Phenol	Total** Solids	Aldrin	Dieldrin	Chlordane	Endrin	Heptaclor	Lindane	Phthalates	DBP	Phenanthrene	Anthracene	DDTs Total mean	DDTs max	DDTs min	Toxaphene	Diethylhe. Phthalate
		SECTION 2.			CLINTON RIVER SPILLWAY															
201-76	DNRPN-500188	1960+	<500		52.8 49 !	<4.0	<10	<20				<1000	<1000			<40				
201-80	DNRSTO-500188													32.0						
202-85	EPA-85-13A	650			77.1			2				3200				0				
		SECTION 3.			CLINTON RIVER FROM RED RUN TO THE SPILLWAY															
301-76	DNRPN-500208	2140#	<500		50.4	<4.0	<10	<20				<1000		<1000		<40				
302-76	DNRPN-500010	1960+	<500		35.6	<4.0	<10	<20				<1000		<1000		<40				
303-76 /79	USGSSTO-04165500 --1976-79 smpling period															17.1	12.1	0.5	80	
304-80	DNRSTO-500233															70.0				
		SECTION 4.			RED RUN															
401-76	DNRPN-500227	3840#	570		35.6	<4.0	<10	<20				<1000	<1000			<40				

* = In mg/kg dry weight.
** = Total solids are in percent.
+ = In moderately polluted range, U.S. EPA, 1977.
# = Exceeds heavily polluted range, U.S. EPA, 1977.
! = Percent heavy metals

Table 4.10 Selected organic contaminant constituents in the Clinton River, 1970 - 1987.
Results are in ug/kg dry weight unless noted.

MAP ID & YEAR	STATION	Oil and Grease*	PCBs	Phenol	Total** Solids	Aldrin	Dieldrin	Chlordane	Endrin	Heptachlor	Lindane	Phthalates	DBP	Phenanthrene	Anthracene	Total mean	DDTs max	min	Toxaphene	Diethylhexyl Phthalate
	S E C T I O N 5. MAIN BRANCH OF THE CLINTON RIVER AND ITS TRIBUTARIES UPSTREAM OF RED RUN																			
501-76	DNRPN-630630	580	<500		27.6	<4.0	<10.0	<20.0				1790	<1000			<40.0				
507-76	DNRPN-630599	60600	<500		41.8	<4.0	<10.0	<20.0				3940	<1000			<40.0				
509-76	DNRPN-630633	50000	177600		21.8	<4.0	<10.0	<20.0				4440	<1000			<40.0				
510-76	DNRSTO-630728		1300+																	
511-76	DNRPN-630635	1180+	<500		40.9	<4.0	<10.0	<20.0				<1000	<1000			<40.0				
512-73	DNRPC2-630613	0.41¦¦	<200		29.4	<1.0	17.0	<1.0	<1.0	<1.0	<1.0			4420.0		71.0				3060.0
513-73	DNRPC2-630614	0.53¦¦	<200		35.7	<1.0	22.0	<1.0	<1.0	<1.0	<1.0			<500.0		76.0				<500.0
514-73	DNRPC2-630619	3.49¦¦	<200		30.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			<500.0		115.0				1640.0
515-73	DNRPC2-630621	0.17¦¦	<200		34.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			2010.0		86.0				500.0
516-73	DNRPC2-630622	0.55¦¦	<200		14.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			<500.0		404.0				6850.0
518-76	DNRPN-76-SEC5	22000	<500		41.5	<4.0	<10.0	<20.0				1190	<1000			<40.0				
519-76	DNRSTO-630637		1190+																	
520-83	DNRLDI-83-1 #											1158		516	<145					
521-83	DNRLDI-83-2											<203		<296	<73					
522-83	DNRLDI-83-3D											4178		<246	<37					
522-83	DNRLDI-83-3											<436		<11						
523-83	DNRLDI-83-4											608		<193	<35					
524-83	DNRLDI-83-5											527		<375	<77					
525-83	DNRLDI-83-6											200u		200u						
526-83	DNRLDI-83-7											200u		200u						
527-83	DNRLDI-83-8											200u		840k						
528-83	DNRLDI-83-9											200u		200u						
531-76	DNRPN-500205	600	<500+		44.7	<4.0	<10.0	<20.0				<1000	<1000			<40.0				
	S E C T I O N 6. NORTH AND MIDDLE BRANCHES, CLINTON RIVER																			
601-83	DNRMDR-83-1 ¡		<50.0	<2500		<20.0		<20.0			<20.0	<5000				<20.0				45,000
602-83	DNRMDR-83-2A		<50.0	<2500		<20.0		<20.0			<20.0	<5000				<20.0				58,000
602-83	DNRMDR-83-2B		<50.0	<2500		<20.0		<20.0			<20.0	<5000				<20.0				13,000
602-83	DNRMDR-83-2C		<50.0	<2500		<20.0		<20.0			<20.0	<5000				<20.0				37,000
603-83	DNRMDR-83-3A		<50.0	<2500		<20.0		<20.0			<20.0	<5000				<20.0				25,000
603-83	DNRMDR-83-3B		<50.0	<2500		<20.0		<20.0			<20.0	<5000				<20.0				39,000
603-83	DNRMDR-83-3C		<50.0	<2500		<20.0		<20.0			<20.0	<5000				<20.0				52,000
604-79	DNRODR-79-1	<500	<6000																	
605-79	DNRODR-79-3	63000	134000																	
606-79	DNRODR-79-2	<500	<7800																	

* = In mg/kg dry weight.
** = Total solids are in percent.
\+ = In moderately polluted range, U.S. EPA, 1977.
@ = Exceeds heavily polluted range, U.S. EPA, 1977.
¦ = Percent heavy metals
¦¦ = Percent oil
# = See table: polynuclear aromatic hydrocarbons also sampled for.
k = Results tentative: unconfirmed data.
u = Undetected at this level of detection.
¡ = A coring tool was used to collect the samples in the McBride study; core depths are A, 0-3", B, 3-6", C, 6-9".

Table 4.11 Selected organic chemical and polynuclear aromatic hydrocarbon contaminant constituents in the Clinton River, 1970 - 1987. Results are in ug/kg dry weight unless noted.

	SECTION 1 NATURAL CHANNEL, DOWNSTREAM OF THE SPILLWAY							SECTION 2 SPILLWAY
	104-81 EPA-1981-5	107-81 EPA-1981-4	112-81 EPA-1981-3	114-81 EPA-1981-2	116-81 EPA-1981-1	117-85 EPA-1985-15a	119-85 EPA-1985-15	202 85 EPA-85-13M
1,1-dichloroethane								
1,2-dichloroethane								
1,1-dichloroethene								
1,2-dichloroethene								
1,1,1-trichloroethane								
1,1,2-trichloroethane								
1-bromo-3-chloropropane								
1,2-dichloropropane								
1,1,2,2-tetrachlorethene								
2,3,7,8-tetrachlorodibenzo-p-dioxin								
2-butanone								
2-cyclohexen-1-one								
2-hexanone								
2-methylnaphthalene								
4-fluro-1,,1-biphenyl								
4-methyl-2-pentanone								
Acenaphthene								
Acenaphythlene								
Acetone								
Acrolein								
Anthracene/Phenanthracene	750.0	1,040.0	1,190.0	330.0	400.0			
Bendosul	9.0	14.0	12.0	3.0	3.0			
Benzene	8.0	25.0	5.0	11.0	11.0			
Benzo(a)anthracene							5	
Benzo(A)pyrene			2,020					
Benzo(b) fluoranthene			2,340.0					
Benzo(k) fluoranthene								
Benzo(ghi)perylene								
Beta BHC		27.0		9.0	2.0			
Bromodichloromethene								
Bromofluorobenzene B 80							150	35.7
Bromoform								
Carbon Tetrachloride								
Chlorobenzene								
Chlorodibromomethane								
Chloroform								
Chrysene								
Chrysene BNZ Anth	3,790.0		6,400.0	1,580.0	400.0			
DCPB	20.0	9.0	27.0	21.0	2.0			
Dibenzofuran								
Dibenzo(a,h)anthracene								
Dichlorobenzene								
Dichloromethane	27.0	1,360.0	63.0	940.0	241.0			
Ethylbenzene								
Flatene	1,770.0	2,500.0	2,700.0	700.0	500.0			
Fluoranthene								
Fluorene			60.0		500.0			
Fluorotrichloro-methane								
Hexachlorobenzene	7.0	23.0	17.0	4.0	1.0			
Hexachlorobutadiene								
Hexachlorocyclopentadiene								
Heptadecane								
Indene (2,3,3-cd) pyrene								
Methyl benzene	3.0	4.0	5.0	5.0	6.0			
Methylene chloride								
Mirex	4.0	2.0	5.0		1.0			
Napthalene	25.0	400.0	340.0	300	150.0	100.0		
N-nitrosodiphenylamine								
Octachlorocyclopentene								
Pentachloronitrobenzene								
Pyrene	2,400.0	2,700.0	3,200.0	630	700.0			
Styrene								
Tetrachloroethene								
Tetrahydrofuran								
Trichloroethene								
Tolsene								
Total xylenes								
Trichloromethane				20,000				
Tridecane								
Zytron	56.0	64.0	73.0	49.0	10.0			

Table 4.11 continued
Results are in ug/kg dry weight unless noted.

SECTION 5 MAIN BRANCH OF THE CLINTON RIVER AND ITS TRIBUTARIES UPSTREAM OF RED RUN

	S20-83 DNRLDI-83-1 #	S21-83 DNRLDI-83-2	S22-83 DNRLDI-83-3	S22-83 DNRLDI-83-3	S23-83 DNRLDI-83-4	S24-83 DNRLDI-83-5	S25-83 DNRLDI-83-6	S26-83 DNRLDI-83-7	S27-83 DNRLDI-83-8	S28-83 DNRLDI-83-9
1,1-dichloroethane										
1,2-dichloroethane										
1,1-dichloroethene										
1,2-dichloroethene										
1,1,1-trichloroethane										
1,1,2-trichloroethane										
1-bromo-3-chloropropane										
1,2-dichloropropane										
1,1,2,2-tetrachlorethane										
2,3,7,8-tetrachlorodibenzo-p-dioxin							2u	2u	2u	2u
2-butanone	< 4	6			6	3				
2-cyclohexen-1-one	191	344	171		346	407				
2-hexanone					2					
2-methylnaphthalene	< 48				19					
4-flura-1,,1-biphenyl			540							
4-methyl-2-pentanone	< 1	1			3	1				
Acenaphthene	< 50	< 13								
Acenaphythlene		599								
Acetone	31				32	14				
Acrolein										
Anthracene/Phenanthracene										
Bendosul										
Benzene										
Benzo(a)anthracene	904		2,909		488	608				
Benzo(A)pyrene	< 258	< 159	1,508		< 147	< 165				
Benzo(b) fluoranthene	635b	430b	2,442	< 15	460b	< 113				
Benzo(k) fluoranthene				< 14		82				
Benzo(ghi)perylene		< 79			< 71	< 84				
Beta BHC										
Bromodichloromethane										
Bromofluorobenzene & B8										
Bromoform					< 2					
Carbon Tetrachloride										
Chlorobenzene										
Chlorodibromomethane										
Chloroform										
Chrysene	1,135	752	3,883	< 35	584	696				
Chrysene BNZ Anth										
DCPA										
Dibenzofuran	< 35	< 13			8					
Dibenzo(a,h)anthracene						< 106				
Dichlorobenzene										
Dichloromethane										
Ethylbenzene										
Flantene										
Fluoranthene	405	< 314	< 347	< 11	< 275	423	310k	200u	670k	200u
Fluorene	54	< 23	< 10		< 14	< 31				
Fluorotrichloro-methane										
Hexachlorobenzene						< 58				
Hexachlorobutadiene										
Hexachlorocyclopentadiene										
Heptadecane		194								
Indeno (1,2,3-cd) pyrene	< 211	< 100			< 91	< 104				
Methyl benzene										
Methylene chloride	< 3	10		< 3	< 7	6				
Mirex										
Napthalene	< 45	< 16	< 20		< 10	< 20				
N-nitrosodiphenylamine					< 23	< 31				
Octachlorocyclopentene										
Pentachloronitrobenzene										
Pyrene	1,190	1,470	5,559	< 56	1,142	810	200u	200u	620k	200u
Styrene	< 1				3					
Tetrachloroethene					< 2					
Tetrahydrofuran	24	62		26	33	39				
Trichloroethene										
Toluene	< 2	< 1	< 2	< 1	< 1	< 1				
Total xylenes	< 1				3					
Tri[illegible]romethane										
T[illegible]	176				137					

b ... ue represents combined cncentration of benzo(b)- and benzp(k) [illegible] ene.

Table 4.11 continued
Results are in ug/kg dry weight unless noted.

S E C T I O N 6 NORTH BRANCH CLINTON RIVER

	601-83 DNRMDR-83-1 a	602-83 DNRMDR-83-2A	602-83 DNRMDR-83-2B	602-83 DNRMDR-83-2C	603-83 DNRMDR-83-3A	603-83 DNRMDR-83-3B	603-83 DNRMDR-83-3C
1,1-dichloroethane	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1,2-dichloroethane	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1,1-dichloroethene	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1,2-dichloroethene	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1,1,1-trichloroethane	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1,1,2-trichloroethane	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1-bromo-3-chloropropane	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1,2-dichloropropane	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1,1,2,2-tetrachlorethane	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2,3,7,8-tetrachlorodibenzo-p-dioxin							
2-butanone							
2-cyclohexen-1-one							
2-hexanone							
2-methylnaphthalene							
4-flure-1,,1-biphenyl							
4-methyl-2-pentanone							
Acenaphthene							
Acenaphythlene							
Acetone							
Acrolein							
Anthracene/Phenanthracene							
Bendesul							
Benzene	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Benzo(a)anthracene							
Benzo(A)pyrene							
Benzo(b) fluoranthene							
Benzo(k) fluoranthene							
Benzo(ghi)perylene							
Beta BHC							
Bromodichloromethene	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Bromofluorobenzene & BB							
Bromoform	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Carbon Tetrachloride	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Chlorobenzene	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Chlorodibromomethane	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Chloroform	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Chrysene							
Chrysene BNZ Anth							
DCPA							
Dibenzofuran							
Dibenzo(a,h)anthracene							
Dichlorobenzene	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Dichloromethane	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Ethylbenzene	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Flantene							
Fluoranthene							
Fluorene							
Fluorotrichloro-methane							
Hexachlorobenzene	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Hexachlorobutadiene	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Hexachlorocyclopentadiene	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Heptadecane							
Indene (2,3,3-cd) pyrene							
Methyl benzene							
Methylene chloride	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Mirex							
Napthalene							
N-nitrosodiphenylamine							
Octachlorocyclopentene	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Pentachloronitrobenzene	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Pyrene							
Styrene	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Tetrachloroethene	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Tetrahydrofuran							
Trichloroethene	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Toluene	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Total xylenes	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Trichloromethane							
Tridecane							
Zytron							

a = A coring tool was used to collect the samples in the McBride drain study; core depths are A, 0-3", B, 3-6", C, 6-9".

Table 4.11 continued

Reports and code listings for each report containing sediment data, Clinton River.

STATION CODE	REPORT FROM WHICH DATA WAS EXTRACTED
COE-75, EPA-70, EPA-73	Maintenance dredging of the federal navigation channel at Clinton River (Final environmental statement). COE 1976.
COE-83	Confined disposal facility for maintenance dredging at Clinton River (supplemental final environmental statement). COE 1987.
EPA-81	Unpublished data, U.S. EPA (GLNPO), no. 67. EPA 1981.
EPA-83	Unpublished data, U.S. EPA (GLNPO), no. 68. EPA 1985.
DNR-87	Unpublished report. MDNR. Kenaga 1987.
DNRGDR	Biological survey of Greiner Drain and North Branch Clinton River, Macomb County, Michigan. MDNR. Saalfeld 1980.
DNRLDI	Report on the impact of Liquid Disposal, Inc. on the Clinton River, Macomb County, Michigan. MDNR. Kenaga and Jones 1986.
DNRMDR	A water, sediment, and benthic macroinvertebrate survey of McBride Drain in the vicinity of South Macomb disposal authority landfill 9a, Macomb County, Mich. MDNR. Kenaga 1984.
DNRPC2	Biological survey of Paint Creek. MDNR. 1973.
DNRPM	Sediment survey of the Clinton River, Pontiac to Mouth, September 9, 1976. MDNR. 1976.
DNRSTO DNR	STORET retrieval from the STORET station listed.
USGSSTO	STORET retrieval from the STORET station listed.

Table 4.11 continued

Clinton River basin sediment sampling stations, from headwaters to mouth, MDNR and federal and local agencies station locations, 1970 - 1987.

MAP ID NUMBER	LATITUDE	LONGITUDE	AGENCY STATION NUMBER	DESCRIPTION
	SECTION 1			
101	42 35 47.0	82 52 36.0	500213	CLINTON R AT CROCKER ST BR; CITY
102	42 35 48.0	82 52 00.0	EPA-70-A EPA-73-A ERG-83-8	Cl. R. just east of Gratiot Ave.
103	42 35 50.0	82 51 53.0	COE-75-1	Cl. R. at N. River Rd north of Avery St.
104	42 35 45.0	82 51 47.0	EPA-81-5	Cl. R. at N. River Rd & Henry Joy Rd
105	42 35 23.0	82 51 32.0	COE-75-2 ERG-83-7 DNR-87-2	Cl. R. just west of I-94
106	42 35 26.0	82 51 27.0	500214	CLINTON R AT I-94 BRIDGE; HARRIS
107	42 35 34.0	82 50 49.0	EPA-81-4	Cl. R. at N. River Rd at bend east of Irwin Rd
108	42 35 22.0	82 50 50.0	EPA-73-B ERG-83-6	Cl. R. off N. end of Chartier Rd.
109	42 35 24.0	82 50 18.0	COE-75-3	Cl. R. at S. River Rd & Hazel Rd
110	42 35 42.0	82 50 11.0	ERG-83-5	Cl. R. west of Bridgeview Rd.
112	42 35 43.0	82 49 35.0	EPA-81-3	Cl. R. at Bridgeview bridge (west side)
113	42 35 22.0	82 49 17.0	EPA-70-C EPA-73-C COE-75-4 ERG-83-4 DNR-87-1	Cl. R. east of Bridgeview Rd.
114	42 35 50.0	82 48 46.0	EPA-81-2	
115	42 35 49.0	82 48 37.0	ERG-83-3	Cl. R. at end of Jefferson Ave.
116	42 35 33.0	82 47 54.0	EPA-81-1	Cl. R. at S. River Rd upstrm of EPA-73-D
117	42 35 37.0	82 47 48.0	EPA-73-D ERG-83-2 EPA-85-15A	Cl. R. near mouth; upstr. ERG-1
118	42 35 38.4	82 47 39.0	EPA-75-1	Cl. R. at N. River Rd east of EPA-73-D
119	42 35 36.0	82 47 31.0	EPA-75-2 COE-75-5 EPA-85-15	Cl. R. at N. River Rd east of EPA-75-1
120	42 35 35.0	82 47 19.0	EPA-75-3	Cl. R. at N. River Rd east of mainland
121	42 35 36.0	82 47 04.0	EPA-75-4	Cl. R. at N. River Rd east of EPA-75-3
122	42 35 38.0	82 46 47.0	EPA-75-5	In channel mouthway, at end of breakwater, west of rubblemoun
123	42 35 34.0	82 46 35.0	EPA-70-E EPA-73-E COE-75-6	Cl R. east of EPA-75-5
124	42 35 36.0	82 46 24.0	ERG-83-1	Cl. R. At mouth; tip of earthfill
125	42 35 39.0	82 46 04.0	EPA-70-F EPA-73-F COE-75-7	Cl. R. east of ERG-83-1
	SECTION 2			
201	42 34 35.0	082 52 15.0	DNR-500188	CLINTON R SPILL@ HARPER AVE
202	42 34 13.0	82 51 53.0	EPA-13-A-85	Spillway midway between I-94 & Jefferson Ave
	SECTION 3			
301	42 34 39.0	082 57 12.0	DNR-500208	CLINTON R AT GARFIELD RD BR; CLI
302	42 35 45.0	082 54 35.0	DNR-500010 USGS-04165500	CLINTON R@ MORAVIAN DRV; W. SIDE
303	42 35 03.0	082 52 58.0	DNR-500233	CLINTON R@ NO. BOUND GRATIOT AVE

Table 4.11 continued

MAP ID NUMBER	LATITUDE	LONGITUDE	AGENCY STATION NUMBER	DESCRIPTION
	SECTION 4			
401	42 33 10.0	082 59 07.0	500227	RED RUN AT 15 MILE ROAD; STERLIN
	SECTION 5			
501	42 37 40.0	083 23 41.0	630630	CLINTON R. AT COOLEY LK RD; WATE
502	42 37 27.0	083 18 57.0	630631	CLINTON R. AT ORCHARD LK RD; PON
503	42 37 22.0	083 18 30.0	630704	CRYSTAL LK @ CLINTON R. MTH; CITY OF PONTIAC, SEC 31
504	42 37 11.0	083 18 05.0	630705	CLINTON R. DNSTRM CRYSTAL LK; CITY OF PONTIAC SEC 32
505	42 37 33.0	083 17 52.0	630600	CLINTON R. AT GILLESPIE STREET;
506	42 37 52.0	083 17 54.0	630703	CLINTON R. AT WESSON ST, CITY OF PONTIAC
507	42 38 48.0	083 16 08.0	630599	CLINTON R ABV PONTIAC STP NO1 IN
508	42 38 33.0	083 15 37.0	630632	CLINTON R @ M-59 BRIDGE; PONTIAC
509	42 38 11.0	083 15 05.0	630728	CLINTON R 50 FT DWNSTR AUBURN WW
510	42 38 02.0	083 13 27.0	630633	CLINTON R. AT AUBURN RD; PONTIAC
511	42 39 14.0	083 11 35.0	630595	CLINTON R AT ADAMS RD BRIDGE; AVON
512	42 39 57.0	083 09 13.0	630594	CLINTON R AT AVON RD; AVON TWP,
513	42 40 37.0	083 07 46.0	630635	CLINTON R. UPSTREAM PAINT CR; AV
514	42 47 00.0	083 14 35.0	630613	PAINT CREEK AT M-24 BRIDGE; ORIO
515	42 46 53.0	083 13 52.0	630614	PAINT CR AT ATWATER ST; CITY OF
516	42 43 52.0	083 09 35.0	630619	PAINT CREEK AT ORION RD; OAKLAND
517	42 41 19.0	083 08 32.0	630621	PAINT CREEK AT WOODWARD ST; AVON
518	42 40 41.0	083 07 42.0	630622	PAINT CR AT GTW RAILROAD BR.; AV
519	42 40 36.0	083 07 37.0	630636	CLINTON R 100 YDS BELOW PAINT CR
521	42 40 58.0	083 06 30.0	630637	CLINTON R @ PARK DAVIS PICNIC AREA
522	42 40 12.0	083 05 46.0	LDI-1	Cl. R. just downstr. Yates Park Dam
523	42 40 08.0	083 05 31.0	LDI-2	Cl. R. downstr. of LDI-1
524	42 39 58.0	083 05 10.0	LDI-3	Cl. R. downstream of LDI-2
525	42 39 30.0	083 04 57.0	LDI-4	Cl. R. downstream of LDI-3
526	42 39 20.0	083 04 36.0	LDI-5	Cl. R. downstream of LDI-4
527	42 39 24.0	083 04 25.0	LDI-6	Cl. R. at Ryan Rd bridge; Shelby
528	42 39 21.0	083 04 07.0	LDI-7	Cl. R. downstream of LDI-6
529	42 39 05.0	083 03 35.0	LDI-8	Cl. R. downstream of LDI-7
530	42 38 46.0	083 03 23.0	LDI-9	Cl. R. downstream of LDI-8
531	42 35 11.0	082 59 49.0	500205	CLINTON R AT KLEINO RD; CITY OF
	SECTION 6			
601	42 41 13.0	082 55 15.0	DNRMDR-1	McBride Drain at 24 Mile Road
602	42 40 45.0	082 54 40.0	DNRMDR-2	McBride Drain between 24 & 23 Mi. Rd.
603	42 40 24.0	082 54 05.0	DNRMDR-3	McBride Drain 23 Mile Road
604	42 37 11.0	082 53 53.0	DNRGDR-1	N. Branch above inlet of Greiner Dr.
605	42 36 45.0	082 53 25.0	DNRGDR-3	Greiner Drain at M-97
606	42 37 07.0	082 53 54.0	DNRGDR-2	N. Branch below inlet of Greiner Dr.

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Table 4.12 Concentrations of Heavy Metals in Fish Collected in the Clinton River Basin. 1971 -1984
Results in mg/kg wet weight.

Map Code	Sample Year	Document Code	Storet Number	Fish Species	Sample Type**	Total Arsenic	Total Cadmium	Total Chromium	Total Lead	Total Mercury	Total Aluminum	Total Iron*	Total Manganese	Total Zinc	Total Selenium	Total Copper	Total Nickel
F531	1986	Storet	630606	Walleye	Skin on		<0.01	<0.10	0.13	1.50				5.60		0.60	0.1
F531	1986	Storet	630606	Carp	Skin off		<0.01	<0.10	0.12	0.15				11.40		0.70	<0.1
F531	1986	Storet	630606	Carp	Skin off		<0.01	<0.10	<0.10	0.13				8.90		<0.40	<0.1
F531	1986	Storet	630606	Carp	Skin off		<0.01	<0.10	0.16	<0.10				16.00		0.70	<0.1
F531	1986	Storet	630606	Carp	Skin off		<0.01	<0.10	<0.10	0.12				7.70		<0.40	<0.1
F531	1986	Storet	630606	Carp	Skin off		<0.01	<0.10	<0.10	0.22				8.00		0.80	<0.1
F531	1986	Storet	630606	Carp	Skin off		<0.01	<0.10	0.18	0.16				16.60		<0.40	<0.1
F531	1986	Storet	630606	Carp	Skin off		<0.01	<0.10	0.22	0.19				15.10		0.60	<0.1
F531	1986	Storet	630606	Carp	Skin off		<0.01	<0.10	<0.10	0.32				14.30		0.50	<0.1
F533	1983	LDIUS-86		N. Pike	Fillet		0.04	0.41	0.12								
F533	1983	LDIUS-86		N. Pike	Fillet			0.11	0.07	0.15							
F533	1983	LDIUS-86		Carp	Fillet		0.02	0.27	0.04								
F533	1983	LDIUS-86		Carp	Fillet		0.04	0.27	0.09	0.08							
F533	1983	LDIUS-86		Carp	Fillet			0.16	0.26								
F533	1983	LDIUS-86		W. Sucker	Fillet			0.19	0.23	0.27							
F533	1983	LDIUS-86		W. Sucker	Fillet			0.20	0.10	0.20							
F533	1983	LDIUS-86		W. Sucker	Fillet			0.18									
F533	1983	LDIUS-86		W. Sucker	Fillet			0.36		0.08							
F533	1983	LDIUS-86		Co.Shiner	Wh. Fish			0.19	0.10								
F533	1983	LDIUS-86		Walleye	Fillet		0.03	1.70	0.39	0.36							
F533	1983	LDIUS-86		Walleye	Fillet			0.12		0.58							
F533	1983	LDIUS-86		Walleye	Fillet			0.94	0.19	0.08							
F533	1983	LDIUS-86		Walleye	Fillet			0.15	0.19								
F533	1983	LDIUS-86		N. Pike	Fillet			0.27	0.24	0.25							
F533	1983	LDIUS-86		Co.Shiner	Wh. Fish	0.2		0.14	0.14								
F533	1983	LDIUS-86		W. Sucker	Fillet			0.09	0.08	0.11							
F533	1983	LDIUS-86		W. Sucker	Fillet			0.36	0.09								
F533	1983	LDIUS-86		W. Sucker	Fillet			0.44	0.13								
F533	1983	LDIUS-86		W. Sucker	Fillet			0.19	0.19								
F533	1983	LDIUS-86		Carp	Fillet			0.32	0.21								
F533	1983	LDIUS-86		Carp	Fillet		0.20	0.24	0.17								
F533	1983	LDIUS-86		Carp	Fillet	0.5	0.04	0.23	0.21								
F533	1983	LDIUS-86		Carp	Fillet			0.29	0.32								
F535	1983	LDIDS-86		Carp	Wh. Fish	<0.5	<0.50	1.00	<2.50	0.10	<10.0	17.5	0.75	18.00	0.4		
F535	1983	LDIDS-86		Carp	Wh. Fish	<0.5	<0.50	<0.50	<2.50	0.20	<10.0	20.0	0.75	31.50	0.5		
F535	1983	LDIDS-86		Carp	Wh. Fish	<0.5	<0.50	0.50	<2.50	0.10	250.0	22.5	2.25	53.50	0.5		
F535	1983	LDIDS-86		W. Sucker	Wh. Fish	<0.5	<0.50	<0.50	<2.50	0.10	20.0	37.5	3.00	15.50	0.3		
F535	1983	LDIDS-86		W. Sucker	Wh. Fish	<0.5	<0.50	0.50	<2.50	0.10	40.0	45.0	3.00	13.50	0.4		
F535	1983	LDIDS-86		W. Sucker	Wh. Fish	<0.5	<0.50	0.50	<2.50	0.10	20.0	30.0	2.25	17.00	0.4		
F535	1983	LDIDS-86		W. Sucker	Wh. Fish	<0.5	<0.50	<0.50	<2.50	0.10	<10.0	12.5	6.75	16.00	0.5		
F535	1983	LDIDS-86		Gizrd Shad	Wh. Fish	<0.5	<0.50	2.50	<2.50	0.10	220.0	275.0	12.00	11.00	0.5		
F535	1983	LDIDS-86		GoldShiner	Wh. Fish	<0.5	<0.50	0.50	<2.50	0.10	70.0	95.0	6.00	31.50	0.9		
F537	1973	DNR-74	500203	ChannelCat	Skin off	0.1	0.08	0.22	0.60	1.28				17.41		4.69	2.7
F539	1973	DNR-74	500205	Carp	Skin off		0.03	0.06	0.30	0.20				17.01		1.11	0.1
F540	1973	DNR-74	500047	Sucker	Skin off		0.03	0.08	0.70	0.37				9.00		0.69	0.6

* Blank Corrected Concentration
** Skin off or skin on sample type are fillets

Table 4.12 Concentrations of Heavy Metals in Fish Collected in the Clinton River Basin. 1971 -1984
Results in mg/kg wet weight.

Map Code	Sample Year	Document Code	Storet Number	Fish Species	Sample Type**	Total Arsenic	Total Cadmium	Total Chromium	Total Lead	Total Mercury	Total Aluminum	Total Iron*	Total Manganese	Total Zinc	Total Selenium	Total Copper	Total Nickel
SECTION 1																	
F101	1973	DNR-74	500213	Carp	Skin off	0.1	0.05	0.04	0.30	0.19				11.91		0.49	0.2
F103	1973	DNR-74	500214	Carp	Skin off		0.06	0.07	0.30	0.38				12.20		0.69	0.3
F104	1973	DNR-74	500008	Carp	Skin off		0.02	0.07	0.50	0.40				14.92		9.37	1.0
F104	1986	Storet	500008	Lg. Bass	Skin on		0.02	<0.10	<0.10	0.23				9.90		<0.40	<0.1
F104	1986	Storet	500008	Sm. Bass	Skin on		<0.01	<0.10	<0.10	0.29				9.00		<0.40	<0.1
F104	1986	Storet	500008	Walleye	Skin on		<0.01	<0.10	<0.10	0.28				6.15		0.50	<0.1
F104	1986	Storet	500008	Walleye	Skin on		<0.01	<0.10	<0.10	0.21				4.70		<0.40	<0.1
F104	1986	Storet	500008	Walleye	Skin on		<0.01	0.21	<0.10	0.40				6.00		<0.40	<0.1
F104	1986	Storet	500008	Walleye	Skin on		<0.01	<0.10	<0.10	0.29				9.40		<0.40	<0.1
F104	1986	Storet	500008	Walleye	Skin on		<0.01	<0.10	<0.10	0.28				7.40		<0.40	<0.1
F104	1986	Storet	500008	Walleye	Skin on		<0.01	<0.10	<0.10	0.26				6.10		<0.40	<0.1
F104	1986	Storet	500008	Carp	Whole		0.04	0.14	0.68	0.10				52.00		1.40	0.2
F104	1986	Storet	500008	Carp	Whole		0.13	0.14	0.63	0.11				58.00		2.10	1.5
F104	1986	Storet	500008	Carp	Skin off		0.01	<0.10	<0.10	0.27				9.10		0.90	<0.1
F104	1986	Storet	500008	Carp	Skin off		<0.01	<0.10	<0.10	0.23				8.30		0.80	<0.1
F104	1986	Storet	500008	Carp	Skin off		<0.01	<0.10	0.17	0.15				30.00		<0.40	<0.1
F104	1986	Storet	500008	Carp	Skin off		0.02	<0.10	0.20	0.26				15.20		0.80	<0.1
F104	1986	Storet	500008	Carp	Skin off		<0.01	<0.10	0.19	0.46				20.00		0.50	<0.1
SECTION 2																	
F203	1973	DNR-74	500188	Carp	Skin off		0.06	0.18	0.50	0.14				32.60		8.29	1.7
SECTION 3																	
F303	1971	Storet	500231	Carp	Skin off		0.20	0.20		0.30				29.00		4.20	0.1
F303	1971	Storet	500231	Redhorse	Skin off		<0.10	0.10		0.30				9.00		0.90	<0.1
F303	1973	DNR-74	500231	Sucker	Skin off		0.03	0.14	0.80	0.32				9.16		0.70	0.6
F304	1973	DNR-74	500230	Carp	Skin off		0.04	0.06	0.50	0.96				17.82		0.75	0.3
F304	1973	DNR-74	500230	Sucker	Skin off	0.1	0.04	0.07	0.40	0.28				9.04		0.69	0.4
F306	1973	DNR-74	500209	Carp	Skin off		0.03	0.04	0.30	0.22				12.92		0.84	0.2
F306	1973	DNR-74	500209	Sucker	Skin off		0.03	0.03	0.20	0.63				8.68		0.79	0.1
F311	1973	DNR-74	500010	Carp	Skin off		0.07	0.04	0.20	0.34				5.80		0.44	0.1
SECTION 5																	
F504	1973	DNR-74	630629	Carp	Skin off	0.1	0.03	0.16	0.30	0.08				19.10		0.85	0.8
F504	1973	DNR-74	630623	Bluegill	Skin off	0.1	0.03	0.17	0.06	0.09				14.72		1.00	0.6
F512	1973	DNR-74	630633	Sucker	Skin off		0.03	0.13	0.90	0.13				11.90		0.77	0.4
F512	1973	DNR-74	630633	Sunfish	Skin off		0.08	0.21	0.70	0.12				19.56		1.28	0.8
F512	1973	DNR-74	630633	Bluegill	Skin off	0.1	0.03	0.26	0.70	0.15				23.61		2.06	1.3
F514	1973	DNR-74	630252	Sucker	Skin off		0.06	0.08	0.60	0.16				6.60		0.79	0.5
F514	1973	DNR-74	630252	Carp	Skin off		0.05	0.06	0.30	0.10				15.61		2.87	0.5
F514	1973	DNR-74	630252	Bluegill	Skin off		0.06	0.12	0.70	0.05				14.51		0.89	0.7
F515	1971	Storet	630594	W. Sucker	Skin off		0.10	0.10		0.10				11.00		4.60	0.1
F526	1973	DNR-74	630637	Sucker	Skin off	0.1	0.04	0.19	0.60	0.36				11.80		0.65	0.6
F531	1986	Storet	630606	Walleye	Skin on		<0.01	<0.10	<0.10	0.23				7.60		0.50	<0.1

Section 6. Section 1 phenol concentrations ranged from 170 to 21,000 ug/kg in 1970, less than 10 to 300 ug/kg in 1973, less than 200 ug/kg in 1983 and 100 ug/kg in 1985.

In 1976, Section 5 sediment oil and grease concentrations were 580 mg/kg at station 501 and 6060 and 5000 mg/kg at stations 507 and 509 in and just downstream of Pontiac. Concentrations decreased to 1180 and 2200 mg/kg at stations 511 and 518, respectively, in the Rochester area to 600 mg/kg at station 531 downstream of Utica. Oil and grease concentrations increased to approximately 2000 mg/kg at stations 301 and 302 downstream of Red Run. Concentrations in Section 2, station 201, were also 2000 mg/kg. Further downstream in Section 2, sediment oil and grease concencentrations were less than 650 mg/kg.

The source of oil and grease was apparently from Section 4 where oil and grease concentrations were 3,840 mg/kg in 1976 at station 401. Sediment oil and grease concentrations in Section 6 were 6,300 mg/kg in Greiner Drain, but were less than 500 mg/kg in the Main Branch up and downstream of Greiner Drain.

Section 1 oil and grease ranged from 320 to 27,000 mg/kg in 1970, 125 to 14,270 mg/kg in 1973, 406 to 10,222 mg/kg in 1975, 2,080 mg/kg in 1976, and 400 to 5,100 mg/kg in 1983. Oil and grease concentrations were greatest at stations 102, 103 and 113, and decreased with distance from those stations, with the lowest values at the Clinton River/Lake St. Clair confluence.

Sediment PCB concentrations in Section 5 were less than 500 ug/kg in 1976 at stations 501 and 507 upstream of the Pontiac WWTP. Sediment PCB jumped to 17,760 ug/kg at station 509 downstream of Pontiac and decreased to 1,300 at station 510. At Rochester just upstream of Paint Creek, sediment PCB concentrations were less than 500 ug/kg. Downstream of Rochester Paper Company, sediment PCB increased to 1,190 ug/kg at station 519 and decreased to less than 500 ug/kg at station 531 downstream of Utica. PCB was also reported at less than 500 ug/kg at stations 301 and 302 in Section 3, and station 201 in Section 2. In Section 4, PCB sediment concentrations were 570 ug/kg at station 401.

In Section 6 in 1979, Greiner Drain station 605 sediments had 13,400 ug/kg total PCB, but at stations 604 and 606 in the North Branch, PCB concentrations were less than 780 ug/kg. Stations 601 through 603 contained less than 50 ug/kg PCB.

Section 1 sediment PCB concentrations were 1,820 ug/kg in 1976, ranged from 195 to 562 ug/kg in 1981, and from 240 to 11,400 ug/kg in 1983. PCB concentrations were highest at stations 104 through 114 in 1981, and stations 105 through 115 in 1983. Two PCB analyses performed on samples collected in 1985, downstream of the stations previously documented as having highest PCB concentrations, were similar to concentrations found in other years. Sediments downstream of station 116 generally contained PCB concentrations an order of magnitude less than upstream stations in Section 1.

Polynuclear aromatic hydrocarbons are a class of compounds known as PNAs or PAHs. Phenanthrene is a common PNA which was reported at less than 500 to 442 ug/kg in Paint Creek. Differences in levels of detection account for these apparent anomalies. In the vicinity of Ryan Road (stations 520 - 528), Clinton River sediments contained from less than 11 to 516 ug/kg phenanthrene.

Section 1 sediments contained phenanthrene at 9,220 ug/kg in 1973 (station 101), 5,290 ug/kg in 1980 (station 106), from 1,285 to 31,071 ug/kg in 1981 (stations 104-116), and 400 ug/kg in 1985 (station 118). PNAs followed the same pattern as other organic contaminants in Section 1 where highest concentrations were in the upstream reaches and the lowest concentrations present near the Clinton River/Lake St. Clair confluence.

In Sections 2 and 3, phenanthrene concentrations were reported at 32 and 70 ug/kg at stations 201 and 303, respectively. Other PNAs and their reported concentrations for Sections 1, 2, 5, and 6 are shown in Table 4.11. Sediments were not analyzed for PNAs in Section 4. PNAs are associated with asphalt roadways, tar, creosote, combustion products, automobile and truck exhaust and oils (Kenaga and Jones, 1986).

Endrin, heptachlor and lindane sediment concentrations were all less than detection limits of 1.0 ug/kg at stations 512 through 516 in 1973. Lindane was less than detection levels of 20 ug/kg at stations 601 through 603 in 1983. No other analyses for these chemicals in sediments were performed.

4.5 CHEMICALS IN CLINTON RIVER FISH TISSUE

Chemical analyses of 14 fish species from the Clinton River Sections 1, 2, 3 and 5 have occurred between 1971 and 1988 (see Map 6.3).

Some chemicals that bioaccumulate in fish tissue such as PCB and pesticides have been determined to be harmful to humans if eaten in sufficient quantities. Fish tissue concentration guidelines have been established by the U.S. Federal Department of Agriculture (USFDA) and by the Michigan Department of Public Health (MDPH) to protect human health. The MDPH is responsible for fish consumption advisories where necessary in the State of Michigan. No fish consumption advisory has ever been issued for the Clinton River.

Because some fish species are mobile, obstructions such as dams allow scientists to draw conclusions from established populations associated with a particular reach of a river. This may assist in locating pollutant sources. The only dam in the Clinton River downstream of Pontiac is at Yates Park at Avon/Dequindre Road. This dam is located near the middle of Section 5, upstream of station F532.

4.5.1 Metals in Clinton River Fish Tissue

Eleven species of fish, including game and rough fish, caught in Sections 1, 2, 3 and 5 were analyzed for metals (Table 4.12). Fish were collected in 1971, 1973, and 1983 and analyzed primarily as skin-off fillets.

Metals in fish tissue were relatively low. The impact of metals in fish tissue is not well understood and few metals bioaccumulate in fish above concentrations found in the ambient water. Only mercury has a tendency for bioaccumulation and, therefore, MDPH and USFDA have established an "action level" of 0.5 mg/kg total mercury in the edible portion.

Only four of the 58 samples analyzed exceeded the mercury action level. All were collected downstream of the Yates Park Dam. Three were collected in 1973, a carp collected at station F304 contained 0.96 mg/kg mercury; a sucker collected at station F306 contained 0.63 mg/kg mercury; and a channel catfish collected at F537 contained 1.28 mg/kg mercury. One walleye collected in 1983 at station F533 contained 0.58 mg/kg mercury.

Other observations were that the chromium concentrations in fish appeared slightly higher in Section 5 than other River Sections. Also, lead concentrations in 1983 fish tissue were less than that in 1973 fish tissue. Copper concentrations were generally highest in carp, white sucker and channel catfish. All fish with copper concentrations of greater than 4.0 mg/kg except one from station F515 were downstream of the Yates Park Dam (Fish Station Map).

4.5.2 Organic Chemicals In Clinton River Fish Tissue

Fish for organic chemical analyses were collected from Sections 1, 2, 3, and 5 (Table 4.13). Analyses were performed primarily on rough fish (carp and suckers) since they have demonstrated a high potential for bioaccumulating organic contaminants. Game fish including walleye, black crappie, bluegills, northern pike, and rock bass were also tested. Analyses were performed for eleven organic contaminants between 1971 and 1986.

The only fish species that exceeded any organic criteria were carp. Nearly all fish tissue analyzed for dieldrin were at least ten times less than the action level (0.3 mg/kg). The highest concentration (0.08 mg/kg) was in a carp collected in 1973 from station F311 (Fish Station Map).

One carp contained 0.300 mg/kg total chlordane, which is the action level for chlordane in fish tissue. All other fish tested for chlordane were below this criterion.

The action level of 5.0 mg/kg total DDT was exceeded only in a large carp with very high lipid (fat) content. This sample was a skin-on fillet collected in 1984 at station F533. This same fish also contained the highest PCB concentration of any fish collected.

In 1973, PCB in carp tissue exceeded the USFDA action level of 2.0 mg/kg in seven of the ten carp analyzed. All three of the carp collected in Section 1 and the three carp from Section 3 exceeded this level while the single carp collected in Section 2 did not exceed this level. In Section 5, only the single carp collected downstream of Yates Park Dam at station F539 exceeded the action level, while the two carp collected above the dam at stations F504 and F514 did not.

Table 4.13 **Concentrations of Organic Constituents and Pesticides in Fish Tissue from the Clinton River Basin. 1971 -1984**
Results in mg/kg Wet Weight Unless Otherwise Noted

Map Code	Sample Year	Document Code	Fish Species	Sample Type**	% Lipids	Diethyl Phthalate	Bis-2-ethyl Hexel Phthalate	Phenanthrene	Pyrene	Dieldrin	Total DDT	Lindane	Total PCB's	Total Chlordane	Heptachlor epoxide	Hexachlorobenzene
SECTION 1																
F101	1973	DNR-74	Carp	Skin off	2.7					0.020	0.600		2.22			
F102	1983	LDI94-86	Carp	Skin off	5.9					0.015	0.782		3.70	0.300	0.016	0.010
F102	1983	LDI94-86	Carp	Skin off	10.3					0.022	0.880		4.70	0.262	0.019	0.020
F102	1983	LDI94-86	Carp	Skin off	10.2					0.023	1.301		3.90	0.252	0.016	0.053
F102	1983	LDI94-86	Walleye	Skin off	3.1					0.021	0.595		0.75	0.092	0.007	0.004
F102	1983	LDI94-86	Sucker	Skin off	6.7					0.026	0.192		0.82	0.089	0.007	0.068
F103	1973	DNR-74	Carp	Skin off	3.8					0.030	1.330		2.77			
F104	1973	DNR-74	Carp	Skin off	3.2					0.030	1.060		2.35			
F104	1986	Storet	Lg. Bass	Skin on	0.4								0.14			
F104	1986	Storet	Sm. Bass	Skin on	2.0								0.80			
F104	1986	Storet	Walleye	Skin on	0.8								0.45			
F104	1986	Storet	Walleye	Skin on	0.9								0.14			
F104	1986	Storet	Walleye	Skin on	0.6								0.36			
F104	1986	Storet	Walleye	Skin on	0.7								0.41			
F104	1986	Storet	Walleye	Skin on	0.8								0.19			
F104	1986	Storet	Walleye	Skin on	0.9								0.31			
F104	1986	Storet	Carp	Whole	6.7								2.34			
F104	1986	Storet	Carp	Whole	9.8								3.59			
F104	1986	Storet	Carp	Skin off	2.9								1.10			
F104	1986	Storet	Carp	Skin off	2.4								0.92			
F104	1986	Storet	Carp	Skin off	1.4								0.46			
F104	1986	Storet	Carp	Skin off	3.3								1.20			
F104	1986	Storet	Carp	Skin off	1.6								0.61			
SECTION 2																
F203	1973	DNR-74	Carp	Skin off	1.8					0.010	0.510		1.47			
SECTION 3																
F303	1973	DNR-74	Sucker	Skin off	3.0					0.020	0.309		1.55			
F304	1973	DNR-74	Carp	Skin off	2.3					0.020	1.390		2.77			
F304	1973	DNR-74	Suckers	Skin off	1.5						0.330		1.33			
F306	1973	DNR-74	Carp	Skin off	2.3					0.020	1.040		2.94			
F306	1973	DNR-74	Suckers	Skin off	1.5					0.010	0.200		0.77			
F311	1973	DNR-74	Carp	Skin off	15.8					0.080	3.920		6.11			
SECTION 5																
F504	1973	DNR-74	Carp	Skin off	5.0					0.010	0.530		1.66			
F504	1973	DNR-74	Bluegill	Skin off	2.3					0.010	0.320		1.17			
F512	1973	DNR-74	Sucker	Skin off	1.9						0.210		0.08			
F512	1973	DNR-74	Sunfish	Skin off	22.1					0.020	0.300		0.94			
F512	1973	DNR-74	Bluegill	Skin off	3.0					0.010	0.310		0.94			

Table 4.13 cont. **Concentrations of Organic Constituents and Pesticides in Fish Tissue from the Clinton River Basin. 1971 -1984**
Results in mg/kg Wet Weight Unless Otherwise Noted

Map Code	Sample Year	Document Code	Fish Species	Sample Type**	% Lipids	Diethyl Phthalate	Bis-2-ethyl Hexel Phthalate	Phenanthrene	Pyrene	Dieldrin	Total DDT	Lindane	Total PCB's	Total Chlorodane	Heptachlor epoxide	Hexachlorobenzene
F514	1971	Storet	Blk Crappie	Skin off						<0.010			0.23			
F514	1973	DNR-74	Sucker	Skin off	1.3						0.150		0.55			
F514	1973	DNR-74	Carp	Skin off	4.3					0.010	0.320		0.08			
F514	1973	DNR-74	Bluegill	Skin off	0.6						0.070		0.23			
F526*	1984	LDIPC-86	Carp 1A	Skin off	4.9					0.005	0.123		0.49	0.069	0.003	0.003
F526*	1984	LDIPC-86	Carp 1B	Skin off	0.2								0.69			
F526*	1984	LDIPC-86	Carp 2A	Skin off	6.3					0.006	0.108		0.55	0.102	0.003	0.003
F526*	1984	LDIPC-86	Carp 2B	Skin off	0.1								0.67			
F526*	1984	LDIPC-86	Carp 3A	Skin off	3.1					0.002	0.073		0.26	0.039	0.002	0.002
F526*	1984	LDIPC-86	Carp 3B	Skin off	0.2								0.66			
F526*	1984	LDIPC-86	W. Sucker	Skin on	0.1								0.44			
F526*	1984	LDIPC-86	W. Sucker	Skin on	0.1								0.46			
F526*	1984	LDIPC-86	W. Sucker	Skin on	0.1								0.61			
F526*	1984	LDIPC-86	W. Sucker	Skin on	<0.1								0.45			
F526*	1984	LDIPC-86	Shiners	Whole	0.4								<0.10			
F526*	1984	LDIPC-86	HogSucker	Skin on	0.1								<0.10			
F526*	1984	LDIPC-86	W. Sucker	Skin on	0.1								<0.10			
F526*	1984	LDIPC-86	W. Sucker	Skin on	0.1								<0.10			
F526*	1984	LDIPC-86	W. Sucker	Skin on	0.1								<0.10			
F526	1973	DNR-74	Sucker	Skin off	2.7						0.190		0.66			
F531	1986	Storet	Walleye	Skin on	0.8								0.21			
F531	1986	Storet	Walleye	Skin on	0.5								1.75			
F531	1986	Storet	Carp	Skin off	3.8								0.95			
F531	1986	Storet	Carp	Skin off	2.9								0.73			
F531	1986	Storet	Carp	Skin off	3.2								0.72			
F531	1986	Storet	Carp	Skin off	0.4								0.17			
F531	1986	Storet	Carp	Skin off	3.1								2.56			
F531	1986	Storet	Carp	Skin off	1.6								0.31			
F531	1986	Storet	Carp	Skin off	1.2								0.52			
F531	1986	Storet	Carp	Skin off	3.2								0.59			
F533	1983	LDIUS-86	N. Pike	Fillet	1.3	0.367	0.661	0.059		0.004	0.270	0.004	1.19			
F533	1983	LDIUS-86	N. Pike	Fillet	1.1		0.223			0.003	0.110	0.005	0.08			
F533	1983	LDIUS-86	Carp	Fillet	2.1	0.170		0.130		0.009	0.268	0.021	3.50			
F533	1983	LDIUS-86	Carp	Fillet	6.6	0.278		0.185		0.029	0.520	0.024	7.00			
F533	1983	LDIUS-86	Carp	Fillet	3.1					0.022	0.246	0.014	1.11			
F533	1983	LDIUS-86	W. Sucker	Fillet	1.1						0.185	0.003	1.56			
F533	1983	LDIUS-86	W. Sucker	Fillet	0.9					0.001	0.101	0.001	0.68			
F533	1983	LDIUS-86	W. Sucker	Fillet	0.1					0.002	0.165	0.004	1.41			
F533	1983	LDIUS-86	W. Sucker	Fillet	0.6						0.086	0.002	0.54			
F533	1983	LDIUS-86	C.Shiners	Whole	13.8					0.005	0.318	0.017	1.97			
F533	1983	LDIUS-86	Walleye	Fillet	1.4					0.005	0.131	0.006	0.71			
F533	1983	LDIUS-86	Walleye	Fillet	0.7					0.003	0.031	0.002	0.33			
F533	1983	LDIUS-86	Walleye	Fillet	1.0				0.284	0.002	0.050	0.002	0.46			
F533	1983	LDIUS-86	Walleye	Fillet	1.0						0.043	0.002	0.27			
F553	1983	LDIUS-86	N. Pike	Fillet	2.2					0.005	0.233	0.003	1.54			
F533	1983	LDIUS-86	C.Shiners	Whole	1.7						0.172	0.006	1.62			
F553	1983	LDIUS-86	W. Sucker	Fillet	0.6						0.052	0.001	0.86			

Table 4.13 cont. **Concentrations of Organic Constituents and Pesticides in Fish Tissue from the Clinton River Basin. 1971 -1984**
Results in mg/kg Wet Weight Unless Otherwise Noted

Map Code	Sample Year	Document Code	Fish Species	Sample Type**	% Lipids	Diethyl Phthalate	Bis-2-ethyl Hexel Phthalate	Phenanthrene	Pyrene	Dieldrin	Total DDT	Lindane	Total PCB's	Total Chlorodane	Heptachlor epoxide	Hexachlorobenzene
F533	1983	LDIUS-86	W. Sucker	Fillet	0.8						0.044	0.002	0.40			
F533	1983	LDIUS-86	W. Sucker	Fillet	0.7	0.032			0.236		0.099	0.003	0.68			
F533	1983	LDIUS-86	W. Sucker	Fillet	0.9						0.080		0.57			
F533	1983	LDIUS-86	Carp	Fillet	7.3					0.001	1.083		5.05			
F533	1983	LDIUS-86	Carp	Fillet	8.6					0.012	1.703	0.029	6.96			
F533	1983	LDIUS-86	Carp	Fillet	45.8		1.730			0.039	5.210	0.177	252.00			
F533	1983	LDIUS-86	Carp	Fillet	1.5						1.493		5.59			
F533	1984	LDIUS-86	Carp	Skin on	0.2								2.10			
F533	1984	LDIUS-86	Carp 1A	Skin off	2.4					0.002	0.105		0.45	0.035	0.002	0.001
F533	1984	LDIUS-86	Carp 1B	Skin on	0.1								0.84			
F533	1984	LDIUS-86	Carp 2A	Skin off	6.5					0.013	3.701		0.63	0.108	0.010	0.023
F533	1984	LDIUS-86	Carp 2B	Skin on	0.3								5.30			
F533	1984	LDIUS-86	Carp 3A	Skin off	1.0					0.001	0.238		0.76	0.026	0.002	0.001
F533	1984	LDIUS-86	Carp 3B	Skin off	0.1								0.92			
F533	1984	LDIUS-86	Carp	Skin off	0.2								1.10			
F533	1984	LDIUS-86	Carp	Skin off	0.3								2.00			
F533	1984	LDIUS-86	Carp	Skin off	0.3								2.90			
F533	1984	LDIUS-86	Carp	Skin off	0.3								2.50			
F533	1984	LDIUS-86	Carp	Skin off	0.2								1.50			
F533	1984	LDIUS-86	Carp	Skin off	0.1								0.93			
F533	1984	LDIUS-86	Carp	Skin off	0.1								0.81			
F533	1984	LDIUS-86	Carp 4A	Skin off	3.8					0.005	0.148		0.54	0.059	0.015	0.005
F533	1984	LDIUS-86	Carp 4B	Skin off	0.1								0.57			
F533	1984	LDIUS-86	Carp	Skin off	0.1								0.58			
F533	1984	LDIUS-86	Carp	Skin off	<0.1								<0.10			
F533	1984	LDIUS-86	W. Sucker 5A	Skin on	1.5					0.003	0.106		0.46	0.025	0.002	0.001
F533	1984	LDIUS-86	W. Sucker 5B	Skin on	0.1								<0.10			
F533	1984	LDIUS-86	W. Sucker	Skin on	0.1								0.74			
F533	1984	LDIUS-86	W. Sucker	Skin on	0.1								0.65			
F533	1984	LDIUS-86	W. Sucker 6A	Skin on	2.3					0.003	0.045		0.16	0.023	0.001	0.001
F533	1984	LDIUS-86	W. Sucker 6B	Skin on	0.1								0.65			
F533	1984	LDIUS-86	W. Sucker	Skin on	0.1								0.25			
F533	1984	LDIUS-86	W. Sucker 7A	Skin on	3.2					0.004	0.053		0.24	0.029	0.005	0.002
F533	1984	LDIUS-86	W. Sucker 7B	Skin on	0.1								<0.10			
F533	1984	LDIUS-86	W. Sucker	Skin on	0.1								0.22			
F533	1984	LDIUS-86	W. Sucker	Skin on	0.1								0.59			
F533	1984	LDIUS-86	Rock Bass	Skin on	0.1								0.39			
F533	1984	LDIUS-86	Rock Bass	Skin on	0.1								0.25			
F537	1973	DNR-74	Channel Cat	Skin off	7.3					0.040	2.920		8.33			
F539	1973	DNR-74	Carp	Skin off	9.6					0.060	5.100		4.11			
F540	1973	DNR-74	Sucker	Skin off	1.8					0.010	0.350		0.80			

* Map Location is the Centerpoint of Sampling Area
** Skin on or skin off sample type are fillets

In 1983, all three carp collected in Section 1 at station F102 exceeded the action level, averaging 4.1 mg/kg total PCB. All except one of the seven carp collected in 1983 in Section 5 downstream of Yates Park Dam at station F533 exceeded the USFDA action level. The PCB data for carp collected in Section 5 in 1983 are questionable because of poor quality assurance/quality control at the contract laboratory used for tissue analysis.

Section 5 carp were resampled in 1984 above and below the Yates Park Dam. The three carp (6 analyses) collected upstream of the Dam at station F526 were all less than the action level. Four of the 14 fish (18 analyses) collected downstream of the dam at station F533 in 1984 exceeded the USFDA action level with average PCB concentrations of 2.98 mg/kg. Average total PCB for all carp analyses downstream of Yates Dam in 1984 was 1.4 mg/kg. These data suggest that the source of PCB to fish is downstream of Yates Dam and may not be in the Clinton River at all.

In 1986 skin-on fillets of large and small mouth bass and walleye, skin-off fillets of carp and whole carp were analyzed from fish collection in Section 1 (F104). Only the whole carp exceeded the 2.0 mg/kg total PCB action level. Skin-on fillets of walleye and skin-off fillets of carp were also analyzed from fish collected at Station F531 just downstream of Yates Drain in 1986. Only one of the eight carp and none of the walleye analyzed exceeded (2.56 mg/kg) the action level of 2.0 mg/kg total PCB.

4.6 CLINTON RIVER FISH COMMUNITIES, 1971-1984

Fish communities in various River Sections have been documented by a variety of fish collection techniques including trap and gill netting, electrofishing, and rotenoning. It was reported that in 1960 the Clinton River had no fish (Johnson, 1984). Between 1972 and 1985 70 stations in Sections 1-6 were assessed for the number of each fish species present or by catch per unit effort (Table 4.14). Table 4.14 also includes the station locations and station codes for all fish sampling stations shown on Map 6.3. Fishing effort and gear type varied from station to station, but general fish communities in each Section are apparent.

Some station numbers actually represent river segments rather than discrete points as they appear on the maps. In these cases, the station number is located in the center of the river segment fished. These river segments often overlap from year to year and precise locations are difficult to plot. However, fish are mobile and precise station locations may be invalid.

Because fish are mobile, they may also avoid areas of poor water quality where dissolved oxygen is low or ammonia or chlorine is high. Creal (1985) demonstrated that fish avoid elevated levels of ammonia and chlorine downstream of municipal facilities.

Table 4.14 Number of Fish Collected or Catch Per Unit Effort in Section 1, the Natural Channel of the Main Branch Clinton River Downstream of the Spillway. 1973 - 1984

Collection Year	1973			1975	1980*	1981*	1982*	1983*	1984*
Document Code	DNR-74	DNR-74	DNR-74	COE-75	DNR-84	DNR-84	DNR-84	DNR-84	DNR-84
Storet Code	500213	500214	500008	-	-	-	-	-	-
Map code	F101	F103	F104	F106	F105	F105	F105	F105	F105
Walleye			1		1.16	2.06	4.52	1.54	8.0
Yellow Perch				24	1.92	11.63	2.71	8.44	1.47
Muskellunge					0.1	0.35	0.06	0	0.07
Northern Pike				3	2.78	2.04	1.94	2.28	4.02
Smallmouth Bass					0	0.02	0.02	0.12	0.09
Largemouth Bass				2	0.02	0.16	0.02	0.04	0.14
Crappie				3	10.5	37.16	14.08	19.1	37.23
Rock Bass				2	2.06	6.49	5.81	5.76	6.3
Pumpkinseed					2.64	3.96	2.77	5.46	6.26
Bluegill				4	0.64	4.16	1.65	2.58	6.58
White Bass				3	0.52	0.8	0.66	1.08	1.02
White Perch					0	0	0	0	0.23
Bullhead					1.36	5.04	2.8	2.4	4.09
Channel Catfish					1.44	1.18	2.25	0.68	1.0
Chinook Salmon					0	0	0	0.02	0
White Sucker					5.26	5.65	7.5	4.36	10.05
Quillback Carpsucker		1	3		6.8	5.92	4.48	1.22	6.58
Redhorse				2	0.08	0.59	0.31	0.22	0.09
Spotted Sucker					0.04	0.51	0.06	0.38	0.63
Freshwater Drum					1.46	0.49	2.94	1.42	2.74
Carp	68	47	104		14.06	10.57	21.06	9.64	11.49
Goldfish	2	2	3		0	0.04	0.04	0.02	0.07
Dogfish					0.4	1.14	1.13	0.2	0.93
Gizzard Shad	3	9	16	3	12.28	3.24	3.56	15.84	4.44
Golden Shiner					0	0.14	0.13	2.48	0.84
Troutperch					0	0	0	0.06	0
Alewife				18					
Sunfish			1	2					

* Based on Catch per Unit Effort - the average number of fish collected per net lift over a 24 hour period.

Table 4.14 continued.

Number of Fish Collected in Section 2, the Clinton River Spillway from the Weir to Lake St Clair. 1973 - 1981

Date	4-4-79	4-11-79	3-30-81	3-31-81	4-1-81	4-2-81	4-1-80	4-15-80	4-2-80	4-16-80	3-9-81	3-16-81	3-17-81	3-25-81
Document Code	DNRWI-79	DNRWI-79	FWSW-81	FWSW-81	FWSW-81	FWSW-81	FWS25-80	FWS25-80	FWS25-80	FWS25-80	FWS5-81	FWS5-81	FWS5-81	DNRF-81
Map Code	F201	F201	F201	F201	F201	F201	F202	F202	F202	F202	F202	F202	F202	F202
Walleye	52	15	90	128	86	44					38	55	24	92
Northern Pike							1	1			2	1	2	
Muskellunge														
Brown Trout									1					
Rainbow Trout										1				
Steelhead											1	1		
Largemouth Bass													1	
White Sucker														*
Redhorse														*
Carp														*
Gizzard Shad														*

Section 2 continued

Date	7&8-73	3-25-81	3-25-80	3-31-80	4-1-80	4-4-80	4-4-79	4-4-80	3-26-80	3-27-81	3-24-80 through 4-25-80
Document Code	DNR-74	FWS4-81	FWS23-80	FWS23-80	FWS23-80	FWS23-80	DNR94-79	FWS22-80	FWS22-80	FWS1-81	FWS2-80
Map Code	F203	F204	F205	F205	F205	F205	F206	F207	F207	F208	Section 2 and 3 to mouth of Red Run
Walleye		20					11			73	1664
Northern Pike			5	2	1	2		2			
Muskellunge									1		
Goldfish	2										
Carp	26										

* Species were present but actual numbers not recorded

Table 4.14 continued.

Fish Collected in Section 3, Main Branch of the Clinton River from the Spillway to Red Run. 1973 - 1981

Date	7-12-78	May-Aug 8	1973	1973	4-23-80	1973	4-8-80	4-8-81
Document Code	FWS18-78	FWSA-81	DNR-74	DNR-74	FWS212-80	DNR-74	FWS210-80	FWS-81
Storet Number	-	-	500231	500230	-	500209	-	-
Map Code	F301	F302	F303	F304	F305	F306	F307	F307
Northern Pike		3					1	
Steelhead					1			
Walleye		7						159
Alewife		10**				1		
Gizzard Shad	*	1						
White Bass	*	20						
Carp	*	10	3	6		3		
Brown Bullhead	*							
Black Bullhead								
Rock Bass	*							
White Sucker	*	67	5	16		9		
Bowfin	*							
Longnose Gar		2						
Goldfish	*							
Spotted Sucker	*							
Largemouth Bass	*							
Redear Sunfish								
Pumpkinseed	*							
Silver Lamprey	*							
Spottail Shiner	*	1						
Northern Hog Sucker	*							
Channel Catfish	*	2						
Bluegill	*							
Yellow Perch	*							
Freshwater Drum	*							
Golden Shiner	*							
Carpsucker	*	2						
Redhorse	*	3						
Shiner	*							
Smallmouth Bass								
Black Crappie								
Quillback carpsucker								
Trout-perch								
Common Shiner		3						

* Species were present but actual numbers not recorded
** Many also seen

Table 4.14 continued.

Fish Collected in Section 3, Main Branch of the Clinton River from the Spillway to Red Run. 1973 - 1981

Date	4-20-81	4-21-81	1973	4-11-79	3-18-81	4-18-80	4-22-81	4-24-80
Document Code	FWS-81	FWS-81	DNR-74	DNRW2-79	FWS-81	FWS29-80	FWS-81	FWS29-80
Storet Number	-	-	500225	-	-	-	-	-
Map Code	F307&F309	F307	F308	F309	F310 .	F310	F310	F310
Northern Pike					1			2
Steelhead						1		
Walleye	35	155		27	9		31	
Alewife								
Gizzard Shad			5					
White Bass								
Carp			1					
Brown Bullhead								
Black Bullhead								
Rock Bass								
White Sucker			2					
Bowfin								
Longnose Gar								
Goldfish								
Spotted Sucker			1					
Largemouth Bass								
Redear Sunfish								
Pumpkinseed								
Silver Lamprey								
Spottail Shiner								
Northern Hog Sucker								
Channel Catfish								
Bluegill								
Yellow Perch								
Freshwater Drum								
Golden Shiner								
Carpsucker								
Redhorse								
Shiner								
Smallmouth Bass								
Black Crappie								
Quillback carpsucker								
Trout-perch								
Common Shiner								

* Species were present but actual numbers not recorded
** Many also seen

Table 4.14 continued.

Fish Collected in Section 3, Main Branch of the Clinton River from the Spillway to Red Run. 1973 - 1981

Date	1973	4-7-80	4-22-81	6-14-78	8-22-78	4-25-79	3-27-81	3-30-81
Document Code	DNR-74	FWS28-80	FWS-81	FWS1A-78	FWS1C-78	FWS3-79	FWS-81	FWS-81
Storet Number	500010	-	-	-	-	-	-	-
Map Code	F311	F312	F312	F313	F313	F313	F314	F314
Northern Pike	1	1			2	3		
Steelhead								
Walleye			48	*	2	61	73	90
Alewife				*				
Gizzard Shad	2			*	18			
White Bass				*	4	1		
Carp	1			*	59			
Brown Bullhead				*	1			
Black Bullhead				*				
Rock Bass				*	4	1		
White Sucker				*	11	59		
Bowfin				*	8			
Longnose Gar				*				
Goldfish				*	1			
Spotted Sucker				*				
Largemouth Bass				*	9			
Redear Sunfish				*	1			
Pumpkinseed				*	10			
Silver Lamprey								
Spottail Shiner								
Northern Hog Sucker								
Channel Catfish								
Bluegill					4			
Yellow Perch					8	3		
Freshwater Drum					5			
Golden Shiner					1			
Carpsucker								
Redhorse					32	23		
Shiner					5	1		
Smallmouth Bass					2			
Black Crappie					1			
Quillback carpsucker						25		
Trout-perch						2		
Common Shiner								

■ Species were present but actual numbers not recorded
** Many also seen

Table 4.14 continued.

Fish Collected in Section 3, Main Branch of the Clinton River from the Spillway to Red Run. 1973 - 1981

Date	3-31-81	4-1-81	4-2-81	4-7-81
Document Code	FWS-81	FWS-81	FWS-81	FWS-81
Storet Number	-	-	-	-
Map Code	F314	F314	F314	F314
Northern Pike				
Steelhead				
Walleye	128	86	44	87
Alewife				
Gizzard Shad				
White Bass				
Carp				
Brown Bullhead				
Black Bullhead				
Rock Bass				
White Sucker				
Bowfin				
Longnose Gar				
Goldfish				
Spotted Sucker				
Largemouth Bass				
Redear Sunfish				
Pumpkinseed				
Silver Lamprey				
Spottail Shiner				
Northern Hog Sucker				
Channel Catfish				
Bluegill				
Yellow Perch				
Freshwater Drum				
Golden Shiner				
Carpsucker				
Redhorse				
Shiner				
Smallmouth Bass				
Black Crappie				
Quillback carpsucker				
Trout-perch				
Common Shiner				

* Species were present but actual numbers not recorded
** Many also seen

Table 4.14 continued.

Fish Collected in Section 4 of the Clinton River Basin, Red Run. 1981

Date	May to Aug, 1981	May to Aug, 1981
Document Code	FWSC-81	FWSB-81
Map Code	F401	F402
White Sucker	132	21
Carp	304	458
Alewife	4	
Spotted Shiner	17	
Goldfish	16	33
White Bass	4	
Northern Pike	7	
Gizzard Shad	2	2
Carpsucker	2	
Bluegill	1	7
Fathead Minnow	3*	
Quillback Carpsucker	1	
Pumkinseed	5	7
Silver Redhorse	1	
Yellow Perch	1	
Rock Bass	2	
Common Shiner	1	
Channel Catfish	1	
Walleye	1	
Golden Shiner	1*	9*
Brown Bullhead		4
Black Bullhead		5
Lake Chubsucker		1

* Many also seen

Table 4.14 continued.

Number of Fish Collected in Section 5 of the Clinton River and its Tributaries Upstream of Red Run. 1972 - 1985

Date:	Jul&Aug73	10-16-80	11-4-80	Jul&Aug73	10-13-81	11-4-80	11-6-80	7to9-73	11-6-80	Jul&Aug73	Jul&Aug73
Document Code:	DNR-74	DNRDP-80	DNRCS-80	DNR-74	DNRPL-81	DNRED-80	DNREL-80	DNRPM-74	DNRCY-80	DNR-74	DNR-74
Storet Number:	630629	-	-	630629	-	-	-	630630	-	630631	630599
Map Code:	F501	F502	F503	F504	F504	F505	F506	F507	F507	F508	F509
Yellow Perch		7	1	1	6	6	19	1	5		
White Sucker	10				2		1				
Brown Bullhead		7	1			6			1		
Rockbass		3	4	14	8	13	3	14	3		
Golden Shiner											
Bluegill			3	20			1	20		9	
Green Sunfish				1				1		10	
Pumpkinseed			2	30		1	1	30		7	
Fathead Minnow											
Banded Killifish											
Brook Silverside		1									
Stonecat						2	1				
Brown Trout	1					1					
Creek Chub	50			20				20			
Hog Sucker				1	7	9	4	1	1		
Northern Pike		2	1	3	2			3			
Common Shiner	15	34	1	1		25	1	1			
Stoneroller	6									2	
Fantail Darter											
Greenside Darter											
Johnny Darter	5	2	1						1	1	
Chinook Salmon											
Yellow Bullhead				4	6			4			
Hornyhead Chub		4			26	9	20				
Carp			3	1	1	10		1		1	
Minnow ssp.					4						
Tadpole Madtom					1						
Blacknose Dace	10										
Black Bullhead	3			1			3	1			
Mud Minnow							4		1		1
Largemouth Bass		1		2		1	2	2	1	7	
Longear Sunfish			2			1			1	1	
Spotfin Shiner		2							1		
Iowa Darter		2									
Greenside Darter		1				3			1		
LogPerch		4		1				1			
Smallmouth Bass						2			3		
Grass Pickerel				4		1		4			
Rainbow Darter	30			1				1		1	
Bluntnose Minnow				1				1			
Black Crappie				2				2			
Goldfish											
Channel Catfish											
Bowfin								1			

p = present
o = occasional
c = common
a = abundant
va = very abundant

Table 4.14 continued.

Number of Fish Collected in Section 5 of the Clinton River and its Tributaries Upstream of Red Run. 1972 - 1985

Date:	Jul&Aug73	Jul&Aug73	Jul&Aug73	Jul&Aug73	Jul&Aug73	Jul&Aug73	Jul&Aug73	9-20-73	8-31-72	8-21-85	9-20-7:
Document Code:	DNR-74	DNR-74	DNR-74	DNR-74	DNR-74	DNR-74	DNR-74	DNRPC-74	DNRPC-74	DNRCL-85	DNRPC-74
Storet Number:	630632	630597	630633	630595	630252	630594	630695	630614	630615	-	63061:
Map Code:	F510	F511	F512	F513	F514	F515	F516	F517	F518	F518	F519
Yellow Perch											
White Sucker		4	3	46	8	32	2	VA	VA	28	VA
Brown Bullhead											
Rockbass		1									
Golden Shiner		10									
Bluegill		39	7	6	8					1	
Green Sunfish	7	9									
Pumpkinseed	5	18	8	1	1	7			O		
Fathead Minnows		13									
Banded Killifish											
Brook Silverside											
Stonecat											
Brown Trout								P		28	O
Creek Chub				5		5			A	5	C
Hog Sucker						1					
Northern Pike											
Common Shiner											O
Stoneroller											
Fantail Darter											
Greenside Darter											
Johnny Darter											
Chinook Salmon											
Yellow Bullhead											
Hornyhead Chub											
Carp	1	16			7			P			
Minnow ssp.											
Tadpole Madtom											
Blacknose Dace									O	3	
Black Bullhead											
Mud Minnow	18	7	12	3	200	1					
Largemouth Bass		3			1						
Longear Sunfish											
Spotfin Shiner											
Iowa Darter											
Greenside Darter											
LogPerch											
Smallmouth Bass											
Grass Pickerel											
Rainbow Darter											
Bluntnose Minnow											
Black Crappie		5									
Goldfish						1					
Channel Catfish											
Bowfin											

p = present
o = occasional
c = common
= abundant
= very abundant

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Table 4.14 continued.

Number of Fish Collected in Section 5 of the Clinton River and its Tributaries Upstream of Red Run. 1972 - 1985

Date:	6-7-80	8-21-85	6-17-80	8-31-72	6-16-80	8-21-85	7-14-80	8-21-85	9-20-73	Jul&Aug73	Jul&Aug73
Document Code:	DNRAD-80	DNRGN-85	DNRGN-80	DNRPC-74	DNRSB-80	DNRSB-85	DNRDT-80	DNRDT-85	DNRPC-74	DNR-74	DNR-74
Storet Number:	-	-	-	630619	-	-	-	-	630622	630636	630637
Map Code:	F519	F520	F520	F521	F522	F522	F523	F523	F524	F525	F526
Yellow Perch								1			
White Sucker	41	35	31	VA	2	8	35	13	VA	5	9
Brown Bullhead									O		
Rockbass											
Golden Shiner											
Bluegill	1	1						1	A		
Green Sunfish		1		O			2				
Pumpkinseed		1		P		3		9	A		
Fathead Minnows									A		
Banded Killifish											
Brook Silverside											
Stonecat											
Brown Trout	10	26	18	O		29	8	47			
Creek Chub	31	3	19	O	1	2	15	12	A		
Hog Sucker							3				
Northern Pike											
Common Shiner	7							11			5
Stoneroller									O		
Fantail Darter											
Greenside Darter											
Johnny Darter							1				
Chinook Salmon											
Yellow Bullhead											
Hornyhead Chub											
Carp											
Minnow ssp.											
Tadpole Madtom											
Blacknose Dace	15		5	C	2		8		C		
Black Bullhead						2		1	C		
Mud Minnow								2			
Largemouth Bass									A		
Longear Sunfish											
Spotfin Shiner											
Iowa Darter											
Greenside Darter											
LogPerch											
Smallmouth Bass											
Grass Pickerel											
Rainbow Darter											
Bluntnose Minnow											
Black Crappie				P					O		
Goldfish											
Channel Catfish											
Bowfin											

p = present
o = occasional
c = common
a = abundant
va = very abundant

Table 4.14 continued.

Number of Fish Collected in Section 5 of the Clinton River and its Tributaries Upstream of Red Run. 1972 - 1985

Date:	8-19-85	8-19-85	8-19-85	6-7-82	Jul&Aug73	10-23-80	5-7-84	10-23-80	Jul&Aug73	Jul&Aug73	Jul&Aug73
Document Code:	DNR33-85	DNR31-85	DNRIN-85	DNRSI-82	DNR-74	DNRAV-80	DNRYC-84	DNRRY-80	DNR-74	DNR-74	DNR-74
Storet Number:	-	-	-	-	630594	-	-	-	500201	500202	500203
Map Code:	F527	F528	F529	F530	F531	F531	F532	F534	F534	F536	F537
Yellow Perch				18		1					
White Sucker	9	61	3	9	10	4		1	5		1
Brown Bullhead				5							
Rockbass		3	5	12							
Golden Shiner				30							
Bluegill		14	10	10							
Green Sunfish	1	6		2							
Pumpkinseed		22	5	14							
Fathead Minnows		1		82							
Banded Killifish				2							
Brook Silverside				2							
Stonecat				1							
Brown Trout	10	5	3								
Creek Chub	29	50									
Hog Sucker	28	54	12			4					
Northern Pike	2										
Common Shiner	4	74	11		2	Many					5
Stoneroller	1	30									
Fantail Darter	2	2									
Greenside Darter		9									
Johnny Darter		3									
Chinook Salmon						3	4	1			
Yellow Bullhead											
Hornyhead Chub											
Carp						2					3
Minnow ssp.											
Tadpole Madtom											
Blacknose Dace											
Black Bullhead											
Mud Minnow											
Largemouth Bass						1					
Longear Sunfish											
Spotfin Shiner											
Iowa Darter											
Greenside Darter											
LogPerch											
Smallmouth Bass											
Grass Pickerel											
Rainbow Darter											
Bluntnose Minnow											
Black Crappie											
Goldfish											
Channel Catfish											
Bowfin											

p = present
o = occasional
o = common
= abundant
= very abundant

Table 4. 14 continued.

Number of Fish Collected in Section 5 of the Clinton River and its Tributaries
Upstream of Red Run. 1972 - 1985

Date:	Jul&Aug73	Jul&Aug73	Jul&Aug73
Document Code:	DNR-74	DNR-74	DNR-74
Storet Number:	500224	500205	500047
Map Code:	F538	F539	F540
Yellow Perch			
White Sucker	1	2	5
Brown Bullhead			
Rockbass			
Golden Shiner			
Bluegill			
Green Sunfish			
Pumpkinseed			
Fathead Minnows			
Banded Killifish			
Brook Silverside			
Stonecat			
Brown Trout			
Creek Chub			
Hog Sucker			
Northern Pike			
Common Shiner			
Stoneroller			
Fantail Darter			
Greenside Darter			
Johnny Darter			
Chinook Salmon			
Yellow Bullhead			
Hornyhead Chub			
Carp	2	2	
Minnow ssp.			
Tadpole Madtom			
Blacknose Dace			
Black Bullhead			
Mud Minnow			
Largemouth Bass			
Longear Sunfish			
Spotfin Shiner			
Iowa Darter			
Greenside Darter			
LogPerch			
Smallmouth Bass			
Grass Pickerel			
Rainbow Darter			
Bluntnose Minnow			
Black Crappie			
Goldfish			
Channel Catfish	1		
Bowfin			

p = present
o = occasional
c = common
a = abundant
va = very abundant

Table 4.14 continued.

Number of Fish Collected in Section 6, the North Branch of the Clinton River. 1978 - 1985

Date: Document: Map Code:	8-9-78 DNRHO-78 F601	8-20-85 DNRBD-85 F602	8-9-78 DNRMK-78 F603	8-21-85 DNRAC-85 F604	8-20-85 DNRNB-85 F605	8-19-85 DNRCA-85 F606	8-20-85 DNR59-85 F607	8-20-85 DNRMC-85 F608	4-5-78 DNRWE-78 F609	4-14-78 DNRWC-78 F609	4-21-78 DNRWD-78 F609
Brown Trout	1	5	2	6	1	6	7	42			
Creek Chub	6	4	15	12	13	20	30	35	50	25	150
White Sucker	7	105	20	15	7	19	14	12	75	40	50
Rock Bass	5	10	18	34	11	3	3	1	4	1	
Pumpkinseed		60		4	1						
Common Shiner	16	8	71	40	54	22	36	55	150	30	100
Hog Sucker		1			1	21	30	33	15		40
Blacknose Dace			1		1						
Mud Minnow			2	10	3		4				
Stoneroller	2	1	1	3	27				30		20
Rainbow Darter					1			6			
Johnny Darter	58		85	3	4	3	4	6		1	
Bluegill		7		3		2					
Northern Pike				1		1	1	1			
Grass Pickerel		3		1							
Bluntnose Minnow				5						3	
Greenside Darter				1							
Black Crappie		1									
Green Sunfish		5				1					
Black Bullhead		44									
Golden Shiner		1						2			
Steelhead										1	1
Carp									50	12	15
Madtom											4
Brook Stickleback									1		
Rainbow Trout								6			
Stone Cat							1	2			
Fantail Darter							1	1			
Largemouth Bass						3					
Chestnut Lamprey						1					
Hornyhead Chub	11		9								
Redsided Dace	15		12								
Bigmouth Shiner	6		9								

Table 4.14 continued.

Document Code	Report From Which Data was Extracted
DNR-74	Biological Survey of the Clinton River: Pontiac to the Mouth. MDNR 1974. Grant, 1974.
COE-75	Confined Disposal Facility for Maintenance Dredging of the Federal Navigation Channel in the Clinton River, Macomb County, Michigan. COE 1986.
DNR-84	Haas, Robert, Personal Communication. MDNR 1987.
DNRW1-79 DNRW2-79 DNR94-79	Deephouse, William, Personal Communication. MDNR 1979.
FWS-81 FWS1-81 FWS4-81 FWS5-81	1981 Update on the Clinton River Walleye Population Study. USFWS. Julian 1982.
FWS212-80 FWS210-80 FWS29-80 FWS28-80 FWS25-80 FWS23-80 FWS22-80 FWS2-80	Odin, Clyde, Personal Communication. USFWS 8-5-80.
FWS1B-78	Odin, Clyde, Personal Communication. USFWS 7-12-78.
FWSA-81 FWSB-81 FWSC-81	Odin, Clyde, Personal Communication. USFWS 10-22-81.
FWS1A-78	Odin, Clyde, Personal Communication. USFWS 6-14-78.
FWS1C-78	Odin, Clyde, Personal Communication. USFWS 8-22-78.
FWS3-79	Odin, Clyde, Personal Communication. USFWS 5-11-79.
DNRPC-74	Biological Survey of Paint Creek. MDNR. Lauer & Grant, 1973.
LDI94-86 LDIPC-86 LDIUS-86 LDIDS-86	Report on the Impact of Liquid Disposal, Inc. onthe Clinton River, Macomb County, Michigan. MDNR. Kamaga & Jones, 1986.
DNRRF-81 DNRHO-78 DNRBP-80 DNRAV-80 DNRCS-80 DNRYC-84 DNRPL-81 DNRRY-80 DNRED-80 DNRBD-85 DNREL-80 DNRMK-78 DNRCY-80 DNRAC-85 DNRCL-80 DNRNB-85 DNRAD-80 DNRCA-85 DNRGN-80 DNR59-85 DNRGN-85 DNRMC-85 DNRSB-85 DNRWE-78 DNRDT-80 DNRWC-78 DNRBT-85 DNRWB-78 DNR33-85 DNRIN-85 DNR31-85 DNRSI-82	Fish Divion Records. MDNR.

Table 4. 14 continued.

Clinton River Fish Sampling Stations. (Locations)

Station Code	Latitude	Longitude	Document Code	Storet Number	Description
SECTION 1					
F101	42 35 47	82 52 36	DNR-74	500213	Cl. R. at Crocker St Br
F102	42 35 39	82 51 52.5	LDI94-86	500375	Cl. R. 2300 ft abv I-94
F103	42 35 26	82 51 27	DNR-74	500214	Cl. R. at I-94 br, Harris
F104	42 35 45	82 49 30.5	DNR-74	500008	Cl.R. Bridgeview at Mouth
F105	42.35 49	82 48 37	DNR-84		Cl. R. at the end of Jefferson Ave.
F106	42 35 40	82 46 10	COE-75		Cl. R at the mouth
SECTION 2					
F201	42 34 51	82 52 39	DNRWI-79		Cl. R. Spillway at weir
			FWSW-81		Cl. R. Spillway at weir
F202	42 34 45	82 52 31	FWS25-80		Cl. R. Spillway just dwstr of weir
			FWS5-81		Cl. R. Spillway just dwstr of weir
			DNRF-81		Cl. R. Spillway just dwstr of weir
F203	42 34 35	82 52 15	DNR-74	500188	Cl. R. Spillway at Harper Ave
F204	42 34 22	82 51 58	FWS4-81		Cl. R. Spillway dwstr of Harper Ave
F205	42 33 58	82 51 19	FWS23-80		Cl. R. Spillway upstr of I-94 Br
F206	42 33 42	82 50 51	DNR94-79		Cl. R. Spillway at I-94 Bridge
F207	42 33 39	82 50 44	FWS22-80		Cl. R. Spillway dwstr I-94 Bridge
F208	42 33 37	82 50 39	FWS1-81		Cl. R. Spillway at Mouth-L. St. Clair
SECTION 3					
F301	42 34 09	82 58 09	FWS1B-78		Cl. R. at Mouth of Red Run
F302	42 34 09	82 57 55	FWSA-81		Cl. R. dwstr of Mouth of Red Run
F303	42 34 40	82 57 06	DNR-74	500231	Cl. R. 100 yds upst Garfield
F304	42 34 33	82 57 02	DNR-74	500230	Cl. R. just dwstr of Garfield Rd
F305	42 34 39	82 56 45	FWS212-80		Cl. R. dwstr of Garfield Rd
F306	42 35 16	82 55 40	DNR-74	500209	Cl. R. off Clinton R. Road
F307	42 35 30	82 55 05	FWS210-80		Cl. R. dwstr of Romeo Plank Rd
			FWS-81		Cl. R. dwstr of Romeo Plank Rd
F308	42 35 30	82 55 18	DNR-74	500225	Cl. R. at River Rd Pumphouse
F309	42 35 59	82 54 35	DNRW2-79		Cl. R. at Mouth of N. Branch
F310	42 35 50	82 54 35	FWS-81		Cl. R. dwstr of N. Branch
			FWS29-80		Cl. R. dwstr of N. Branch
F311	42 35 45	82 54 35	DNR-74	500010	Cl. R. at Moravian Drive
F312	42 35 33	82 54 18	FWS28-80		Cl. R. dwstr of Moravian Drive
			FWS-81		Cl. R. dwstr of Moravian Drive
F313	42 35 21	82 53 34	FWS1A-78		Cl. R. between Moravian Br & weir
			FWS1C-78		Cl. R. between Moravian Dr & weir
			FWS3-79		Cl. R. between Moravian Br & weir
F314	42 35 12	82 53 10	FWS-81		Cl. R. Upstr of the Spillway weir
SECTION 4					
F401	42 31 36	83 01 35	FWSC-81		Red Run at Van Dyke Rd
F402	42 33 43	82 58 25	FWSB-81		Red Run near Mouth of Plum Brook

Table 4.14 continued.

SECTION 5

F501	42 44 40 83 24 40	DNR-74	630623	Cl. R. at I-75 ramp
F502	42 40 10 83 22 49	DNRDP-80		Cl. R. at Dray. Plains Nat Center
F503	42 39 50 83 23 13	DNRCS-80		Cl. R. at Cresent Lake Rd
F504	42 39 12 83 23 49	DNR-74	630629	Cl. R. at Pontiac Lk Rd
		DNRPL-81		Cl. R. at Pontiac Lk Rd
F505	42 38 48 83 24 05	DNRED-80		Cl. R. at Edgeorge Rd Bridge
F506	42 38 40 83 24 14	DNREL-80		Cl. R. at Elizabeth L. Rd
F507	42 37 40 83 23 41	DNRPM-74	630630	Cl. R. at Cooley Lk Rd
		DNRCY-80		Cl. R. at Cooley Lk Rd
F508	42 37 27 83 18 57	DNR-74	630631	Cl. R. at Orchard Lk Rd
F509	42 38 48 83 16 08	DNR-74	630599	Cl. R. above Pontiac stp
F510	42 38 33 83 15 37	DNR-74	630632	Cl. R. at M-59 bridge; Pont
F511	42 38 01 83 13 29	DNR-74	630597	Cl. R. at Auburn Rd
F512	42 38 02 83 13 27	DNR-74	630633	Cl. R. at Auburn Rd
F513	42 39 14 83 11 35	DNR-74	630595	Cl. R. at Adams Rd Bridge
F514	42 39 02 83 10 40	DNR-74	630252	Cl. R. at Hamlin Rd Bridge
F515	42 39 57 83 09 13	DNR-74	630594	Cl. R. at Avon Rd
F516	42 40 37 83 07 46	DNR-74	630635	Cl. R. upstream Paint Cr.
F517	42 46 53 83 13 52	DNRPC-74	630614	Paint Cr at Atwater St
F518	42 46 03 83 13 06	DNRPC-74	630615	Paint Cr at Kern Rd
		DNRCL-85		Paint Cr at Kern Rd
F519	42 45 03 83 11 50	DNRPC-74	630616	Paint Cr at Adams Rd, Oakland
		DNRAD-80		Paint Cr at Adams Rd, Oakland
F520	42 44 23 83 10 11	DNRGN-85		Paint Cr at Gunn Rd
		DNRGN-80		Paint Cr at Gunn Rd
F521	42 43 52 83 09 35	DNRPC-74	630619	Paint Cr at Orion Rd; Oakland
F522	42 43 35 83 09 31	DNRSB-80		Paint Cr at Silver Bell Rd
		DNRSB-85		Paint Cr at Silver Bell Rd
F523	42 42 40 83 09 26	DNRDT-80		Paint Cr at Dutton Rd
		DNRDT-85		Paint Cr at Dutton Rd
F524	42 40 41 83 07 42	DNRPC-74	630622	Paint Cr at GTW Railroad Br
F525	42 40 36 83 07 37	DNR-74	630636	Cl. R. 100 yds below Paint Cr
F526	42 40 58 83 06 30	DNR-74	630637	Cl. R. at Park Davis Picnic area
F527	42 48 49 83 05 48	DNR33-85		Stony Cr at 33 Mi Rd
F528	42 47 07 83 05 14	DNR31-85		Stony Cr at 31 Mi Rd
F529	42 45 54 83 04 29	DNRIN-85		Stony Cr at Inwood Rd
F530	42 44 05 83 04 29	DNRSI-82		Stony Cr. Impoundment
F531	42 40 19 83 05 50	DNR-74	630606	Cl. R. at Avon Rd
		DNRAV-80		Cl. R. at Avon Rd
F532	42 56 56 82 56 21	DNRYC-84		Cl. R. just dwstr Yates Park Dam
F533	42 39 45 83 05 07	LDIUS-86		Cl. R. between Dequindre and Ryan Rd
F534	42 39 24 83 04 25	DNR-74	500201	Cl. R. at Ryan Rd Bridge
		DNRRY-80		Cl. R. at Ryan Rd Bridge
F535	42 39 23 83 04 13	LDIDS-86		Cl. R. dwstr of Ryan Rd
F536	42 37 34 83 02 18	DNR-74	500202	Cl. R. at Auburn Rd
F537	42 37 14 83 01 55	DNR-74	500203	Cl. R. at Van Dyke Rd
F538	42 35 46 83 00 56	DNR-74	500224	Cl. R. at Dodge Bros. Park No.8
F539	42 35 11 82 59 49	DNR-74	500205	Cl. R. at Kleino Rd
F540	42 34 13 82 58 16	DNR-74	500047	Cl. R. at Hayes Rd Bridge

Table 4.14 continued.

SECTION 6

F601	42 54 17 83 03 36	DNRHO-78	N. Branch 1300ft dwstr from Hough Rd
F602	42 53 39 83 0 08	DNRBD-85	N. Branch 50yds upstr from Boardman Rd
F603	42 52 41 83 00 02.5	DNRMK-78	N. Branch 2500ft upstr from McKay Rd
F604	42 50 52 82 58 35	DNRAC-85	N. Branch at Armada Center Rd
F605	42 49 10 82 58 34	DNRNB-85	N. Branch at 33 Mi. Rd
F606	42 48 58 83 04 11	DNRCA-85	E. Pond Cr at 33 Mi. Rd
F607	42 49 22 83 01 12	DNR59-85	E. Pond Cr at M-59
F608	42 48 59 83 00 29	DNRMC-85	E. Pond Cr at McVicar Rd
F609	42 45 46 82 55 11	DNRWE-78	N. Branch at Wolcott Rd
		DNRWC-78	N. Branch at Wolcott Rd
		DNRWD-78	N. Branch at Wolcott Rd

4.6.1 Section 5 Clinton River Fish Community

In Section 5 there were 32 fish assessment stations along the Main Branch, eight in Paint Creek, and four in Stony Creek. These stations, totalling 44, were assessed in one or more years including 1972, 73, 78, 80, 81, 82, 83, 85, and 86. The most extensive survey efforts were done in 1973 in a cooperative action by Fisheries and Surface Water Quality Divisions. The 1972 and 1973 data is used sparingly, since more recent surveys indicate improved species diversity in most instances.

Upstream from the City of Pontiac, the Clinton River is connected through a series of lakes and impoundments. Fish species reflect lake communities more than riverine. Perhaps the most significant threat to their populations is low summer flows which are further reduced by lake level control structures. In 1973 at station F501, the fish community was dominated by creek chubs, rainbow darters, blacknose dace, common shiners, and suckers. One brown trout was also noted (see Map 6.3). At stations F504 and F508 the community was dominated by pumpkinseeds, bluegills, and creek chubs. Largemouth bass were present at both F504 and F508. Surveys in 1980 and 1981 indicated well-rounded communities including yellow perch, brown trout, largemouth and smallmouth bass, and grass pickerel in the area upstream from Cass Lake.

At Pontiac, the Clinton River drops down an incline and flows through a tunnel, then through a cement channel until being restored to a more natural appearing watercourse at the city limits. From Pontiac downstream to the confluence of Paint Creek in the City of Rochester populations have improved since 1973. In 1973 at stations F509 and F510 only three species of fish (carp, mudminnows, and green sunfish) were found. Stations F511 through F516 held more species but never more than six, including some panfish and largemouth bass. However, more recent surveys indicate improved fish populations at the station at Crooks Road, Table 4.15. A 1983 survey collected eight species of fish including spottail shiners and blacknose dace.

The fish community structure from the Paint Creek confluence downstream to Yates Dam at Dequindre and Avon Roads was difficult to assess due to unintended extensions of chemical reclamation projects on Paint Creek in 1974 and 1984. Sufficient fish toxicant escaped the detoxification station to kill a significant portion of the fish population for one or more miles downstream. Since Paint Creek is a managed trout stream and Stony Creek--which empties into the Clinton one mile downstream from Paint Creek--is stocked with trout, it would seem reasonable to assume better water quality and improving fisheries populations exist in that reach also.

Stations F531 and F532 include the general area from Yates Park Dam downstream less than one-half mile. A 1978 survey took 10 species of fish. In 1983, there were 11 more species added, and in August, 1986 an additional four species including walleye, brown trout, and steelhead brought the species total to 25.

On January 12, 1984 eyed and viable chinook salmon eggs were found in Clinton River gravel redds near Avon Bridge. These eggs were subsequently hatched and reared to fingerling size in an aquarium containing Clinton River water. On May 7, 1984 four 1.5 to 2.0-inch chinook salmon

Table 4.15 Summary of major fish species and number of fish taxa present per station in the Clinton River Sections 5, 3, and 1 (1973-1984).

				Game Fish						Rough Fish	
Year	Station	Storet	No. of Taxa	Yellow Perch	Brown Trout	Northern Pike	Lgmouth Bass	Smlmouth Bass	Walleye	Sucker	Carp
1973	501	630623	9		*					*	
1980	502		13	*		*	*				
1980	503		10	*		*					*
1973	504	630629	18	*		*	*				*
1980	505		15	*	*		*	*			*
1980	506		12	*			*			*	
1980	507		11	*				*			
1973	508	630631	9				*				
1973	509	630599	1								*
1973	510	630632	4								*
1973	511	630597	11				*			*	*
1973	512	630633	4							*	
1973	513	630595	5							*	
1973	514	630252	6				*			*	*
1973	515	630594	6							*	
1973	516	630635	1							*	
1973	525	630636	1							*	
1973	526	630637	2							*	
1984	532		1								
1980	534	500201	2							*	
1973	536	500202	0								
1973	537	500203	3							*	*
1973	538	500204	3							*	*
1973	539	500205	2							*	*
1973	540	500047	1							*	*
1978	301		22	*						*	*
1981	302		13						*	*	*
1973	303	500231	2						*	*	*
1973	304	500230	2						*	*	*
1973	306	500209	3						*	*	*
1973	308	500225	4	*					*	*	*
1973	311	500010	3	*					*		*
1978	313		16	*			*	*	*	*	*
1973	101		3								*
1974	103		4								*
1973	104		6						*		*
1975	105		24	*		*	*	*	*	*	*
1980-8	106		11	*		*	*				

fingerlings were captured downstream of the redds. This section of the river and miles of stream below where the fingerlings were collected has an abundance of spawning gravel and is used each fall by growing numbers of chinook salmon.

Station F534 surveyed in 1983 and 1986 yielded 20 species including walleye and brown trout. When station F535 was surveyed in 1983 and 1985, crews captured 13 and 15 species of fish respectively, but 20 species collectively including walleye and brown trout. Clearly, the fish populations in the section of Clinton River from Yates Park Dam, downstream at least to the Red Run confluence, are responding to much improved water quality (Table 4.15). Spawning runs of steelhead trout, walleye, and suckers in the spring, and steelhead, coho, and chinook salmon in the fall, plus year-round availability of brown trout and walleye (especially), seem to support this statement.

Paint Creek from Lake Orion Dam downstream to its confluence with the Clinton River (10 miles) is a managed trout stream. As part of the management efforts, periodic chemical reclamations are done in order to maintain mono-species populations. The survey data is used to gauge the population structure. When too many species combine with too few trout, a treatment to rid the stream of all fish is done, followed by continuing annual trout stocking. Because Paint Creek is spring fed for at least 50 percent of its volume by the time it reaches Rochester, it is considered of high quality for fisheries management. The presence of numerous naturally reproduced brown and brook trout from tributaries and/or the main creek supports this. The fact that a warmwater lake (Orion) spills into the stream at one end and the Clinton River fish population has unobstructed access at the other end requires frequent monitoring of the population balance and occasionally reclamations. It is regarded as the best trout stream fishery in the area by trout anglers.

Stony Creek, the other major tributary to the Main Branch in Section 5, was chemically reclaimed upstream from Stony Creek impoundments in 1986 in order to establish an improved brown trout fishery. Fisheries managers consider that reach (approximately 10 miles) to be marginal for trout management; it could become too warm for trout during occasional hot, dry summers. The population of fish at treatment time included 18 species. The most abundant were pumpkinseed, common shiner, and hornyhead chubs. Two-thirds of the biomass were taken up by white sucker, northern pike, and hogsucker. Four species of darter were included. Brown trout were observed at other locations.

Between the Clinton River confluence and Winkler Millpond Dam on Stony Creek, the fish population essentially reflects species common to the impoundments and Clinton River. It is considered to be good water quality by fisheries managers.

4.6.2 Section 3 Clinton River Fish Community

Section 3 was surveyed in 1973 and 1978-81. In 1973, carp, gizzard shad, and white suckers were present in very low numbers, indicating poor water quality conditions during the survey. Only one top predator, a northern pike, was present at station F311.

By 1978, the community was more varied and dominated by species common to that area of Lake St. Clair, particularly carp, suckers, and gizzard shad. Other species collected included primarily forage fish, but some northern pike, largemouth bass, and walleye were captured.

Most of the surveys from 1979 to the present were conducted during springtime conditions in order to monitor the walleye spawning runs. Increasing numbers of species and abundance indicated an improvement in water quality, although this section along with sections 1 and 4 are considered to have the most water quality problems in the river by fisheries biologists.

According to USFWS and MDNR studies in 1980 and 1981, 18,000 to 24,000 walleyes ascended the Clinton River at spawning time. Several attempts were made to determine if natural reproduction of walleye is occurring, but efforts proved unsuccessful so far. "Drift nets" set in current have captured many white sucker fry as well as numerous minnow species fry, but the walleye fry remain elusive even though surveys have found ripe and spent (spawned out) adult walleye far upriver. An excellent run of walleye continues to move upstream each spring. More surveys will be conducted to determine the magnitude of the run and efforts continue to capture naturally produced walleye fry.

4.6.3 Section 4 Clinton River Fish Community

The fish community in Section 4 was surveyed at two stations (F401 and F402) during the spring and summer of 1981. The fish community was dominated by carp and white suckers at both stations. Goldfish were the next most abundant species at station F401. The majority of other fish were forage fish, but seven northern pike, one yellow perch and one walleye were reported. The low numbers and dominance by pollution tolerant forms indicated poor fish community quality in Red Run in 1981.

4.6.4 Section 6 Clinton River Fish Community

Section 6 was sampled in 1978 and 1985. During 1978, the upstream stations (F601 and F603) were dominated by Johnny darters, chubs, dace and shiners. A brown trout was the only top predator at these stations. Creek chubs, common shiners, carp and suckers dominated the fish community although two steelhead were also reported in the three visits made at station F609 in April of 1978.

In 1985, the upstream station (F602) was dominated by white suckers, black bullheads and pumpkinseeds, but five brown trout and three grass pickerel were also reported. Further downstream at stations F604-F607, the community was dominated by shiners, chubs, and suckers, while other forage fish were less prevalent. Brown trout were more frequently reported at stations F604-F607 than at station F602, as were pike and largemouth bass. At station F608, shiners, chubs, and suckers were prevalent, but brown trout nearly dominated the system.

This stretch of the river made a good recovery between 1978 and 1985 and had a well-balanced fish community in 1985.

4.6.5 Section 2 Clinton River Fish Community

Section 2 was surveyed in the spring of 1979, 1980, and 1981, primarily to assess walleye runs. The fish species list is noticeably smaller with a sprinkling of both game and rough fish. In 1979, most walleye were collected at station F201 with a few caught further downstream at station F206. In 1980, a large number of walleye (1664) were collected throughout Sections 2 and 3 during a one month period. In 1981, abundant walleye were collected rather uniformly throughout Section 2.

4.6.6 Section 1 Clinton River Fish Community

In Section 1 during 1973, carp were by far the dominant species at all stations sampled. In 1975, yellow perch and alewives were the major fish collected at station F106. In 1980 through 1984, trap nets revealed that carp and crappie were the dominant forms, followed by gizzard shad in 1980, white sucker in 1982, gizzard shad and yellow perch in 1983, white sucker and walleye in 1984, and yellow perch in 1985. The increased number of species between 1980 and 1985 suggest a dramatic improvement in the fish community.

4.7 CLINTON RIVER BENTHIC MACROINVERTEBRATE COMMUNITY, 1972-1984

Benthic macroinvertebrate organisms are bottom dwelling aquatic animals without backbones that can be seen with the naked eye. These organisms are primarily larval (and some adult) forms of aquatic insects, snails, clams and crayfish. They are basically incapable of long distance rapid movement like fish and are unable to escape when poor water quality conditions arrive quickly. Some forms are very sensitive to poor water quality, especially low dissolved oxygen and are known as intolerant organisms. Others are less sensitive and are called facultative organisms. Those able to withstand severe pollution are called tolerant organisms. High quality streams have a diverse number of species present in moderately abundant numbers with intolerant and facultative organisms as dominant species. Poorer quality streams have fewer species and often fewer numbers of individuals with facultative and tolerant species dominant. Degraded streams are dominated by a few pollution tolerant species, usually found in high densities. When even the pollution tolerant forms are present in only very low numbers or absent, it is likely that toxicants are or were present. Since aquatic organisms never get confused, the aquatic macroinvertebrate community is a reliable, long-term indicator of stream quality.

Macroinvertebrate communities are measured either qualitatively or quantitatively. In quantitative methods, the number of individuals of each species in a known area are counted. A "petite ponar" dredge or a "Hester-Dendy" sampler are tools used by aquatic biologists to collect the organisms. A Hester-Dendy sampler provides artificial substrate for aquatic life when the natural substrate is unsuitable, allowing measurement of water quality only, rather than stream quality. Qualitative measurements are made by examining all aquatic substrates with nets and hand picking for a rough estimate of the presence, absence and abundance of indicator organisms used to assess stream quality.

The benthic macroinvertebrate community has been surveyed nine times between 1972 and 1984 at a total of 100 different stations (see Map 6.4). There were 26 quantitative analyses performed on samples collected with a petite-ponar, 49 quantitative analyses performed on Hester-Dendy samples, and 128 qualitative analyses over the 13-year period. The data from these are included in Appendix 4.9, and summarized in Table 4.16. Table 4.16 also shows the station locations and codes for all benthic macroinvertebrate sampling stations corresponding to Map 6.4.

4.7.1 Section 5, Main Branch Clinton River Upstream of Red Run 1972-1984

In 1972, qualitative sampling revealed that at station 511, scuds were dominant among the twelve macroinvertebrate taxa collected. Also common were hydropsychid caddisflies, midges and bryozoans.

At station 512, seven macroinvertebrate taxa were collected and scuds were dominant. No organisms were abundant, indicating reduced stream quality.

At station 513, approximately 0.2 miles above Pontiac WWTP Number 1, eight macroinvertebrate taxa were collected. Damselflies, snails, and true bugs were dominant indicating poor stream quality.

At station 514, 0.4 miles below Pontiac WWTP number 1, the aquatic macroinvertebrate community was composed of five taxa, present only along stream margins. Animals collected included damselflies and sludgeworms indicating very poor stream quality.

At station 515, 1.0 mile below the Pontiac WWTP Number 1 outfall, and approximately 0.5 miles below the WWTP Number 2 outfall, four taxa were present, and dominated by sludgeworms and damselflies indicating poor stream quality.

At stations 516 and 517, the animal communities were dominated by sludgeworms, indicating very poor stream quality.

The benthic macroinvertebrate community at station 521 was composed of 15 taxa and was dominated by sludgeworms and hydropsychid caddisflies, indicating higher stream quality than upstream. At station 522, approximately 10.5 miles below the Pontiac WWTP, midges, hydropsychid caddisflies, and snails were present, exhibiting still higher stream quality than at station 521.

The 1973 qualitative macroinvertebrate collections at stations 501 through 511 (above Pontiac) were quite similar to the 1972 survey. Total taxa ranged from 11 to 19, while caddisfly and mayfly species ranged from 3 to 10, indicating fairly good water quality. Acroneuria arida, an intolerant stonefly, was found at Station 501.

Stations 512 through 523, 535 and 536 from Wesson Street to the first station downstream of the Rochester WWTP (covering a 16.5-mile zone) had degraded macroinvertebrate communities. Only one station below Paint Creek was capable of supporting a limited number of mayflies and caddisflies.

Table 4.16 **Summary of quantitative benthic macroinvertebrate sampling in Section 1 Clinton River, natural channel downstream of the spillway (1973–1983).**

Date	1973			1973			1975			
Map ID	101	105	109	101	105	109	103	108	112	114
Storet	500213	500214	500009	500213	500214	500008				
Document	12	12	12	12	12	12	49	49	49	49
Method	h-d*	h-d	h-d	ponar	ponar	ponar	ponar	ponar	ponar	ponar
Total Number of Taxa	4	2	6	3	1	1	6	2	6	11
Number of Intolerant taxa	0	0	0	0	0	0	1	0	1	2
Number of Facultative taxa	2	2	4	2	0	0	3	1	2	4
Number of Tolerant taxa	2	0	1	1	1	1	2	1	3	5
Mean Number of Individuals / sq m	1317	1251	1500	1175	2050	1204	130	394	332	1989
Diversity Index	2.8	1.7	2.4	0.2	0.0	0.0				

*hester-dendy sampler

Date	1983							
Map ID	102	104	106	107	108	110	111	113
Storet								
Document	52	52	52	52	52	52	52	52
Method	ponar	ponar	ponar	ponar	ponar	ponar	ponar	ponar
Total Number of Taxa	1	2	2	2	3	2	2	3
Number of Intolerant taxa	0	0	0	0	0	0	0	0
Number of Facultative taxa	0	0	1	1	1	1	1	1
Number of Tolerant taxa	1	2	1	1	2	1	1	2
Mean Number of Individuals / sq m	989	2580	473	1540	817	516	1720	1978
Diversity Index								

Summary of quantitative benthic macroinvertebrate sampling in Section 2 Clinton River, the spillway (1973).

Date	1973		1973	
Map ID	201	202	201	202
Storet	500188	500229	500188	500229
Document	12	12	12	12
Method	h-d*	h-d	ponar	ponar
Total Number of Taxa	5	4	2	2
Number of Intolerant taxa	0	0	0	0
Number of Facultative taxa	4	3	1	1
Number of Tolerant taxa	1	1	1	1
Mean Number of Individuals / sq m	2373	1169	8170	5834
Diversity Index	2.9	2.9	.0	.0

* hester-dendy sampler

Table 4.16 continued.

Summary of quantitative benthic macroinvertebrate sampling in Section 3 Clinton River, Red Run to spillway (1973-1979).

Date	1973					1979			1973	
Map ID	301	303	304	305	306	302	304	305	305	306
Storet	500231	500230	500209	500225	500010	500208	500209	500225	500225	500010
Document	12	12	12	12	12	29	29	29	12	12
Method	h-d*	h-d	h-d	h-d	h-d	h-d	h-d	h-d	ponar	ponar
Total Number of Taxa	6	3	3	5	7	9	6	8	6	3
Number of Intolerant taxa	0	0	0	0	0	0	0	1	0	0
Number of Facultative taxa	3	1	2	3	4	8	6	5	4	1
Number of Tolerant taxa	3	2	1	2	3	1	0	2	2	2
Mean Number of Individuals / sq m	3019	1444	3963	2171	1210	4752	1614	1767	7195	126671
Diversity Index	2.1	2.2	1.2	1.5	2.3				0.4	0.1

*Hester-dendy sampler

Summary of qualitative benthic macroinvertebrate sampling in Section 3 Clinton River, Red Run to spillway (1973-1982).

Date	1973			1979			1982
Map ID	301	303	304	302	304	305	302
Storet	500231	500230	500209	500208	500209	500225	500208
Document	12	12	12	29	29	29	70
Total Number of Taxa	10	7	10	9	13	11	14
Number of Intolerant taxa	0	0	0	0	0	0	0
Number of Facultative taxa	7	4	7	5	8	5	9
Number of Tolerant taxa	3	3	3	4	5	6	5
Total Number of Individuals	133	91	113	130	76	74	
Diversity Index	2.9	1.0	2.3				

Table 4. 16 continued.

Summary of qualitative benthic macroinvertebrate sampling in Section 4 Clinton River, Red Run to the spillway (1973-1982).

Date	1973									1982
Map ID	401	402	403	404	405	406	407	408	409	406
Storet						500227				
Document	17	17	17	17	17	23,12	17	17	17	70
Total Number of Taxa	9	9	3	14	2	4	9	10	2	6
Number of Intolerant taxa	0	0	0	0	0	0	1	0	0	0
Number of Facultative taxa	4	4	2	7	1	2	5	5	1	3
Number of Tolerant taxa	5	5	1	7	1	2	3	5	1	3
Total Number of Individuals	283	114	76	286	104	40	60	71	531	
Diversity Index						1.5				

Summary of quantitative benthic macroinvertebrate sampling in Section 4 Clinton River, Red Run to the spillway (1973).

Date	1973
Map ID	406
Storet	500227
Document	23,12
Method	h-d*
Total Number of Taxa	2
Number of Intolerant taxa	0
Number of Facultative taxa	1
Number of Tolerant taxa	1
Mean Number of Individuals / sq m	194
Diversity Index	0.5

*hester-dendy sampler

Table 4.16 continued.

Summary of quantitative benthic macroinvertebrate sampling in Section 5 Clinton River, upstream of Red Run (1973-1979).

Date	1973											1973			
Map ID	509	510	511	512	513	514	516	517	518	519	521	524	525	526	527
Storet	630629	630630	630631	630600	630599	630632	630597	630633	630595	630252	630594	630313	630614	630615	630616
Document	12	12,23	12	12	12	12	12	12,23	12	12	12	13	13	13	13
Method	h-d*	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d
Total Number of Taxa	4	7	5	3	5	2	3	1	4	2	6	15	9	11	9
Number of Intolerant taxa	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1
Number of Facultative taxa	3	5	4	3	4	1	2	1	3	1	5	12	6	10	8
Number of Tolerant taxa	1	1	0	0	1	1	1	0	1	1	1	2	3	1	0
Mean Number of Individuals / sq m	840	3543	3797	1606	1025	1614	186	4800	105	1573	1688	2730	2339	2205	1231
Diversity Index	1.8	1.4	0.9	0.7	3.0	1.3	1.8	0.0	1.7	0.4	1.7				
Mean Station Biomass (g wet wt/sq m)															

*hester-dendy sampler

Date	1973													
Map ID	530	531	532	533	534	535	536	537	539	543	544	545	546	547
Storet	630618	630619	630620	630621	630622	630636	630637	630606	500201	500202	500203	500224	500205	500047
Document	13	13	13	13	12,13	12	12	12	12	12	12	12	12	12
Method	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d
Total Number of Taxa	11	14	14	10	8	8	7	7	7	10	8	6	9	8
Number of Intolerant taxa	1	2	1	0	1	0	0	0	0	1	0	0	0	0
Number of Facultative taxa	9	11	12	9	4	4	7	7	7	6	8	6	6	7
Number of Tolerant taxa	1	1	1	1	3	4	0	0	0	3	0	0	3	1
Mean Number of Individuals / sq m	3985	2667	2382	4109	806	540	1630	6464	4252	2509	3704	4462	1332	3801
Diversity Index					1.9	2.8	2.2	1.4	2.0	2.4	2.5	2.3	2.6	2.7
Mean Station Biomass (g wet wt/sq m)														

Date	1975			1977		1978				1979	
Map ID	510	513	517	510	513	510	513	517	518	546	547
Storet	630630	630599	630633	630630	630599	630630	630599	630633	630595	500205	500047
Document	31	31	31	31	31	31	31	31	31	29	29
Method	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d
Total Number of Taxa	7	4	2	10	5	15	5	5	7	7	8
Number of Intolerant taxa	0	0	0	1	0	2	0	0	1	1	0
Number of Facultative taxa	6	3	2	7	2	9	3	4	5	6	7
Number of Tolerant taxa	1	1	0	2	3	4	2	1	1	0	1
Mean Number of Individuals / sq m	1258	597	3091	3349	1065	6859	5560	1945	3213	4858	[illegible]559
Diversity Index	2.1	2.6	0.6	[illegible]	0.4	2.9	0.3	2.0	2.4		
Mean Station Biomass (g wet wt/sq m)				63.[illegible]	7.10	17.8	4.0	0.9	4.0		

Table 4.16 continued.

Summary of qualitative benthic macroinvertebrate sampling in Section 5 Clinton River, upstream of Red Run (1972-1980).

Date	1972												
Map ID	511	512	513	514	515	517	518	521	522	523	534	535	501
Storet	630631	630600	630599	630632		630633	630595	630594		630635	630622	630636	630623
Document	10	10	10	10	10	10	10	10	9,10	9	9	9 R-L	12
Total Number of Taxa	12	7	8	5	4	3	6	15	12	0	13	10	17
Number of Intolerant taxa	0	0	0	0	0	0	0	0	0	0	0	0	4
Number of Facultative taxa	7	4	3	2	2	2	4	10	7	0	6	6	11
Number of Tolerant taxa	5	3	5	3	2	1	2	5	5	0	7	4	2
Total Number of Individuals													188
Diversity Index													3.4

Date	1973													1973
Map ID	503	504	506	507	508	509	510	511	512	513	514	516	517	518
Storet	630624	630625	630626	630627	630628	630629	630630	630631	630600	630599	630632	630597	630633	630595
Document	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total Number of Taxa	12	15	11	11	11	16	19	15	5	8	5	6	4	13
Number of Intolerant taxa	1	1	0	1	1	1	1	2	0	0	0	0	0	0
Number of Facultative taxa	10	11	8	9	8	8	11	8	2	4	2	3	3	7
Number of Tolerant taxa	1	3	3	1	2	7	7	5	3	4	3	3	1	6
Total Number of Individuals	98	143	67	106	95	70	128	81	21	134	47	117	60	96
Diversity Index	3.1	3.0	3.4	3.1	3.1	3.8	3.9	3.4	1.9	1.5	1.5	0.9	1.5	2.9

Date	1973													
Map ID	519	520	521	523	524	525	526	527	530	531	532	533	534	535
Storet	630252	630037	630594	630635	630313	630614	630615	630616	630618	630619	630620	630621	630622	630636
Document	12	12	12	12	13	13	13	13	13	13	13	13	12	12
Total Number of Taxa	12	14	11	6	12	18	16	23	21	22	16	20	14	10
Number of Intolerant taxa	0	0	0	0	1	0	1	2	2	3	2	2	0	0
Number of Facultative taxa	6	5	6	2	9	12	8	14	11	14	9	11	8	6
Number of Tolerant taxa	6	9	5	4	2	6	7	7	8	5	5	7	6	4
Total Number of Individuals	145	79	50	66	0	0	0	0	0	0	0	0	240	74
Diversity Index	1.9	3.3	3.5	1.3									3.3	3.1

Table 4.16 continued.

Summary of qualitative benthic macroinvertebrate sampling in Section 5 Clinton River, upstream of Red Run (1972-1984).

Date	1973								1975			
Map ID	536	537	539	543	544	545	546	547	510	513	517	510
Storet	630637	630606	500201	500202	500203	500224	500205	500047	630630	630599	630633	630630
Document	12	12	12	12	12	12	12	12	31	31	31	31
Total Number of Taxa	10	11	15	12	16	10	12	7	14	6	10	22
Number of Intolerant taxa	0	0	0	1	0	0	0	0	1	1	0	2
Number of Facultative taxa	5	9	11	6	11	6	7	5	8	3	6	12
Number of Tolerant taxa	5	2	4	5	5	4	5	2	5	2	4	8
Total Number of Individuals	49	82	135	41	103	43	111	75	137	139	153	165
Diversity Index	3.2	3.4	3.9	3.5	3.4	3.3	3.6	2.8				

Date	1977		1978				1979				
Map ID	513	517	510	513	517	518	546	547	502	504	506
Storet	630599	630633	630630	630599	630633	630595	500205	500047		630625	630626
Document	31	31	31	31	31	31	29	29	70	70	70
Total Number of Taxa	13	11	20	6	13	16	9	13	25	24	18
Number of Intolerant taxa	0	0	3	0	0	1	0	0	7	4	0
Number of Facultative taxa	7	6	11	3	8	8	6	7	10	12	12
Number of Tolerant taxa	6	5	6	3	5	7	3	6	8	8	6
Total Number of Individuals	96	123	68	26	54	101	143	121			
Diversity Index											

Date	1982													1982
Map ID	507	508	509	510	511	513	514	516	517	519	520	534	535	536
Storet	630627	630628	630629	630630	630631	630599	630632	630597	630633	630252	630067	630622	630636	630637
Document	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Total Number of Taxa	16	16	19	20	15	14	11	13	10	14	16	20	16	23
Number of Intolerant taxa	2	1	2	2	0	0	0	0	0	0	0	3	1	1
Number of Facultative taxa	8	7	8	9	7	5	6	6	8	8	11	11	11	15
Number of Tolerant taxa	6	8	9	9	8	9	5	7	2	6	5	6	4	7
Total Number of Individuals														
Diversity Index														

Table 4.16 continued.

Summary of qualitative benthic macroinvertebrate sampling in Section 5 Clinton River, upstream of Red Run (1972-1984).

Date						1983					1984	
Map ID	537	539	543	546	547	538	539	540	541	542	528	529
Storet	630606	500201	500202	500205	500047		500201					
Document	70	70	70	70	70	38	38	38	38	38	39	39
Total Number of Taxa	19	20	20	19	13	14	19	17	17	19	8	10
Number of Intolerant taxa	2	1	1	0	0	3	2	2	2	4	0	1
Number of Facultative taxa	12	13	14	13	8	7	12	10	10	10	5	5
Number of Tolerant taxa	5	6	5	6	5	4	5	5	5	5	3	4
Total Number of Individuals												
Diversity Index												

Summary of quantitative benthic macroinvertebrate sampling in Section 6 Clinton River, the North Branch (1973).

Date	1973	1973
Map ID	622	622
Storet	500210	500210
Document	12	12
Method	h-d*	ponar
Total Number of Taxa	8	8
Number of Intolerant Taxa	2	0
Number of Facultative Taxa	6	4
Number of Tolerant Taxa	0	4
Mean Number of Individuals / sq m	2598	3096
Diversity Index		1.2

*hester-dendy sampler

Table 4. 16 continued.

Summary of qualitative benthic macroinvertebrate sampling in Section 6 Clinton River, the North Branch (1973-1983).

Date	1973										1973		
Map ID	601	602	603	604	605	606	607	608	609	610	611	612	613
Storet	500236	440057	440058	440059	440060	440061	500237	500238	500239	500240	500241	500242	500243
Document	16	16	16	16	16	16	16	16	16	16	16	16	16
Total Number of Taxa	14	25	14	21	8	15	12	15	18	13	18	19	16
Number of Intolerant Taxa	1	4	1	2	0	1	1	2	2	2	4	3	3
Number of Facultative Taxa	9	17	8	10	6	9	7	8	10	8	7	10	9
Number of Tolerant Taxa	4	4	5	9	2	5	4	5	6	3	7	6	4
Total Number of Individuals	39	145	76	163	97	72	71	94	134	106	204	278	176
Diversity Index		4.7	3.8	4.4	3.0	3.8	3.8	4.1	3.5	3.9	4.1	3.9	3.6

Date			1979			1983		
Map ID	614	615	616	617	618	619	620	621
Storet	500244	500245						
Document	16	16	30	30	30	37	37	37
Total Number of Taxa	18	20	15	6	18	5	6	12
Number of Intolerant Taxa	3	2	2	0	2	0	0	1
Number of Facultative Taxa	9	12	8	3	9	2	1	3
Number of Tolerant Taxa	6	6	5	3	7	3	5	8
Total Number of Individuals	146	229						
Diversity Index	3.2	3.6						

Table 4.16 continued.

STATION CODE LISTING (MACROINVERTEBRATES).

Station Code	REPORT FROM WHICH DATA WAS EXTRACTED
9	Biological investigation of the Clinton River, vicinity of the Rochester Paper Company, Rochester, MI. MDNR. Willson 1973.
10	Biological investigation of the Clinton River between Pontiac and Rochester, Oakland County, Michigan. MDNR. Jackson 1973.
12	Biological survey of the Clinton River--Pontiac to mouth. MDNR. Grant 1973.
13	Biological survey of Paint Creek. MDNR. Lauer and Grant 1973.
16	Biological survey of the North Branch Clinton River. MDNR. Grant 1973.
17	Biological investigation of Red Run and its tributaries, July 11-12, 1973, Macomb County, Michigan. MDNR. Jackson 1974.
23	Primary monitoring network biological stations--1973 results. MDNR. Staff Report 1974.
24	North Branch of the Clinton River at Almont, July 14-15, 1975. MDNR. Staff Report 1975.
30	A biological survey of Greiner Drain and the North Branch Clinton River, Macomb County, Michigan. MDNR. Saalfeld 1980.
31	Michigan's biological primary monitoring program, 1973-1978. MDNR. Creal and Johnson 1980.
37	A water, sediment, and benthic macroinvertebrate survey of McBride Drain in the the vicinity of South Macomb disposal authority landfill 9A, Macomb County, Michigan. MDNR. Kenaga 1984.
38	Report on the impact of Liquid Disposal, Inc. on the Clinton River, Macomb County, Michigan. MDNR. Kenaga and Jones 1986.
39	Biological survey of Trout Creek, Bald Mountain recreation Area, Oakland County, Michigan. MDNR. Kenaga 1984.
49	Maintenance dredging of the federal navigation channel at Clinton River, Michigan (final environmental statement). COE 1976.
50	Confined disposal facility for maintenance dredging at Clinton River, Michigan (final environmental statement). COE 1976.
52	Field methodology, Clinton River collections for COE. Environmental Research Group 1983.
62	Evaluation of proposed confined disposal and transfer facilities for sediments from the Clinton River, Michigan. USFWS. Best 1987.
64	Confined disposal facility for maintenance dredging of the federal navigation channel in the Clinton River, Macomb County, Michigan (supplental EIS). COE 1987.
70	Unpublished data, 1982 Field work. MDNR. Johnson and Kenaga 1982.

Table 4.16 continued.

Clinton River basin macroinvertebrate sampling stations, from headwaters to mouth, MDNR and federal and local agencies station locations, 1970 - 1987.

MAP ID NUMBER	LATITUDE	LONGITUDE	AGENCY STATION NUMBER	DESCRIPTION
	SECTION 1			
101	42 35 47.0	82 52 36.0	MDNR/COE-75-26 DNR-500213	CL. R AT CROCKER ST BR; MT. CLEMONS (CITY)
102	42 35 48.0	82 52 04.0	ERG-83-8	Cl. R. just east of Gratiot Ave.
103	42 35 48.0	82 51 56.0	COE-75-1	Cl. R. at N. Rvr Rd. north of Avery St.
104	42 35 23.0	82 51 32.0	ERG-83-7	Cl. R. just west of I-94
105	42 35 26.0	82 51 27.0	DNR-500214 DNR/COE-75-27	CLINTON R AT 1-94 BRIDGE; HARRIS
106	42 35 34.0	82 50 42.0	ERG-83-6	Cl. R. off N. end of Chartier Rd.
107	42 35 45.0	82 50 03.0	ERG-83-5	Cl. R. west of Bridgeview Rd.
108	42 35 22.0	82 49 17.0	COE-75-4 ERG-83-4	Cl. R. east of Bridgeview Rd.
109	42 35 45.0	82 49 30.5	DNR-500008 MDNR/COE-75-28	CLINTON R. BRIDGEVIEW RD AT MOUTH
110	42 35 49.0	82 48 37.0	ERG-83-3	Cl. R. at end of Jefferson Ave.
111	42 35 39.0	82 46 58.0	ERG-83-2	Cl. R. near mouth; upstr. ERG-1
112	42 35 37.0	82 46 31.0	COE-75-6	Cl. R. mouth at midpt of earth fill breakwater
113	42 35 39.0	82 46 15.0	ERG-83-1	Cl. R. at mouth; tip of earthfill
114	42 35 39.0	82 46 04.0	COE-75-7	Cl. R. channel east of Rvr mouth
	SECTION 2			
201	42 34 35.0	082 52 15.0	DNR-500188	CR SPLLWY AT HARPER AVE.
202	42 33 43.5	082 50 51.5	DNR-500229	CR SPLLWY AT JEFFERSON AVE
	SECTION 3			
301	42 34 40.0	082 57 06.0	500231	CLINTON R 100YD UPST GARFLD R; C
302	42 34 39.0	082 57 12.0	500208 DNRCR-82-25	CLINTON R AT GARFIELD RD BR; CLI
303	42 34 40.0	082 57 05.0	500230	CLINTON R. BELOW GARFIELD ROAD
304	42 35 16.0	082 55 40.0	500209	CLINTON R OFF CLINTON R RD; CLIN
305	42 35 35.0	082 55 01.0	500225	CLINTON R AT R. RD PUMPHOUSE; CLI
306	42 35 45.0	082 54 35.0	DNR-500010 USGS-04165500	CLINTON R@ MORAVIAN DRV; N. SIDE
	SECTION 4			
401	42 31 46.0	083 04 06.0	DNRRR-73-1	Red Run at Ryan Rd bridge
402	42 31 44.0	083 02 54.0	DNRRR-73-2	Red Run at Mound Rd. bridge
403	42 32 30.0	083 02 54.0	DNRRR-73-3	Beaver Creek at Mound Rd. bridge
404	42 32 10.0	083 02 06.0	DNRRR-73-4	Beaver Creek at 14 Mile Rd. bridge
405	42 32 11.0	083 00 43.0	DNRRR-73-5	Red Run at 14 Mile Rd. bridge
406	42 33 10.0	082 59 07.0	500227 DNRCR-82-24	RED RUN AT 15 MILE ROAD; STERLIN
407	42 35 55.0	083 03 12.0	DNRRR-73-6	Plum Brook at Mound Rd. bridge
408	42 34 22.0	082 59 21.0	DNRRR-73-7	Plum Brook at Schoenherr Rd. bridge
409	42 35 18.0	082 51 35.0	DNRRR-73-8	Red Run at Utica Rd. bridge

Table 4.16 continued.

MAP ID NUMBER	LATITUDE	LONGITUDE	AGENCY STATION NUMBER	DESCRIPTION
	SECTION 5			
501	42 44 40.0	83 24 40.0	630623	Cl. R. at I-75 bridge at Clarkston
502	42 44 30.0	083 25 24.0	DNRCR-82-1	Cl. R. at Blue Grass Drive at Clarkston
503	42 44 10.0	083 25 13.0	630624	Cl. R. above Waldon Rd. bridge
504	42 43 07.0	083 25 22.0	630625 DNRCR-82-3	Cl. R. at U.S. 10 bridge at Dollar Lake
506	42 42 14.0	083 24 28.0	630626 DNRCR-82-4	Cl. R. at U.S. 10 bridge at Waterford
507	42 41 24.0	083 21 05.0	630627 DNRCR-82-5	Cl. R. at Walton Blvd., Clintonville
508	42 40 42.0	083 22 30.0	630628 DNRCR-82-6	Cl. R. at Hatchery Rd. (Drayton Plains fish station)
509	42 39 12.0	083 23 49.0	630629	CLINTON R AT PONTIAC LK RD; WATE
510	42 37 40.0	083 23 41.0	630630	CLINTON R. AT COOLEY LK RD; WATE
511	42 37 27.0	083 18 57.0	630631 DNRCR-82-9 DNRPR-72-1	CLINTON R. AT ORCHARD LK RD; PON
512	42 37 33.0	083 17 52.0	630600 DNRPR-72-2	CLINTON R. AT GILLESPIE STREET;
513	42 38 48.0	083 16 08.0	630599 DNRCR-82-10 DNRPR-72-3	CLINTON R ABV PONTIAC STP NO1 IN
514	42 38 33.0	083 15 37.0	630632 DNRCR-82-11 DNRPR-72-4	CLINTON R @ M-59 BRIDGE; PONTIAC
515	42 38 10.0	083 14 56.0	DNRPR-72-5 DNRRPC-72-1	CLINTON R. @ OPDYKE RD.
516	42 38 01.0	083 14 46.0	630597 DRNCR-82-12	CLINTON R. @ AUBURN RD; PONTIAC TWSHP, SEC 26
517	42 38 02.0	083 13 27.0	630633 DNRCR-82-13 DNRPR-72-6	CLINTON R. AT AUBURN RD; PONTIAC
518	42 39 14.0	083 11 35.0	630595 DNRPR-72-7	CLINTON R AT ADAMS RD BRIDGE; AVON
519	42 39 02.5	083 10 40.0	630252 DNRCR-82-14	CLINTON R AT HAMLIN RD BR; AVON
520	42 39 03.0	083 10 26.0	630067 DNRCR-82-15	CLINTON R. AT CROOKS RD; AVON TO
521	42 39 57.0	083 09 13.0	630594 DNRPR-72-8	CLINTON R AT AVON RD; AVON TWP,
522	42 40 31.0	083 07 59.0	CRWC-K DNRPR-72-9 DNRRPC-72-1	Clinton River at Rochester Road
523	42 40 37.0	083 07 46.0	DNR-630635 DNRRPC-72-2	CLINTON R ABOVE PAINT CREEK
524	42 47 00.0	083 14 35.0	630613	PAINT CREEK AT M-24 BRIDGE; ORIO
525	42 46 53.0	083 13 52.0	630614	PAINT CR AT ATWATER ST; CITY OF
526	42 46 03.0	083 13 04.0	630615	PAINT CREEK AT KERN RD; ORION TW
527	42 45 03.0	083 11 50.0	630616	PAINT CR AT ADAMS RD; OAKLAND TW
528	42 44 26.0	083 14 25.0	DNRTC-84-1	Trout Crk south of Tippett's property (100 yds from dump site)
529	42 44 24.0	083 14 12.0	DNRTC-84-2	Trout Crk at Greenshield Rd
530	42 44 23.0	083 10 11.0	630618	PAINT CREEK AT GUNN RD; OAKLAND
531	42 43 52.0	083 09 35.0	630619	PAINT CREEK AT ORION RD; OAKLAND
532	42 42 40.0	083 09 26.0	630620	PAINT CREEK AT DUTTON ROAD; AVON
533	42 41 19.0	083 08 32.0	630621	PAINT CREEK AT WOODWARD ST; AVON
534	42 40 41.0	083 07 42.0	630622 DNRCR-82-16 DNRRPC-72-3	PAINT CR AT GTW RAILROAD BR.; AV

Table 4.16 continued.

MAP ID NUMBER	LATITUDE	LONGITUDE	AGENCY STATION NUMBER	DESCRIPTION
	SECTION 5			
535	42 40 36.0	083 07 37.0	630636	CLINTON R 100 YDS BELOW PAINT CR
			DNRCR-82-17	
			DNRRPC-72-4	
536	42 40 58.0	083 06 30.0	630637	CLINTON R @ PARK DAVIS PICNIC AREA
			DNRCR-82-18	
537	42 40 19.0	083 05 50.0	630606	CLINTON R AT AVON RD. BRIDGE; AV
			DNRCR-82-19	
538	42 40 12.0	083 05 46.0	LDI-1	Cl. R. downstr. of Avon Rd Bridge
539	42 39 24.0	083 04 25.0	500201	CLINTON R AT RYAN RD BR; SHELBY
			DNRCR-82-20	
			LDI-6	
540	42 39 21.0	083 04 07.0	LDI-7	Cl. R. downstream of LDI-6
541	42 39 05.0	083 03 35.0	LDI-8	Cl. R. downstream of LDI-7
542	42 38 46.0	083 03 23.0	LDI-9	Cl. R. downstream of LDI-8
543	42 37 34.0	083 02 18.0	500202	CLINTON R AT AUBURN RD; CITY OF
			DNRCR-82-21	
544	42 37 14.0	083 01 55.0	CRWC-6	CLINTON R AT VAN DYKE RD; CITY O
			SEMCOG-9	CLINTON R AT VAN DYKE RD; CITY O
			500203	CLINTON R AT VAN DYKE RD; CITY O
545	42 35 46.0	083 00 56.0	500224	CLINTON R AT DODGE BROS. PARK #8
546	42 35 11.0	082 59 49.0	500205	CLINTON R AT KLEINO RD; CITY OF
			DNRCR-82-22	
547	42 34 13.0	082 58 16.0	500047	CLINTON R AT HAYES RD BR; CLINTO
			DNRCR-82-23	
	SECTION 6			
601	42 53 10.0	083 04 35.0	500236	North Branch Cl. R. at Fisher Rd bridge
602	42 53 22.0	083 04 26.0	440057	North Branch Cl. R. at Bordman Rd bridge (west of Almont)
603	42 54 42.0	083 02 60.0	440058	North Branch Cl. R. at Hough Rd bridge (west of Almont)
604	42 54 59.0	083 02 42.0	440059	North Branch Cl. R. at M-53 bridge (in Almont)
605	42 55 16.0	083 02 08.0	440060	north Branch Cl. R. at Kidder Rd bridge
606	42 55 28.0	083 00 16.0	440061	North Branch Cl. R. north of Hough Rd (east of Almont)
607	42 53 36.0	083 00 11.0	500237	North Branch Cl. R. at Bordman Rd bridge (east of Almont)
608	42 51 26.0	082 59 24.0	500238	North Branch Cl. R. at Brown Rd bridge
609	42 51 04.0	082 58 43.0	500239	North Branch Cl. R. at Armada Rd bridge
610	42 50 04.0	082 58 50.0	500240	North Branch Cl. R. at 34 Mile Rd bridge
611	42 49 10.0	082 58 34.0	500241	North Branch Cl. R. at 33 Mile Rd bridge
612	42 48 18.0	082 58 05.0	500242	North Branch Cl. R. at 32 Mile Rd bridge
613	42 47 44.0	082 57 45.0	500243	North Branch Cl. R. at Romeo-Plank bridge
614	42 46 37.0	082 56 23.0	500244	North Branch Cl. R. at 30 Mile bridge
615	42 43 53.0	082 54 26.0	500245	North Branch Cl. R. at 27 MileRd bridge
616	42 37 11.0	082 53 53.0	DNRGDR-1	North Branch Cl. R. above inlet of Greiner Drain
617	42 36 45.0	082 53 25.0	DNRGDR-3	Greiner Drain at M-97
618	42 37 07.0	082 53 54.0	DNRGDR-2	North Branch Cl. R. below inlet of Greiner Drain
619	42 41 13.0	082 55 15.0	DNRMDR-1	McBride Drain at 24 Mile Road
620	42 40 45.0	082 54 40.0	DNRMDR-2	McBride Drain between 24 and 23 Mile Roads
621	42 40 24.0	082 54 05.0	DNRMDR-3	McBride Drain at 23 Mile Rd
622	42 36 04.0	082 54 34.0	DNR-500210	North Branch Cl. R. at Cass Avenue bridge

The macroinvertebrate community diversities were low at the stations in Pontiac and increased at the downstream stations to station 521. A decrease in species diversity was noted in the vicinity of Rochester. Total numbers of taxa ranged from 4 to 14 with the lowest numbers encountered at Wesson Street and directly below the two Pontiac WWTPs. Signs of higher quality communities were present at stations 520 and 521 although stable caddisfly and mayfly populations were not established.

Stations 537, 539 and 543 through 547, from below Rochester to Red Run, represented 14.2 miles of river receiving no major wastewater discharges. At these stations in 1973, the number of taxa ranged from 10 to 16 per station, with 1 to 2 of these being caddisfly or mayfly families.

In 1973 companion Hester-Dendys were placed in the Main Branch. Results indicated areas of water quality degradation. Stations 509, 510 and 511 had low diversity but caddisflies and mayflies comprised 26 to 88 percent of the individuals present, indicating good water quality.

Hester-Dendys placed at Stations 512 through 519 (from Wesson Street to Adams Road) revealed degraded benthic communities in and below Pontiac. Community degradation was apparent at Station 513 where dragonflies, snails, and midges comprised the benthic community, indicating poor water quality.

At station 517 Cricotopus, a facultative midge, was the only organism present. All stations, 512-519, were dominated by midges and sludgeworms. This and the complete absence of caddisflies and mayflies indicated very poor water quality.

Community structure improved downstream of Pontiac beginning at station 521 where mayflies comprised 65 percent of the individuals, reflecting improved water quality.

At station 535, a substantial decline in the quality of the Clinton River biota was measured. The percent mayflies dropped from 65 at station 521 to 6 percent at station 535 and midges increased from 29 to 68 percent.

At stations 535 and 536 downstream of the Rochester WWTP, only eight and seven taxa were present respectively, most of which were midges.

Between Avon (station 537) and Hayes Roads (station 547), a distance of 14 river miles, benthic community structure was improved with caddisflies and mayflies comprising 14 to 80 percent of the total number of individuals. All stations, except Kleino Road (station 546), exhibited high productivity with diversity increasing in the downstream direction indicating increasing macroinvertebrate community stability.

The Clinton River was sampled in 1975, 1977 and 1978 at stations 510, 513 and 517 and also in 1978 at station 518 to assess impacts from the City of Pontiac. During these years at station 510, diverse and abundant caddisflies/mayflies dominated the macroinvertebrate community. Water quality in the Pontiac area was degraded in and downstream of the City between 1973 and 1978. Macroinvertebrate communities had fewer taxa and consisted primarily of midges and oligochaetes at stations 513 and 517.

The occurrence of caddisflies at stations 517 in 1978 indicated improvement in river quality downstream of Pontiac. At station 518, some recovery in river quality was indicated by an increase in mayflies and caddisflies and a more diverse macroinvertebrate community.

In 1979, the Clinton River was assessed at stations 546 and 547. Qualitative samples at both stations were dominated by hydropsychid caddisflies, scuds and midges, with number of taxa at 9 and 13 respectively. There were sparse heptageniid mayflies at station 546. Snails, clams and damselflies were also present at each station indicating a stressed, moderate quality stream. Quantitative Hester-Dendy samples at these stations were dominated by midges and hydropsychid caddisflies. Scuds, snails and baetid mayflies were also present. The presence of perlid stoneflies suggested improved water quality from 1973.

Section 5 was qualitatively surveyed at 22 stations during the summer of 1982 from Clarkston to Hayes Road near Mt. Clemens. The number of taxa ranged from 10 to 25 per station with intolerant taxa ranging from zero to seven, facultative from five to fourteen and tolerant from two to nine. At station 502, there were 25 taxa and the macroinvertebrate community was dominated by high quality stream indicators, including stoneflies, mayflies, blackflies and caddisflies. Mayflies and caddisflies were dominant. The community at station 504 was similar, although no stoneflies were found and blackflies were dominant.

Stations 506 through 509 were dominated by mayflies and scuds with moderately abundant numbers of caddisflies present. Stations 510 and 511 were dominated by scuds, although mayflies and caddisflies were still present in reduced numbers suggesting a moderate impact. Stations 513, 514, and 516, located downstream of Pontiac and the Pontiac WWTP, were dominated by oligochaetes, leeches and midges with no mayflies, caddisflies or scuds present, indicating severely degraded stream quality.

At station 517, the community continued to be dominated by midges, but one species each of caddisfly and mayfly were found. Station 519 was dominated by mayflies and stoneflies, and caddisflies were present. Stations 520 and 535 were mayfly/caddisfly dominated and had 16 taxa, indicating a recovering community, but station 536, downstream of the Rochester WWTP, was dominated by midges, blackflies and mayflies. Stations 537, 538 and 539 were dominated by mayflies, caddisflies and blackflies with occasional stoneflies indicating an improved condition downstream of Rochester. Stations 546 and 547 were dominated by blackflies and scuds and no stoneflies, representing some degradation compared with the stations immediately upstream.

Qualitative sampling in 1983 at station 538 in the vicinity of Ryan Road revealed 14 taxa, all of which were common or very commonly found. At station 539, 19 taxa were present. A few organisms not collected upstream were present at station 539, although numbers of these organisms were sparse. Craneflies and clinger type mayflies (heptageniids) increased from common to very common.

Community structure at stations 540 and 541 were virtually identical and varied little from conditions at station 539. Sponges and flatworms were new additions, scuds and craneflies were less abundant, but numbers of crayfish, damselflies and stoneflies increased. At station 540, scuds and crayfish increased, while stoneflies, damselflies and hellgramites decreased. In addition, damselflies were present and blackflies and purse-case making caddisflies reappeared. These diverse and abundant communities dominated by hydropsychid caddisflies, stoneflies and heptageniid mayflies indicates very good stream quality from stations 538 through 542. These results indicate a substantial improvement in stream quality since the 1973 survey.

Hester-Dendys placed at station 524 in Paint Creek in 1973 documented the water quality of Lake Orion. Caddisflies and mayflies comprised 34 percent of the community. Only one of the 15 taxa was intolerant, indicating fair water quality.

Benthic community structure indicated that water quality was poorer at station 525 than at station 524 since mayflies and caddisflies comprised only 10 percent of the individuals.

Stations 526 through 530 had improved water quality with taxa numbers ranging from 9 to 11. Mayflies and caddisflies comprised 49 to 73 percent of the individuals present.

Water quality degradation and subsequent partial recovery was present at stations 531 through 533 where the number of taxa ranged from 10 to 14. Mayflies and caddisflies dropped from 65 percent at station 530 to 33 percent at station 531. Discharges from Avon Industries between these stations may have caused this decrease. Stations 532 and 533 showed a partial recovery.

Companion qualitative collections in Paint Creek in 1973 at stations 524 through 534 indicated that the number of taxa ranged from 12 to 23. Caddisflies and mayflies were present in relatively high numbers at all stations to station 531 at Goodison. Below station 532, the macroinvertebrate community quality decreased probably due to the effluent from Avon Industries.

Trout Creek, a tributary to Paint Creek, in its upper headwaters is a narrow, slow moving channel through a hummocky marsh. In 1984, it was dominated by snails, clams, dragonflies and surface dependent beetles at station 528. Further downstream at station 529, it was dominated by snails, scuds and crayfish, but clams, limnephilid and hydropsychid caddisflies, and midges were also common. There was relatively good diversity with 8 to 10 taxa per station. This community indicates moderate stream quality impacted only by natural factors.

4.7.2 Section 3, 1972-1984

Section 3 was sampled quantitatively with Hester-Dendys at five stations and petite ponars at two stations in 1973, and with Hester-Dendys only at three stations in 1979. Three stations were also qualitativly sampled in 1973 and 1979, and one location in 1982.

In 1973, quantitative sampling showed from 3 to 7 taxa per station, whereas qualitative sampling indicated 7 to 10 taxa. All organisms were facultative or pollution tolerant forms dominated by midges and oligochaetes. A few hydropsychid caddisflies and sparse baetid mayflies were also present.

In 1979, the number of taxa increased and shifted to slightly more facultative rather than tolerant organisms with one intolerant caddisfly present. Hydrophyschid caddisfly numbers increased significantly, but midges were still dominant.

In 1982, benthic macroinvertebrate sampling results were similar to those reported for 1979, although no mayflies were noted in 1982. Stream quality was relatively poor in Section 3 over the nine years sampled.

4.7.3 Section 4, Red Run 1973-1982

Qualitative macroinvertebrate sampling was performed at nine locations in Section 4 during 1973 and in 1982. The number of taxa per station ranged from 2 to 14. One quantitative sample was collected at station 406 in 1973.

In 1973, stations 401 and 402 had relatively diverse communities with the number of tolerant and facultative taxa nearly equal. Stations 403 through 406 were dominated by oligochaetes, midges and several other surface dependent forms. Scuds and a baetid mayfly were present at station 404, which had a more diverse community than 403, 405 and 406. Stations 407 and 408 had diversities similar to 404 and also had scuds, sowbugs and a few caddisflies. The 1982 community at station 406 was similar to the 1973 community, suggesting little significant stream quality improvement.

4.7.4 Section 6, North and Middle Branches of the Clinton River 1973-1983

Fifteen qualitative and two quantitative samples were collected from the North Branch in 1973. Two qualitative samples were collected in the North Branch, and one qualitative sample was taken from Greiner Drain in 1979. Three qualitative samples were collected from McBride Drain in 1983.

In 1973 the benthic macroinvertebrate community in the North Branch upstream of Almont (stations 601-604) was dominated by caddisflies and mayflies, with 7 to 16% of the taxa intolerant to pollution. At station 605 downstream of the Almont WWTP, the number of taxa sharply declined and mayflies and caddisflies were replaced by scuds and midges. Stream quality was improved at stations 606 and 607 and at stations 609 to 610, mayflies, caddisflies, and scuds were dominant. Station 611, just upstream of the confluence of East Pond Creek, showed a high quality benthic community with 22% of the taxa intolerant to pollution. Downstream of East Pond Creek, the total number of individuals increased and the community remained high quality through stations 613 to 615.

A similar benthic macroinvertebrate community was found in 1979 at stations 616 and 618 with facultative organisms more abundant than tolerant organisms. Two intolerant species were also recorded.

At the confluence of the North and Main Branches, at station 622, both Hester-Dendy and petite ponar samples were collected in 1973. The number of taxa was slightly lower than upstream stations (14 taxa) when both sampling techniques were combined, and facultative organisms dominated the tolerance list. Numerically, oligochaetes and midges dominated other taxa, but intolerant and facultative mayflies were present and caddisflies were moderately abundant. These data reflect a slight decrease in stream quality from upstream, probably due to reduced stream velocity.

In Greiner Drain, qualitative macroinvertebrate sampling in 1979 at station 617 revealed six primarily surface dependent forms, three of which were facultative and three of which were pollution tolerant. The benthic community in this impacted drain is very poor quality but the drain caused no apparent biological impact on the North Branch.

McBride drain samples collected in 1983 showed fewer taxa upstream (station 619) than downstream (station 621). At station 619, there were three tolerant and two facultative forms. At station 620, oligochaetes and surface dependent forms dominated the community. At stations 621, eight tolerant, three facultative and one intolerant organisms were present, indicating a potentially healthy stream quality in McBride Drain, considering it flows only intermittently.

4.7.5 Section 2, the spillway 1973

The benthic macroinvertebrate community in Section 2 was sampled at stations 201 and 202 in 1973 using ponar and Hester-Dendy techniques. The Hester-Dendy samplers provided a substrate which was apparently preferred to the natural substrate since both the number of taxa and the number of individuals per species were greater on the Hester-Dendys. The ponar samples from natural substrates were dominated by tolerant oligochaetes while the artificial substrates were dominated by facultative midges, scuds and damselflies. These data suggest that sediment quality may have limited the benthic community in Section 2.

4.7.6 Section 1, the natural channel downstream of the weir 1973-1983

Benthic macroinvertebrates in Section 1 were quantitatively sampled at a total of 14 stations in 1973, 1975 and 1983.

In 1973, both petite ponar bottom grabs and Hester-Dendys were used to assess the benthic macroinvertebrate community at stations 101 and 105 and only Hester-Dendys were used at station 109. The total number of taxa per station ranged from one to six. Station 105 had the lowest number of taxa for both Hester-Dendy and ponar samples.

All organisms were either facultative or pollution tolerant forms dominated by oligochaetes and midges. The best community was at station 109 near the confluence of the river with Lake St. Clair.

In 1975, four stations were surveyed. The number of taxa ranged from two to 11 with the lowest number of taxa at station 108 and highest at the Clinton River Mouth/Lake St. Clair confluence. Oligochaetes and midges continued to dominate throughout Section 1 at station 114. There were nearly as many scuds and mayflies as there were midges with at least one intolerant species, an ephemerid mayfly, present at three of the four stations. In 1983 eight stations were assessed with the number of taxa ranging from one to three. All organisms were either facultative or pollution tolerant.

Very little stream quality improvement was indicated in Section 1 between 1973 and 1983.

4.7.7 Summary

Water chemical conditions have improved considerably since 1970 in all river sections, except Sections 1, 2, and 3 where poor dissolved oxygen concentrations continue to exist. Dissolved oxygen problems are related to sediment organic oxygen demand and sediment chemical oxygen demand, especially in section 1. Flow regime and topography influence reaeration and sediment deposition which exacerbates the dissolved oxygen, sediment contaminant, and physical habitat problems. Degraded benthic communities and limited resident fish communities are present in Sections 1, 2, 3 and 4.

5. POLLUTION SOURCES AND LOADINGS

This chapter describes the sources of pollution to the Clinton River by River Section. These sources include municipal and industrial point sources, and all types of nonpoint sources including waste disposal sites, sites of environmental contamination and active hazardous treatment storage or disposal sites. Loadings of conventional pollutants were calculated or estimated using the most recent data from 1976 to 1987. Metal and organic loadings were developed where data were available.

There are presently 35 NPDES permitted dischargers in the Clinton River watershed, eight of which are municipals WWTPs. The remaining 27 are industrial facilities, the majority of which are automotive related. In addition, there are 69 sites of potential environmental contamination, 24 active hazardous waste treatment, storage, or disposal sites, and 61 waste disposal sites in the Clinton River watershed.

The description parallels the flow of the river proceeding from the headwaters of Section 5 upstream of Pontiac, incorporates Sections 4 and 6, moves down through Section 3 to Lake St. Clair via the spillway (Section 2) and finishes with the natural channel (Section 1).

5.1 SECTION 5 - MAIN BRANCH CLINTON RIVER AND ITS TRIBUTARIES UPSTREAM OF RED RUN

5.1.1 Point Sources

There are two continuous municipal dischargers, ten continuous industrial dischargers and two intermittant industrial dischargers in Section 5 (Map 6.5). Municipal dischargers are the Cities of Pontiac (15 mgd) and Rochester (2 mgd) who have a full compliment of NPDES permit limits for conventional parameters and either short or long term monitoring for metals (Table 5.1.1).

5.1.1.1 Continuous Industrial Dischargers

The outfall type, receiving water, permitted flow and permit limited or monitored parameters for all NPDES dischargers are shown in Table 5.1.1. Permits for Chrysler Technical Center, G.M. Fisher Body, G.M. Giddings Road, G.M Pontiac and Grand Trunk all require oil and grease monitoring. G.M. Giddings Road also monitors total dissolved solids and total phosphorus. The Chrysler Tech Center and the Ford Motor Company also monitor their outfalls for total suspended solids. Total continuous point source industrial flow is 6.6 mgd with 63% originating from G.M's Pontiac Motor Division and 20% from G.M. Truck and Bus. Eighty-four percent of all directly discharged industrial flow is noncontact cooling water and all industrial dischargers are in compliance with their NPDES Permits limits.

5.1.1.2 Intermittent Industrial Discharges

Chrysler Tech Center and General Motors Giddings Road have NPDES discharge permits for stormwater discharges only, through outfalls 001-004 and outfall 001, respectively. The General Motors Pontiac Motor

TABLE 5.1.1 SUMMARY OF NPDES PERMITTED DISCHARGERS TO THE CLINTON RIVER BY RIVER SECTION

Actual permit limits are shown in Appendix 5.1

Discharger NPDES #	Longitude	Latitude	Issue/Exp. Date	Outfall/Type	Permitted Flow	Permited Limited Parameters
*SECTION 1						
Mt. Clemens MI0023647 (Interim)	42 35 53	82 51 50	4-21-86/4-30-88	#001/Wastewater to the Clinton River	6.0 mgd	BOD_5, TSS, fecal coliform bacteria, pH, total phosphorus, Cd, Cr^{+6}, CN, Pb, Hg, As, Zn
				#002/Wet Weather Facility	4.0 mgd	BOD_5, TSS, fecal coliform bacteria, NH_3-N, total phosphorus, pH, total residual chlorine
				#003/Retention Basin Overflow		fecal coliform bacteria, BOD_5, TSS, total phosphorus, pH, total residual chlorine
(Final)				#001/Wastewater to the Clinton River	6.0 mgd	$CBOD_5$, BOD_5, TSS, NH_3-N, dissolved oxygen, fecal coliform bactera, total residual chlorine, total phosphorus, pH, Cd, Cr^{+6}, CN, Pb, Hg, Ag, Zn
				#002/Watewater to the Clinton River	4.0 mgd	$CBOD_5$, NH_3-N, pH, dissolved oxygen, TSS, total phosphorus, fecal coliform bacteria

Table 5.1.1 continued

Discharger NPDES #	Longitude	Latitude	Issue/Exp. Date	Outfall/Type	Permitted Flow	Permited Limited Parameters
*SECTION 3						
Molloy Mfg. Co. MI0041696	42 33 09	82 56 06	3-18-81/6-30-86	#002/Noncontact Cooling to Tesk and Harrington drain	0.204 mgd	pH
*SECTION 4						
General Electric Carboloy Systems MI0004260	42 27 20	82 59 34	2-7-83/5-31-85	#002/Noncontact cooling water and stormwater runoff via Red Run	0.664 mgd	flow, temperature
OMI Corp. MI0027995	42 27 46	82 59 25	3-19-81/12-3-85	#001/Noncontact cooling water and tank application water/storm sewers and drains to Clinton River	0.01066 mgd	oil and grease, pH, flow outfall observation
Dept. of the Army Tank Command MI0041661	42 29 33	83 03 13	12-19-86/10-1-90	#002/Noncontact cooling water to Bear Creek	0.1 mgd	flow, outfall observation
G.M. Tech Center MI0043931	42 30 05	83 02 31	12-26-84/11-30-89	#001-069/Stormwater to Bear Creek	unspecified	outfall observation
Volkswagon of America/Chrysler Corp. MI0000345	42 30 42	83 02 13	12-1-80/4-22-85	#001/Noncontact cooling water; surface water runoff; coal storage runoff/Moore-Ledwidge Drain to Plum Brook	3.5 mgd	TSS, pH, flow, temperature

Table 5.1.1 continued

Discharger NPDES #	Longitude	Latitude	Issue/Exp. Date	Outfall/Type	Permitted Flow	Permited Limited Parameters
SECTION 4 CONTINUED						
Southeast Oakland County Sewage Disposal System/ Pollution Control Facility MI0026115	42 31 30	83 05 09	4-30-74/12-31-78	#001/Combined sewage overflow, chlorinated to Red Run	5.1 mgd (1854 mg/yr)	flow pH, TSS, BOD, fecal coliform bacteria
Schenck Treble Corporation MI0045161	42 33 36	83 06 17	1-22-87/10-31-91	#001/Cooling tower blow-down	0.0015 mgd	flow, TSS, outfall observation, pH
				#002/Cooling tower blow-down	0.000168 mgd	flow, TSS, outfall observation, pH
				#003/Noncontact cooling water to Red Run via Douglas Drain	0.0059 mgd	flow, temperature outfall observation, pH
Big Beaver Specialty Company MI0038741	42 33 47	83 05 07	6-20-86/2-28-91	#001/Noncontact cooling water and stormwater runoff/Big Beaver Creek via Spencer Drain and storm Sewer	0.0005 mgd	flow, outfall observation
C.S. OHM Corp. MI0038628	42 32 33	83 02 28	3-24-77/2-28-82	#001/Noncontact cooling water/Big Beaver Creek via storm sewer	unspecified	flow, oil and grease observation
Warren WWTP MI0024295	42 32 00	83 01 00	9-25-84/9-30-89	#001/Wastewater via Red Run	31 mgd	$CBOD_5$, NH_3, TSS, dissolved oxygen, fecal coliform bacteria, total residual

Table 5.1.1 continued

Discharger NPDES #	Longitude	Latitude	Issue/Exp. Date	Outfall/Type	Permitted Flow	Permited Limited Parameters
SECTION 4 CONTINUED						
Warren WWTP Cont.						chlorine, total phosphorus, monitor for Cd, Cu, CN, Hg, Ag, and Zn
Union Carbide MI0037672	42 32 29	82 59 50	4-13-82/1-31-87	#001/Noncontact cooling water to Red Run	0.05 mgd	flow, temperature, outfall observation
				Holding Pond/Lime Slurry to Red Run	0.05 mgd	flow, observation, pond freeboard
Borg Warner Corp MI0004774	42 36 09	83 03 28	4-18-74/1-31-79	#001/Stormwater runoff; via Plum Brook	unspecified	pH, flow, oil and grease
Ford Motor Co. Sterling Axle Plant MI0003417	42 34 47	83 02 29	1-20-83/12-31-87	#001/Noncontact cooling water; stormwater runoff via Moore Drain and Plum Brook	8.5 mgd	oil and grease, pH, outfall observation
***SECTION 5**						
Buckeye Pipeline MI0041700	42 44 38	83 26 56	6-30-80/3-31-85	#001/Treated ground-water to Deer Lake via unnamed creek	0.7826 mgd	flow, outfall observation
General Motors Giddings Road MI0042099	42 43 09	83 16 17	6-9-81/12-31-85	#001/Stormwater only to Carpenter Lake	unspecified	flow, oil and grease, outfall observation, TDS, total phosphorus, pH

Table 5.1.1 continued

Discharger NPDES #	Longitude	Latitude	Issue/Exp. Date	Outfall/Type	Permitted Flow	Permited Limited Parameters
SECTION 5 CONTINUED						
Grand Trunk MI0044202	42 43 47	83 16 58	9-22-85/10-31-90	#001/Stormwater and oil/water seperator effluent to Judah Lake via wetland	0.077 mgd	flow, oil and grease, outfall observation
General Motors Pontiac Motor Div. MI0042412	42 38 12	83 17 30	12-15-81/11-30-86	#001/Noncontact cooling to Clinton River via Montcalm storm sewer	4.178 mgd	flow, oil and grease outfall observation, temperature, pH
				#002,010,011/Stormwater	unspecified	outfall observation
General Motors Fisher Body MI0027804	42 39 28	83 17 54	6-30-80/4-30-85	#001/Noncontact cooling water to Harris Lake	0.03 mgd	flow, outfall observation
General Motors Truck and Bus Group MI0001007	42 38 20	83 17 00	1-21-86/1-31-91	#001/Noncontact cooling water to Murphy Creek via storm sewer	1.3 mgd	flow, outfall observation temperature, pH
Pontiac WWTP MI0023825	42 38 15	83 15 16	7-87/10-1-90	#001/Treated municipal wastewater to the Clinton River	15 mgd	flow $CBOD_5$, TSS, NH_3-N, dissolved oxygen, total phosphorus fecal coliform bacteria, total residual chlorine pH, Cd, Pb, Cr^{+6}, Ag, CN
Auburn Heights Mfg Co. MI0038199	42 38 21	83 13 16	1-31-83/12-31-87	#001/Noncontact cooling water to the Clinton River via unnamed tributary	0.000106 mgd	flow, outfall observation

Table 5.1.1 continued

Discharger NPDES #	Longitude	Latitude	Issue/Exp. Date	Outfall/Type	Permitted Flow	Permited Limited Parameters
SECTION 5 CONTINUED						
G.P. Plastics MI0044822	42 38 33	83 12 12	8-25-86/6-30-91	#001/Plastic parts, river water	0.0048 mgd	flow, temperature, BOD_5 oil and grease, TSS, dissolved oxygen, outfall observation, pH
Chrysler Tech Center MI0045586	42 40 07	83 13 36	5-21-87/3-31-85	#001-004/storm only via Galloway Creek	unspecified	flow, TSS, oil and grease, outfall observation
Molmec, Inc. Metalplast, Inc. MI0039446	42 40 42	83 07 42	4-21-86/2-28-91	#001/Recirculating non-contact cooling water system blowdown to the Clinton River	0.011 mgd	flow, temperature, outfall observation
				#002/Stormwater runoff	unspecified	outfall observation
Higbie Manufacturing MI0004995	42 40 53	83 07 39	3-21-74/1-31-79	#001/Noncontact cooling water to Paint Creek via storm sewer	0.0015 mgd	pH, oil and grease temperature, flow
Rochester WWTP MI0023931	42 40 51	83 07 03	1-31-84/12-31-88	#001 Wastewater treated municipal water to the Clinton River	2.0 mgd	$CBOD_5$, TSS, dissolved oxygen, pH, fecal coliform bacteria, total residual chlorine, <u>NH_3-N</u> total phosphorus, <u>trichloroethylene</u>
Ford Motor Co. Utica Trim Plant MI0003441	42 39 22	83 03 04	1-20-77/1-31-79	#001/Treated sanitary noncontact cooling water to Old Clinton Canal	0.214 mgd	BOD_5, TSS, total phosphorus, fecal coliform bacteria, pH, <u>NH_3-N</u>,

Table 5.1.1 continued

Discharger NPDES #	Longitude	Latitude	Issue/Exp. Date	Outfall/Type	Permitted Flow	Permited Limited Parameters
SECTION 5 CONTINUED						
Ford Motor Co. Utica Trim Plant Continued				(Clinton River)		dissolved oxygen, flow, oil and grease, total residual chlorine
***SECTION 6**						
Almont MI0020931	42 55 02	83 02 32	2-24-82/9-30-88 Interim	#001/Wastewater to N. Branch Clinton River	0.32 mgd	BOD_5, TSS, total phosphorus, fecal coliform, pH, dissolved oxygen, dissolved oxygen, NH_3-N, total residual chlorine
			9-30-88/7-1-90	#001 Wastewater to E. Branch Clinton River	0.35 mgd	BOD_5, TSS, fecal coliform bacteria, total residual chlorine, dissolved oxygen, total phosphorus, pH
Ford Motor Co. MI Proving Grounds MI0003425	42 50 03	83 04 17	11-22-82/1-30-87	#001/Sanitary wastewater, kitchen wastes, and groundwater to East Pond Creek	0.15 mgd	BOD_5, TSS, total phosphorus, fecal coliform bacteria, total residual chlorine, flow, outfall observation, pH
Romeo WWTP MI0021679	42 48 15	82 59 23	2-21-86/9-30-90	#001/Wastewater to East Pond Creek	1.6 mgd	$CBOD_5$, TSS, NH_3-N, total phosphorus, dissolved oxygen, total residual chlorine, fecal coliform bacteria

Table 5.1.1 continued

Discharger NPDES #	Longitude	Latitude	Issue/Exp. Date	Outfall/Type	Permitted Flow	Permited Limited Parameters
SECTION 6 CONTINUED						
Armada WWTP MI0022225	42 50 25	82 53 11	7-18-86/6-30-90 Interim	#001/Wastewater to E. Branch of Coon Creek	0.35 mgd	BOD_5, TSS, fecal coliform bacteria, pH
			7-1-88/Undetermined Final	#001/Wastewater to E. Branch of Coon Creek	0.35 mgd	$CBOD_5$, NH_3-N, TSS, fecal coliform bacteria, total residual chlorine, dissolved oxygen, total phosphorus, pH
South Macomb Disposal Authority MI0038717	42 40 48	82 54 33	5-27-81/6-30-86	#001/Treated Contaminated Surface Runoff to McBride Drain	unspecified	BOD_5, TSS, NH_3-N, total iron, pH, flow
TRW Seatbelt Div. MI0000621	42 44 25	83 01 32	1-71/2-28-79	#001/Noncontact cooling water to Clinton River via Taft Drain	0.07 mgd	flow, oil and grease, BOD_5, TSS, total phosphorus, pH

Underlined values------- indicates monitoring only, no effluent limits.

Division, Grand Trunk and Molmec Inc. discharge stormwater through outfalls 002, 010 and 011, outfall 001 and outfall 002 respectively during wet weather in addition to their other NPDES permitted discharges.

5.1.1.3 Continuous Municipal Dischargers

Pontiac WWTP

The City of Pontiac WWTP is a tertiary facility consisting of two separate secondary plants, one on East Boulevard and the other on Auburn Road. These plant share a combined design flow of 100,000 m^3/day (30 mgd) and an average flow of 45,000 m^3/day (15.0 mgd). The plants serve a separated sanitary and storm sewer system, but inflow from outlying townships is a problem during rains. There are no CSOs from the Pontiac sewer system.

The plants are operated in parallel and are combined for grit removal, primary sedimentation, aeration in biological reactors and secondary clarification and tertiary treatment. Ferric chloride for phosphorus removal is added in the primary clarifiers. The secondary effluents of both plants are combined at the Auburn Road plant and gravity filtration is performed in mixed filters of anthracite and sand. Tertiary treated wastewater is disinfected with chlorine in an aerated contact tank and discharged to the Clinton River.

Combined primary and secondary sludges are treated by anearobic digestion at each plant. At the Auburn Road Plant, all sludge is filtered and incinerated. Ash is sluiced to an on-site lagoon.

The Pontiac WWTP has final effluent limits for $CBOD_5$, total suspended solids, ammonia nitrogen, dissolved oxygen, total phosphorus, fecal coliform bacteria, total residual chlorine, pH, cadmium, and lead. Hexavalent chromium, silver and cyanide must be monitored (Table 5.1.1, Appendix 5.1).

Results of an MDNR point source wastewater survey conducted on August 18, 1986 at the Pontiac Wastewater Treatment Plant, indicated that during the survey the facility met the National Pollutant Discharge Elimination System (NPDES) permit final effluent limitations (Stone 1987a). Estimated annual loadings to the Clinton River for the parameters measured are shown in Table 5.1.2 along with the permitted effluent loadings for the Pontiac WWTP.

Pontiac has had an approved pretreatment program since 1985. There were initially 230 non-domestic users surveyed, 170 of which reported back. Of the total number, 65 were significant users, that is, they could have priority pollutants, process water greater than ten percent of the total WWTP flow, or were subject to a national categorical pretreatment standard. A major significant user, of which there were seven, requires pretreatment or monitoring (Table 5.1.3).

Table 5.1.2 Permitted and Estimated Loadings from Municipal Facilities in Section 5, of the Clinton River.

Conventional Loading	Pontiac WWTP** Annual Permitted Loading lbs/year	Pontiac WWTP** Annual Estimated Loading lbs/year	Pontiac WWTP** Loading lbs/day	Pontiac WWTP** Conc. ug/l	Rochester WWTP* Annual Permitted Loading lbs/year	Rochester WWTP* Annual Estimated Loading lbs/year	Rochester WWTP* Loading lbs/day	Rochester WWTP* Conc. ug/l
Suspended Solids	1100000	79493***		<4000	182500	99280	272	
Dissolved Solids		21138245	57913			8395000	23000	
BOD-5		75555	207			160600	440	
BOD-5(Carbon)	389500				136850	55115	151	
COD		754820	2068			244550	670	
TOC						56575	155	
NO2+NO3		528520	1448			26645	73	
NH3-N	193200	5293	14.5			18980	52	
Total Kjel. Nitrogen		45397	124.1			37595	103	
Total Phosphorus	45625	17374	47.6		6088	4015	11	
Orthophosphorus		15111	41.4			54.8	0.15	
CN(total)				<5.0				
Cl		4529650	12410			2912700	7980	
Na		3702925	10145			1934500	5300	
Metal Loading								
Silver				<0.5		11	0.03	
Aluminum		1496.5	4.1			1825	5	
Arsenic				<2.5				<2.5
Barium		814	2.23					
Beryllium				<1.0				<20
Cadmium	32			<0.2				<0.2
Cobalt				<10				<50
Chromium				<3.0		25.6	0.07	
Hex. Chromium				<5.0				<5.0
Copper		325	0.89			73	0.2	
Iron		1186	3.25					<100
Mercury				<0.5				<0.5
Lithium				<8.0				<20
Manganese		245	0.67			511	1.4	
Molybdenum		902	2.47					<50
Nickel		307	0.84			146	0.4	
Lead	411	80	0.22			36.5	0.1	
Antimony								<2.5
Selenium				<2.5				<2.5
Titanium		602	1.65					<25
Vanadium				<10				<25
Zinc		1442	3.95					<50
Organic Loading								
Phthalates								
HCB								
PCB								
TCE								
Toluene								
Xylene								
Phenol		361	0.99			146	0.4	
Bromodichloro-methane				7.0				
Dibromochloro-methane				2.0				

*=Results based on sampling done Nov. 18-19, 1987. Flow was measured at 2.51 million gallons per day.
**=Results based on sampling done Aug. 18-19, 1987. Flow was measured at 12.4 million gallons per day.
***=Estimated value

Table 5.1.3 City of Pontiac Industrial Pretreatment Program Major Significant Users

Name	Address	Business Type (SIC)	Raw Materials/ Chemicals	Toxicants	Volume Discharged
Art Metal Platers	61 Short Street Pontiac, MI 48058	Electroplater (3471)	Steel, Aluminum, Sulfuric Acid, Chromium, Copper, Nickel	Sulfuric Acid, Chromium, Copper, Nickel	Approx. 5,000 gpd of process water
General Motors Corp., Central Foundry	701 Glenwood Pontiac, MI	Grey Iron Foundry, Automotive Castings, (3321)	Scrap Steel, Sand	PCB, Sulfuric Acid	Approx. 242,000 gpd of water treatment excess and core belt wash overflow
General Motors Corp., Fisher Body Division	900 Baldwin Pontiac, MI 48055	Auto Manufacturer (3711)	Paint, Sealers, Welding Rod, Phosphating Materials	Tetrachloroethylene, Toluene, Xylene, Lead, Acids	Approx. 1,290,000 gpd of process water
General Motors Corp., Truck and Coach Division	660 S. Boulevard East Pontiac, MI 48093	Truck and Bus Manufacturer (3710)	Steel, Copper, Aluminum, Plastics, Rubber, Paint, Solvents, Sealers, Glass, Lubricants and Antifreeze	Chromium, Copper, Lead, Nickel, Acids	Approx. 1,150,000 gpd of process water
General Motors Corp., Pontiac Motors Division	One Pontiac Plaza Pontiac, MI 48053	Motor Vehicles and Equipment (3710)	Metals, Plastics, Oils, Paint, Solvents, Adhesives, Acids, Bases, Coolants, Salts, Plating, Cleaners, Printing Materials	Antimony, Arsenic, Cadmium, Chlorine, Chromium, Cobalt, Copper, Cyanide, Lead, Lithium, Nickel, Selenium, Silver, Zinc, Triaryl Phosphate Esters, Benzene, Trichloroethylene, Styene Hydroquione, Tetrachloroethylene, Chloroform, 1,1,1-Trichloroethylene, Xylene, Mercury	Approx. 797,000 gpd of process water

Table 5.1.3 continued

Name	Address	Business Type (SIC)	Raw Materials/ Chemicals	Toxicants	Volume Discharged
Circuit Boards of America, Inc.	938 Featherstone Rd. Pontiac, MI 48058	Electronic Components (3679)	Fiberglass, Epoxy, Copper	Copper, Acids	Approx. 75,000 gpd of process water
Pontiac Industrial Plating	27 Jacokes Pontiac, MI 48058	Plating (3471)	Nickel Sulfate, Nickel Chloride, Chromium Salts, Copper Sulfate, Zinc Oxide, Sodium Xydroxide	Acids, Chromium, Copper, Nickel, Zinc	Approx. 4,000-5,000 gpd of process water

Rochester WWTP

The Rochester wastewater treatment plant is a secondary municipal WWTP with phosphorus removal. It has a design flow of 2.0 mgd and a peak flow of 4.0 mgd. Industrial flow comprises 49 percent of the plant influent. The treatment system consists of a grit chamber, a bar screen, comminutor, primary settling tanks, aeration tanks, final settling tanks and chlorine contact chamber. Waste activated sludge is sent to the primary tanks.

Primary sludge goes to the two-stage anaerobic digesters. After digestion, the sludge is dried in drying beds or centrifuges. The dried sludge is applied to agricultural land. Intensive investigation of the sludges for metals and nutrients indicated that metals discharged by industries to the WWTP are not a problem.

The plant was improved in 1985-86 with the addition of a new primary tank, and renovation of the aeration tanks including installation of bubblers. Two digesters were also renovated, a sludge dewatering building was added which included a sludge centrifuge, and the plants electrical and plumbing systems were revised.

There are no combined sewers in this community's wastewater conveyance system and therefore, no combined sewer overflows to the Clinton River.

Results of a MDNR point source wastewater survey conducted at Rochester WWTP on August 18, 1986, indicated that during the survey, this facility met their National Pollutant Discharge Elimination System (NPDES) permit final effluent limits (Stone 1987b). Although the Rochester WWTP must meet limits for $CBOD_5$, total suspended solids, dissolved oxygen, pH, fecal coliform bacterial, total residual chlorine, ammonia nitrogen, and total phosphorus, other parameters were measured during this survey. Annual estimated loadings, based on this survey, are presented in Table 5.1.2. Appendix 5.1 contains their NPDES permit limits.

The Rochester WWTP exceeded its carbonaceous BOD_5 seven day average limit three times in 1986, and missed the minimum dissolved oxygen level five times based on quarterly compliance reports. Although there are no combined sanitary overflows in Section 5, occasional overflows or bypasses may occur at the Rochester WWTP during very rainy weather.

The City of Rochester has had an industrial waste monitoring program since 1975 with support from the Oakland County Health Department. Based on a 1980 survey, there are approximately 300 non-domestic users in the service area. Table 5.1.4 lists thirty three of these which were considered significant users, most of which are small volume metal producers, metal platers and machine shops. The four major significant dischargers of concern to the city are highlighted with asterisks.

Parke-Davis Company cooling water discharge was investigated in 1973 for toxicity to minnows. Results of a 96-hour continuous flow bioassay suggested that algicides in the cooling tower may have caused the high mortality and that the cooling water discharge could be detrimental to the Clinton River. Parke-Davis now pretreats its sulfuric acid and waste solvents and contributes an estimated 380,580 gallons per day of effluent (33% of total influent) to the Rochester WWTP.

Table 5.1.4. Significant Industrial Dischargers to the Rochester WWTP.

Company Name	Standard Industrial Classification Title	Daily Flow (gals/day)	Chemical
Rochester Packing**	Meat Packing	3,458	Conventional
Parke Davis**	Drugs	380,580	Sulfuric Acid, Waste Solvents Phenolic Compounds
James River Rochester**	Paper Mill	153,736	Biocides, Strong Acids, Solvents Phenolic Compounds
Troy Lab**	Electroplating	22,498	Solvents, Heavy Metals, Aluminum
Metalmite Corp	None	271	Metals
Auburn Metalfab	Fabric, Structural Metals Products	1,589	Solvents
SBS Corp.	Boiler Shops	439	None
W.P. Burke Co.	Screw Machine Products	440	None
Metal Awning Co.	Metal coars sash trim	115	None
Ferro Plastic	Misc. Plating	1,148	Solvents
Hoff. Eng. Co.	3569(?)*	--	None
Fab Machine & Tool	Fabric Metal Products	100	None
Dynamic Mold	Plastic	631	None
Cygnus Company	Metals, Acids	--	None
Acorn Tool & Die	3540 (?)	210	None
Torca Products	Metals Prod.	3,156	Solvents
Melody Tool & Mold	Metals Prod.	--	Solvents
Exacto Mold	Casting	41	None
B & M Bending	Metal Prod.	--	None

Table 5.1.4. Continued.

Company Name	Standard Industrial Classification Title	Daily Flow (gals/day)	Chemical
Rochester Manuf.	None	7,442	Solvents
T & S Tool	None	64	None
Great Lakes Spline	None	—	None
Recon Corp.	Industrial Machinery	374	None
Lynd Gear	None	—	Solvents
Boyle Machine	None	162	None
J.B. Harmon	None	—	None
Expert Hydraulics	None	—	None
Numerical Machine	3599(?)	526	None
Rochester Tube	Metal Heat Treating	292	None
Avon Gear	Iron and Steel Forging	664	None
Nu-Products	None	8,238	None
Solaronics	Metals	3,013	None
ITT Higbee	Steel	2,816	None

*SIC Title not provided in permit listing
**Major significant users

Source: Rochester WWTP, Pretreatment File, MDNR

The James River Paper Company pretreats and discharges 0.15 mgd to the Rochester WWTP. The major treatment required is for solids removal. Rochester Packing also pretreats prior to discharging 0.0035 mgd of wastewater to the Rochester WWTP and is a source of conventional pollutants (BOD_5, SS, TP, etc). Troy Laboratory is the only industry on the categorical list since it discharges heavy metals to the system.

5.1.1.4 Intermittent Point Sources

Intermittent point sources include unintentional overflows and bypasses, from municipal systems, urban stormwater discharges, and intermittent industrial stormwater discharges. None of the above have been assessed or quantified in Section 5.

5.1.2 Nonpoint Sources

Nonpoint sources of pollutants in Section 5 include urban, rural, suburban, and industrial site runoff, landfills, dumps and other potential sites of environmental contamination and atmospheric deposition.

5.1.2.1 Urban Stormwater

Urban stormwater loadings were estimated by SEMCOG (1978) for the main branch of the Clinton River which includes our River Sections 1, 2, 3, and 5. Percent of total load was calculated using 1987 point source data shown in Table 5.1.5. For Sections 1, 2, 3, and 5, the Main Branch of the Clinton River from the Pontiac area to the mouth through the natural channel and the spillway, approximately 29,369 metric tons per year of suspended solids, 996 metric tons of BOD_5, 129 metric tons of nitrogen, and 55 metric tons of phosphorus were contributed from urban stormwater runoff. These data indicate that urban stormwater contributes 93, 66, 25 and 65% of the total loading of suspended solids, BOD_5, total nitrogen and total phosphorus, respectively, to the Main Branch and the spillway (Sections 1,2,3, and 5).

Suspended solids loadings from stormwater to Section 5 downstream as far as Rochester were estimated at 18,069 metric tons per year, similar to suspended solids loadings from urban runoff in Section 4 - Red Run, and one-third greater than stormwater suspended solids loadings from Section 6.

5.1.2.2 Rural and Suburban Runoff

Rural and suburban runoff may include runoff from grassland and active croplands. Estimates of these types of runoff for Section 1, 2, 3, and 5 were estimated by SEMCOG (1978) and are shown in Table 5.1.5.

Much of the watershed in the Pontiac/Rochester area (Section 5) is active cropland or grasslands with parklands adjacent to the river near Rochester-Utica. Rural and cropland runoff contribute a relatively small quantity of conventional constituents to Section 5. SEMCOG (1981) identified the Rochester-Utica Recreation Area as a priority area for stormwater management (Figure 5.1.1). Based on the 1982 Natural Resources Inventory (NRI) of Macomb County, about 166,300 tons of soil is lost

Table 5.1.5. **Comparison of Actual and Percent Annual Pollutant Loadings to the Clinton River Basin by Sections**

Area		Point Source	Urban Stormwater	Runoff from Grassland	Runoff from Active Cropland	Combined Sewer Overflows	Total
Section 1,2,3, and 5							
Metric Tons Per Year	(SS)	299.0	29369	811	1247	0	31666.0
	(BOD)	338.0	996	72	101	0	1507.0
	(N)	301.0	129	39	40	0	511.0
	(P)	21.9	55	5	7	0	88.9
Percent Load	(SS)	0.8	92.7	2.6	3.9	0	100%
	(BOD)	22.4	66.1	4.8	6.7	0	100%
	(N)	58.9	25.2	6.5	9.4	0	100%
	(P)	24.6	61.9	5.6	7.9	0	100%
Section 4							
Metric Tons Per Year	(SS)	199.2	18223	87.0	38.0	636.0	19123.2
	(BOD)	49.8	620	27.0	29.0	170.0	889.8
	(N)	3.9	78	13.5	11.5	49.0	155.9
	(P)	14.9	34	1.2	1.0	18.4	69.5
Percent Load	(SS)	0.7	95.3	0.5	0.2	3.3	100%
	(BOD)	5.6	69.7	3.0	2.6	19.1	100%
	(N)	2.5	50.0	8.7	7.4	31.4	100%
	(P)	21.4	48.9	1.7	1.5	26.5	100%
Section 6							
Metric Tons Per Year	(SS)	41.1	12865	1523.0	25722	0	40151.1
	(BOD)	29.1	440	109.0	2012	0	2590.1
	(N)	20.1	56	56.0	1170	0	1302.1
	(P)	10.3	24	7.5	129	0	170.8
Percent Load	(SS)	0.1	32.0	3.8	64.1	0	100%
	(BOD)	1.1	17.0	4.2	77.7	0	100%
	(N)	1.5	4.3	4.3	89.9	0	100%
	(P)	6.0	14.1	4.4	75.5	0	100%
Total Basin							
Metric Tons Per Year	(SS)	419.4	60457	2421.0	27007.0	636.0	90940.4
	(BOD)	411.2	2056	208.0	2136.0	170.0	4981.2
	(N)	324.5	263	102.5	1229.5	49.0	1968.5
	(P)	46.8	113	13.7	145.0	18.4	336.9
Percent Load	(SS)	0.4	66.5	2.7	29.7	0.7	100%
	(BOD)	8.2	41.3	4.2	42.9	3.4	100%
	(N)	16.5	13.4	5.2	62.4	2.5	100%
	(P)	13.9	33.5	4.1	49.0	5.5	100%

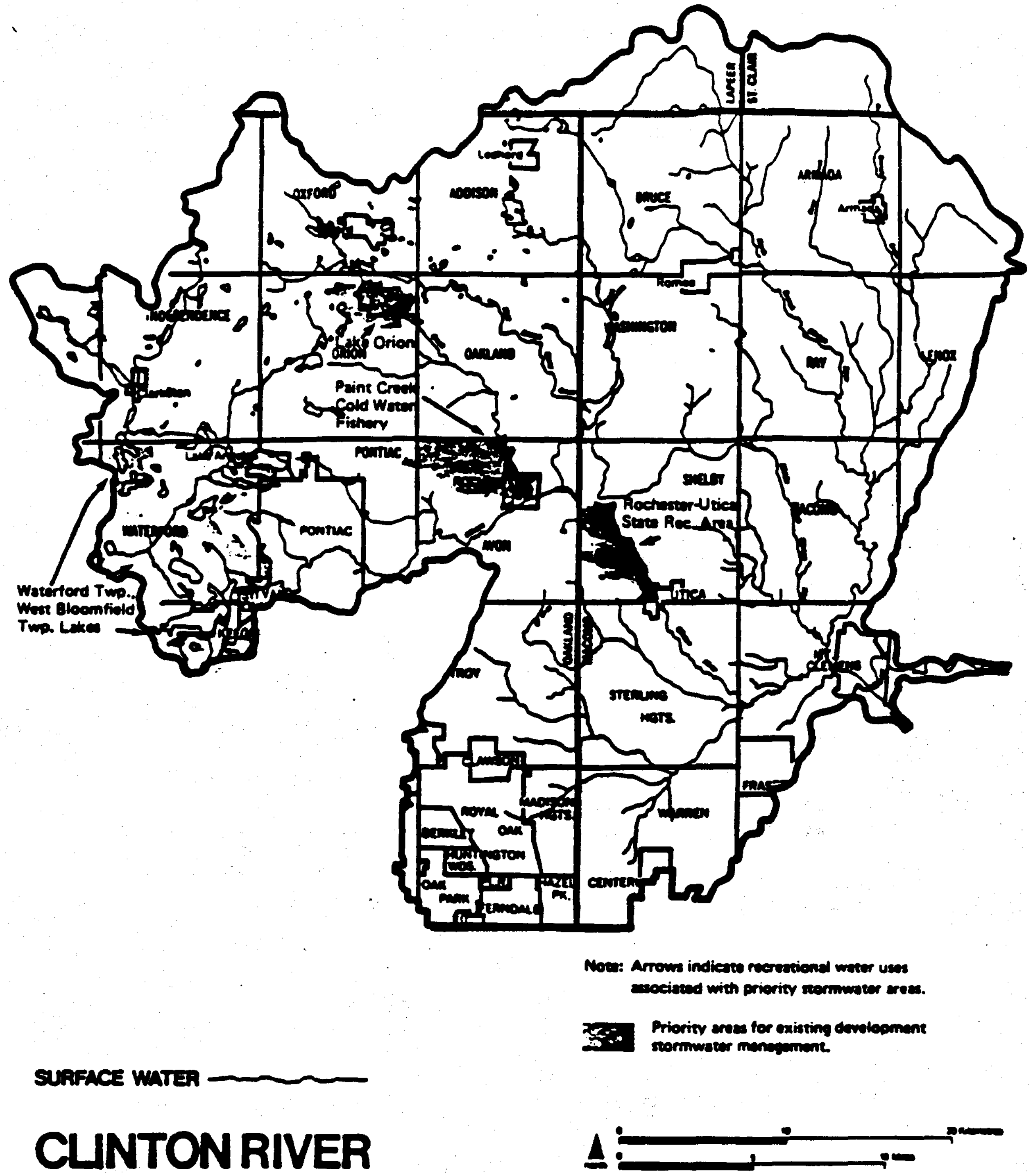


Figure 3.1.1. Priority Stormwater Management Areas in Developed Areas of the Clinton River

Source: SEMCOG 1981

annually from water erosion to the Clinton River and its tributaries (J. Johnson, USDA Personal Communication, March 12, 1987).

5.1.2.3 Industrial Site Runoff

There are currently no estimates of pollutant loads from industrial site runoff, but industrial areas generally have higher loadings of contaminants than commercial or residential areas (SEMCOG 1978a).

5.1.2.4 Landfills, Dumps and Other Sites of Potential Environmental Contamination

Waste Disposal Sites

There are 32 Type II or Type III waste disposal sites (including refuse processing stations and incinerators) in the Section 5 watershed (Table 5.1.6, Map 6.6). Nine are in Macomb County and 23 are in Oakland County. There are four Type II and one Type III landfills that are open and monitoring is required. There are five Type II landfills and one Type III landfill that are closed, and have monitoring. There are 15 Type II and four Type III landfills that are closed with no monitoring. In addition, there is one incinerator that is closed with no monitoring, and one refuse processing station that is open but with no monitoring required.

The landfills presently open are: A and A Landfill (Type II) and Malow Disposal (Type III) in Macomb County; Southeast Oakland County Incinerator Authority Sanitary Landfill (Type II), Weber Sand and Gravel, (Type II), Waterford Sanitary Landfill (Type II), and Pontiac Central Mfg. Refuse Plant (Refuse processing) in Oakland County. The impact, if any, from these sites on the Clinton River is unknown. Specific information on these sites can be obtained from the MDNR Environmental Response Division at the Detroit District Office in Northville.

Act 307 Sites of Environmental Contamination

Michigan's Public Act 307 (The Michigan Environmental Resource Act) provides for the identification, risk assessment, and priority evaluation of environmental contamination sites in the state (MDNR 1986a). Two lists are developed each year by the Environmental Response Division. One list identifies all known sites requiring further "evaluation and interim response activities." The other list identifies sites where "response activities" are to be undertaken by the State. Priority List One is divided into two groups of sites as follows:

Group 1: Scored Sites (in Rank Order by County)
Group 2: Screened Sites (by County).

Group 1 is composed of sites which have been scored, based on a risk assessment model on a scale of 10-2000 by the Michigan Site Assessment System (SAS) (MDNR 1986a). Group 2 are sites screened by the Michigan Site Assessment System, but not scored by the detailed risk assessment model. Screening scores range from one to 15.

TABLE 5.1.6. WASTE DISPOSAL SITES IN CLINTON RIVER WATERSHED SECTIONS 1,3,4,5, AND 6, MACOMB COUNTY, MICHIGAN, 1987.

********* MACOMB COUNTY *********

MAP ID NUMBER	LATITUDE	LONGITUDE	SITE NAME	TOWNSHIP	WASTE DISPOSAL TYPE	SITE STATUS
			SECTION 1.			
MA08	42 34 42	82 47 17	Metropolitan Beach Incin.	Harrison	Incinerator	Cl, No monitoring
			SECTION 3.			
MA04	42 36 19	82 53 37	M-97 Landfill	Clinton	Landfill - 2	Cl, No monitoring
MA05	42 32 49	82 55 12	Fourteen Mile Rd. Site	Clinton	Landfill - 2	Cl, No monitoring
MA06	42 34 44	82 57 09	Clinton River Rd DS Area	Clinton	Landfill - 2	Cl, No monitoring
			SECTION 4.			
MA15	42 30 26	82 57 42	So. Macomb Disp. Auth.	Roseville	Transfer Station	Op, No monitoring
MA26	42 32 50	82 58 24	Hayes Road Site 8	Sterling Hgts	Landfill - 2	Cl, No monitoring
MA27	42 33 52	82 58 39	So. Macomb Disp. Auth. 6	Sterling Hgts	Landfill - 2	Cl, No monitoring
MA28	42 32 28	83 03 02	Wiegland Disposal Inc.	Sterling Hgts	Transfer Station	Cl, No monitoring
MA29	42 29 10	83 02 35	City of Warren DPW Garage	Warren	Incinerator	Cl, No monitoring
MA30	42 29 01	82 59 07	City of Warren Refuse TS	Warren	Transfer Station	Op, No monitoring
MA31	42 30 15	83 02 22	Gen. Motors Tech Center	Warren	Refuse Process	Op, No monitoring
			SECTION 5.			
MA17	42 39 30	83 05 24	A & A Landfill Inc.	Shelby	Landfill - 2	Op, Monitoring
MA18	42 38 04	83 02 57	St. Lawrence Cemetary	Shelby	Landfill - 2	Cl, No monitoring
MA19	42 37 41	83 02 23	Utica Site	Shelby	Landfill - 2	Cl, No monitoring
MA20	42 39 10	83 04 35	Hamlin 2	Shelby	Landfill - 2	Cl, No monitoring
MA21	42 37 41	83 02 03	American Legion 351	Shelby	Landfill - 2	Cl, No monitoring
MA22	42 37 50	83 02 40	Ramona Park SLF	Shelby	Landfill - 2	Cl, No monitoring
MA23	42 38 44	83 05 12	Malow Disposal	Shelby	Landfill - 3	Op, Monitoring
MA24	42 38 55	83 04 31	Hamlin Landfill	Shelby	Landfill - 2	Cl, Monitoring
MA25	42 40 02	83 04 33	G & H Landfill	Shelby	Landfill - 2	Cl, Monitoring
			SECTION 6.			
MA32	42 46 48	83 04 32	So. Macomb Disp. Auth. Site 7	Washington	Landfill - 2	Cl, Monitoring
MA33	42 47 13	83 04 01	Walker Land Reclamation	Washington	Landfill - 2	Cl, Monitoring
MA34	42 46 43	83 02 53	Washington Twp Site 010	Washington	Landfill - 2	Cl, Monitoring
MA35	42 46 46	83 04 29	So. Macomb Disp Auth. LF 011	Washington	Landfill - 2	Cl, Monitoring
MA36	42 45 55	83 05 05	Stony Creek Metro. Park	Washington	Landfill - 2	Cl, No monitoring
MA01	42 49 34	82 55 00	Armada Township San. LF	Armada	Landfill - 3	Cl, No monitoring
MA03	42 37 54	82 49 12	Rosso Hwy SAFB	Chesterfield	Landfill - 3	Cl, No monitoring
MA10	42 45 10	82 48 56	Lenox Township Disposal	Lenox	Landfill - 2	Cl, No monitoring
MA11	42 41 02	82 54 40	So. Macomb Disp. Auth. 9	Macomb	Landfill - 2	Cl, Monitoring
MA12	42 46 12	82 56 55	Ray Township Disposal	Ray	Landfill - 2	Cl, No monitoring
MA13	42 45 57	82 57 00	Ray Township Transfer site	Ray	Transfer Station	Op, No monitoring
MA14	42 49 10	82 48 15	Richmond Township LF	Richmond	Landfill - 3	Cl, No monitoring

Cl = Closed
Op = Open

TABLE 5.1.6 CONTINUED. WASTE DISPOSAL SITES IN CLINTON RIVER WATERSHED SECTIONS 4 AND 5, OAKLAND COUNTY, MICHIGAN, 1987.

******** OAKLAND COUNTY ********

MAP ID NUMBER	LATITUDE	LONGITUDE	SITE NAME	TOWNSHIP	WASTE DISPOSAL TYPE	SITE STATUS
			SECTION 4.			
OK23	42 29 52	83 08 01	Unknown	Royal Oak	Landfill - 2	Cl, No monitoring
OK24	42 29 50	83 05 47	Unknown	Royal Oak	Landfill - 2	Cl, No monitoring
OK25	42 29 48	83 05 45	Unknown	Royal Oak	Landfill - 2	Cl, No monitoring
OK26	42 30 21	83 06 00	Southeastern Oakl. Co. Incin.	Royal Oak	Incinerator	Op, Monitoring
OK27	42 32 24	83 11 08	S.E. Oakl. Co. Incin. Auth.	Troy	Transfer Station	Op, Monitoring
OK28	42 37 00	83 06 28	Northeast Landfill Inc.	Troy	Landfill - 2	Cl, No monitoring
OK29	42 36 33	83 07 26	Cleary Property	Troy	Landfill - 2	Cl, No monitoring
			SECTION 5.			
OK01	42 39 43	83 06 28	S.E. Oakl. Co. Incin. Auth. San. LF	Avon	Landfill - 2	Op, Monitoring
OK02	42 39 48	83 06 37	S.E. Oakl. Co. Incin. Auth. San. LF	Avon	Landfill - 2	Cl, Monitoring
OK03	42 39 53	83 06 28	S.E. Oakl. Co. Incin. Auth. San. LF	Avon	Landfill - 2	Cl, Monitoring
OK04	42 38 58	83 11 25	Adams Rd. Landfill	Avon	Landfill - 2	Cl, No monitoring
OK05	42 39 18	83 05 43	Sandfill #2	Avon	Landfill - 3	Cl, No monitoring
OK06	42 39 24	83 06 28	Six Star LTD	Avon	Landfill - 3	Cl, No monitoring
OK07	42 39 15	83 05 45	Sandfill Inc. #1	Avon	Landfill - 2	Cl, No monitoring
OK08	42 38 50	83 11 10	Cardinal Landfill Corp.	Avon	Landfill - 2	Cl, No monitoring
OK09	42 36 22	83 16 48	Ankerson Resource Systems Inc.	Bloomfield	Landfill - 2	Cl, No monitoring
OK10	42 44 02	83 25 17	Dervage Disposal	Independence	Landfill - 2	Cl, No monitoring
OK11	42 44 01	83 25 35	Don Powell Disposal	Independence	Landfill - 2	Cl, No monitoring
OK12	42 43 22	83 26 41	Inter Lakes Auto and Truck Salvage	Independence	Landfill - 3	Cl, No monitoring
OK13	42 43 48	83 16 24	Weber Sand and Gravel	Orion	Landfill - 2	Op, Monitoring
OK14	42 42 33	83 17 22	Garavaglia Disposal Co.	Orion	Landfill - 2	Cl, No monitoring
OK15	42 42 48	83 14 16	Sanicon Landfill	Orion	Landfill - 2	Cl, No monitoring
OK16	42 41 44	83 17 02	Industrial Services of America	Pontiac	Landfill - 2	Cl, No monitoring
OK17	42 38 25	83 14 52	Salterelli Landfill	Pontiac	Landfill - 3	Cl, Monitoring
OK18	42 41 24	83 17 15	Collier Rd. Landfill	Pontiac	Landfill - 2	Cl, Monitoring
OK19	42 42 26	83 13 48	Oakl. Co. Rd. Comm. San. LF #2	Pontiac	Landfill - 2	Cl, No monitoring
OK20	42 38 52	83 13 37	Northeast Lf and Sand Co.	Pontiac	Landfill - 3	Cl, No monitoring
OK21	42 38 41	83 12 45	General RFS and Pathological Incin.	Pontiac	Incinerator	Cl, No monitoring
OK22	42 43 04	83 11 45	Pontiac Central Mfg. Refuge Plant	Pontiac	Refuse Process	Op, No monitoring
OK30	42 40 25	83 22 13	Waterford San. Lf LTD	Waterford	Landfill - 2	Op, Monitoring

Cl = Closed
Op = Open

There are five Group 1 307 sites in Macomb County and twelve Group 1 307 sites in Oakland County within the Section 5 watershed (Map 6.7). In addition, there are four Group 2 307 sites in Macomb County and 21 Group 2 307 sites in Oakland County (Table 5.1.7). Twenty-one of the 42 sites were contaminated by landfills, but other sources include gasoline stations, oil and pipeline spills, industrial wastes, and salt storage. Contaminants include organics, metals, pesticides, oils, solvents, salt, and chemical manufacturing products.

Resources affected are primarily ground water and soils, but air and surface water are affected or potentially affected at some sites. Six sites are listed as having affected surface water. These sites include Hamlin Road Landfill, Great Lakes Container, Anchor Motor Freight, Sanicem, Oakland County Road Commission, and Pontiac Motor Division Truck and Coach. Site descriptions prepared by the Site Assessment Unit, Environmental Response Division, MDNR, are provided for these sites in Appendix 5.2. Twelve additional sites are listed as potentially having an effect on surface water. The extent of contamination at these sites is unknown.

Only G & H Landfill and Liquid Disposal Inc. (LDI) are CERCLA (Superfund) sites, and also have had feasibility studies or remedial actions completed or begun under CERCLA. However, the portion of the Clinton River surveyed to determine their impact on the surface water bracketed eight 307 sites including Avon Township J & L Landfill (68), G & H Landfill (01), LDI (04), Hamlin Road Landfill (06), Ryan and 23 Mile Rd (05), Sandfill Landfill No. 2 (20), Closed Hamlin Rd (42) and Sandfill Landfill No. 1 (60). The numbers in parenthesis refers to their locations shown in Map 6.7. Although recent remedial investigations by both MDNR and USEPA showed no contaminant migration into the river, these sites do contain contaminated groundwater and possible overland runoff to the Clinton River (MDNR 1986a) (Appendix 5.2).

Hazardous Waste Treatment, Storage or Disposal Sites

There are six active Storage or Disposal facilities located in the Section 5 watershed, and one active Hazardous Waste Treatment facility (Table 5.1.8, Map 6.8). One site is closed, another is partially closed, and another is proposed to be closed. All except one is regulated by the local pretreatment ordinances for toxic materials and under the NPDES permits system for cooling or stormwater discharges. The impact from these facilities on the Clinton River is not expected to be measurable.

Atmospheric Sources

The contribution of pollutants from atmospheric deposition is unknown. The only reference is a 1986 report (Kenaga and Jones, 1986) suggesting that nearby facilities (an asphalt plant, exhaust from vehicles, an open burning dump, and past incineration activities at LDI) may have contributed to contaminant levels in Clinton River sediments.

Table 5.1.7

MICHIGAN SITES OF ENVIRONMENTAL CONTAMINATION IN SECTION 1 - THE MAIN BRANCH CLINTON RIVER FROM THE SPILLWAY TO THE MOUTH

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
GROUP 1										
Macomb	0750 07-30-86	03	Clinton River Mt. Clemens to Mouth Harrison	Unknown	Unknown	Chrome Lead Oil & Grease	Sediment Surface Water	Fauna Flora	42 35 48	82 49 43
Macomb	0891 07-30-86	12	Selfridge ANG Base 50-02N-14E-129F Harrison	National Security	Landfill	Copper Volatile Organics	Groundwater Soil	Surface Water Air	42 36 18	82 48 45
GROUP 2										
Macomb	08	28	NI Industries/Mirrex 50-02N-13E-10 Clinton	Paint Products	Barrel Surface Discharge	Paint Waste	Air Soil	Groundwater	42 35 55	82 52 53

Table 5.1.7 continued

MICHIGAN SITES OF ENVIRONMENTAL CONTAMINATION IN CLINTON RIVER SECTIONS 2 AND 3, THE SPILLWAY AND THE MAIN BRANCH OF THE CLINTON RIVER BETWEEN RED RUN AND THE SPILLWAY, RESPECTIVELY

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
SECTION 2 **Group 2**										
Macomb	07 11-01-84	36	John March Gas Sta 16 Mile & Gratiot 50-02N-13E-27Aa Clinton	Gas Station	Underground Tank	Benzene Toluene Xylene	Groundwater		42 34 09	82 53 33
SECTION 3 **Group 2**										
Macomb	05 10-11-84	41	Clinton River Rd Disp Area 50-02N-13E-19AD Clinton	Landfill	Landfill	Phenols	---	Groundwater to Soil	42 34 45	82 57 16

Table 5.1.7 continued

MICHIGAN SITES OF ENVIRONMENTAL CONTAMINATION IN CLINTON RIVER SECTION 4 WATERSHED

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
GROUP 1										
Macomb	0815 01-10-85	02	Red Run Drain LF 50-02N-12E-25A Sterling Heights	Landfill	Landfill Unknown	Heavy Metals, Toluene, Benzene	Surface Water		42 33 03	82 59 18
GROUP 2										
Macomb	06 09-04-84	40	Tuff Kote Dinol, Inc. 50-01N-12E-12CC Warren	Unknown	Unknown	Light Industrial		Groundwater, Air	42 30 32	82 59 09
Macomb	06 08-13-86	39	Fini Finish Prod. 50-01N-12E-29AA Warren	Plating, Polishing	Surface Discharge	Chrome, Cyanide	Surface Water, Soil		42 28 35	83 02 49
Macomb	07 09-26-86	32	GE Carboloy 50-01N-12E-34DC Warren	Electronic Component	Underground Tank	Acetone	Groundwater		42 27 01	83 00 54
Macomb	07 09-27-86	33	Koch Rd Dump 50-02N-12E-32BD Sterling Heights	Unknown	Landfill, Barrel	Heavy Mfg		Surface Water, Groundwater, Soil	42 32 41	83 03 40
Macomb	07 08-13-86	30	Clark Gas Station 50-01N-12E-05DA Warren	Gas Station	Underground Tank	Gasoline	Groundwater, Soil		42 31 33	83 03 01
Macomb	07 09-30-87	48	Amoco Station #5414 50-02N-12E-34BB Sterling Heights	Gas Station	Pipeline	Toluene, Benzene, Xylene	Groundwater, Soil		42 32 56	83 01 42

Section 4 Continued (Table 5.1.7)

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
GROUP 2 CONTINUED										
Macomb	07 08-17-87	47	Mobil Station 12 Mile & Ryan 50-01N-12E-08CC Warren	Gas Station	Underground Tank	Petroleum	Groundwater, Soil		42 30 16	83 04 02
Macomb	06 08-6-87	45	Mobil Station 04LCW 50-02N-12E-35CC Sterling Heights	Gas Station	Underground Tank	Petroleum	Groundwater, Soil		42 32 19	83 00 16
Oakland	03 10-11-84	67	Old Fons Sanitary LF 63-02N-11E-01BC Troy	Landfill	Landfill	Ammonia		Surface Water, Groundwater	42 37 02	83 06 29
Oakland	05 08-15-86	62	Ethyl Corp 63-01N-11E-33CD Ferndale	Petro Refining	Pit	Chem Prod Mfg		Groundwater, Soil	42 26 52	83 08 20
Oakland	07 09-27-86	55	Howard Plating 63-01N-11E-01AA Royal Oak	Plating, Polishing	Surface Discharge	Cyanide, Heavy Metals	Groundwater, Soil		42 31 58	83 05 24
Oakland	07 10-11-84	54	Davis Mfg Clawson 63-02N-11E-34BC Troy	Unknown		TCE	Soil		42 32 33	83 08 30
Oakland	07 08-17-87	72	Howard Gas & Go 63-01N-11E-01 Royal Oak	Unknown	Underground Tank	Gasoline	Groundwater, Soil		42 29 10	83 05 30

*The common site name is for identification only and is not necessarily a party responsible for contamination.

Table 5.1.7 continued

MICHIGAN SITES OF ENVIRONMENTAL CONTAMINATION IN
CLINTON RIVER SECTION 5 WATERSHED

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
GROUP 1										
Macomb	1085 01-20-87	01	G & H Landfill 50-03N-12E-19AA Shelby	Landfill	Landfill	PCBs, Phthalates Benzenes, Chromium, Cyanide, Solvents	Groundwater, Fauna, Flora, Soil	Sediment, Surface Water	42 40 02	83 04 33
Macomb	0676 10-10-84	04	Liquid Disposal Inc. 50-03N-12E-30AA Shelby	Haz Waste Facility	Lagoon, Underground Tank	PCBs, TCE, PCE, Phthalates	Groundwater, Air	Surface Water, Sediment, Soil	42 39 09	83 04 28
Macomb	0668 10-08-85	05	Ryan & 23 Mile Rd 50-03N-12E-19CD Shelby	Unknown	Unknown	TCE, Toluene, Xylene, Vinylidene, Chloride	Groundwater, Res. Well		42 39 59	83 04 24
Macomb	0503 10-11-84	06	Closed Hamlin Rd Landfill East 50-03N-12E-19CD Shelby	Landfill	Landfill	Methylene Chloride, Dichloro- propane, Chlorobenzene	Surface Water	Surface Water, Sediment, Groundwater, Air	42 39 10	83 04 31
Macomb	0464 08-08-85	08	Res. Wells Cedargrove 50-03N-12E-20AB Shelby	Unknown	Unknown	Dichloro- ethane	Groundwater	Res. Well	42 40 02	83 03 41
Oakland	0934 08-26-86	13	Great Lakes Container Corp. 63-03N-10E-08AA Pontiac	Barrel Reclaiming	Barrel, Landfill	Dieldrin, Lead, Carbon Tetrachlor, Cadmium, Nickel	Surface Water, Sediment, Groundwater	Air, Res. Well	42 41 25	83 17 42

Section 5 Continued (Table 5.1.7)

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
GROUP 1 CONTINUED										
Oakland	0783 01-26-87	26	Anchor Motor Freight 63-03N-10E-16BA Pontiac	Truck Transport	Surface Discharge	Oil, Solvents, Diesel Fuel	Surface Water, Groundwater, Air, Soil, Wetland	Fauna, Flora	42 40 20	83 17 00
Oakland	0758 09-27-86	14	Res Wells Sashabaw Road Area 63-04N-09E-34DB	Unknown	Unknown	Benzene, Toluene, Xylene, Dichloro-ethane	Groundwater, Soil, Res. Well		42 42 40	83 22 33
Oakland	0699 10-11-84	15	Cardinal Land Corp Veterans 63-03N-11E-29BC-BD Avon	Landfill	Unknown	Chromium, Manganese	Res. Well	Surface Water	42 38 50	83 11 10
Oakland	0680 10-08-85	16	Sanicem LF J Fons Co 63-03N-10E-02AA Pontiac	Landfill	Landfill	PCBs, Zinc	Surface Water, Groundwater		42 42 22	83 14 17
Oakland	0668 09-18-84	17	Bald Mountain Rec Area 63-04N-10E-22BB Orion	Landfill	Waste Pile, Geologic Fm, Barrel	Benzene, Lead, Toluene, TCE, Dichloroethane	Soil	Surface Water, Sediment, Groundwater, Res. Well	42 44 30	83 15 30
Oakland	0638 10-08-84	18	Industrial Services of America 63-03N-10E-04CA Pontiac	Landfill	Landfill	Phenols, Naphthalene, Chloroethane		Surface Water, Groundwater	42 41 44	83 17 02

Section 5 Continued (Table 5.1.7)

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
GROUP 1 CONTINUED										
Oakland	0588 08-23-85	19	Collier Rd LF Pontiac 63-03N-10E-09B Pontiac	Landfill	Landfill	Phenol, Dichloro-ethane, Chloro-ethane	Groundwater	Res. Well, Wetland, Sediment	42 41 24	83 17 15
Oakland	0578 10-10-84	20	Sandfill LF No 2 63-03N-11E-24DD Avon	Landfill	Landfill	Chem Prod Mfg, Domestic Comm		Groundwater, Res. Well	42 39 16	83 05 40
Oakland	0574 08-22-85	21	Christianson & Adams Road Dumps 63-03N-11E-29BB Avon	Landfill	Landfill	Chromium, Lead, Zinc	Soil	Surface Water, Groundwater, Wetland	42 38 58	83 11 25
Oakland	0510 01-29-85	23	Lanthier Foundry and Machine 63-05N-10E-22DD	Iron Steel Foundry	Surface Discharge	Perchloro-ethylene	Soil, Groundwater		42 49 35	83 15 35
Oakland	0413 08-22-85	25	House of Imports 63-03N-11E-02CC Avon	Misc Metal Product	Lagoon	Chromium, Oil, Grease	Soil	Groundwater	42 41 51	83 07 51
GROUP 2										
Macomb	07 10-10-84	29	Carolee St Area 50-03N-12E-22 Shelby	Salt Storage	Unknown	Salt, Chloride	Groundwater	Surface Water, Soil Res. Well	42 39 44	83 01 29

Section 5 Continued (Table 5.1.7)

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
GROUP 2 CONTINUED										
Macomb	07 10-10-84	34	Ramona Park LF 50-03N-12E-33CA Shelby	Landfill	Landfill	Phenols	Surface Water	Surface Water, Sediment, Groundwater, Res. Well	42 37 54	83 02 41
Macomb	07 01-27-86	37	Walker Land Reclamation 50-04N-12E-05DC Washington	Landfill	Lagoon, Barrel	Chemical Products Mfg		Soil, Groundwater	42 47 13	83 04 01
Macomb	05 10-10-84	42	Closed Hamlin Rd Landfill West 50-03N-12E-19DC Shelby	Landfill	Landfill	Light Industrial		Groundwater, Municipal Well, Res. Well	42 39 10	83 04 50
Macomb	05 10-10-84	43	Utica Site Cardinal Land Corp. 50-03N-12E-33DC Shelby	Landfill	Landfill	Light Industrial		Surface Water, Groundwater	42 37 41	83 02 23
Oakland	08 08-01-86	49	Kayo Oil Co. 63-03N-10E-31AD Pontiac	Gas Station	Underground Tank	Benzene, Ethylbenzene, Toluene, Xylene	Groundwater		42 37 47	83 18 21
Oakland	08 10-11-84	50	Kingston Development 63-03N-11E-24DC Avon	Auto Mfg.	Landfill	Domestic · Comm., Heavy Mfg.	Groundwater, Residential Well	Surface Water	42 39 18	83 06 01
Oakland	08 09-26-86	51	Michigan Dust Control 63-03N-10E-17AB Pontiac	Oil Storage	Aboveground Tank, Surface Discharge	Oil		Groundwater	42 40 18	83 17 52

Section 5 Continued (Table 5.1.7)

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
GROUP 2 CONTINUED										
Oakland	08 08-19-85	52	Oakland Co. Rd Comm. Dixie Lake 63-04N-08E-03DC Springfield	Salt Storage	Pile	Sodium Chloride	Surface Water, Groundwater, Res. Well	Soil, Wetland	42 46 31	83 29 57
Oakland	08 10-03-84	53	Pontiac GMC Truck and Coach Division 63-02N-10E-03AA Pontiac	Auto Mfg.	Barrel, Landfill	PCBs, Cyanide	Surface Water, Soil	Groundwater, Air, Res. Well	42 43 04	83 11 45
Oakland	07 10-11-84	58	Oakland Co. Rd Comm Sanitary LF 63-03N-10E-01BB Pontiac	Landfill	Barrel, Landfill	Domestic Comm., Light Industrial		Groundwater, Soil	42 42 26	83 13 48
Oakland	07 08-20-85	59	Stans Trucking LF 63-03N-11E-24C Avon	Landfill	Landfill	Phenols, Chromium, Lead, Zinc, Copper, 11-Dichloroethane	Groundwater	Soil	42 39 24	83 06 28
Oakland	06 08-25-86	68	Avon Twp J & L 63-03N-11E-24DD Avon	Landfill	Landfilll	Copper, Chromium		Surface Water, Groundwater	42 39 17	83 05 43
Oakland	06 09-23-85	60	Sandfill LF No 1 63-03N-11E-24DD Avon	Landfill	Landfill	Heavy Mfg.		Groundwater, Res. Well	42 39 19	83 05 45

Section 5 Continued (Table 5.1.7)

County	SAS Screen & Date Screened	Map Code Number	Common Site Name & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
GROUP 2 CONTINUED										
Oakland	05 07-31-86	61	Angelos Asphalt Materials 63-03N-11E-29AA Avon	Asphalt Roofing Prod.	Surface Discharge	Oil	Soil	Groundwater, Res. Well	42 38 59	83 08 20
Oakland	05	63	Oakland Co. Rd. Comm. Lake Orion 11-09-83 63-04N-10E-14AB Orion	Salt Storage	Salt Pile	Chloride		Surface Water, Groundwater, Res. Well	42 45 57	83 14 31
Oakland	05 09-27-86	64	Pontiac Steel 63-04N-08E-14BD Springfield	Metal Processing	Unknown	Heavy Mfg.	Groundwater		42 45 00	83 28 49
Oakland	04 09-26-84	65	Buckeye Pipeline 63-04N-09E-19BC Independence	Pipeline	Pipeline	Chem Prod Mfg	Soil	Groundwater	42 44 28	83 26 42
Oakland	04 10-14-85	66	Clarkston Rd Area 63-04N-09E-21BD Independence	Landfill	Unknown	Domestic Comm		Groundwater, Res. Well	42 44 34	83 24 12
Oakland	07 07-31-86	56	Northpoint Office Bldg. 63-02N-10E-05DC Bloomfield	Gas Station	Underground Tank	Benzene, Toluene, Xylene	Groundwater, Soil		42 36 37	83 17 28
Oakland	07 08-13-86	57	Nu Kar Products 63-03N-09E-13BD Waterford	Metal Coating	Surface Discharge	Chem Prod Mfg	Soil	Groundwater	42 40 12	83 20 2[illegible]

Section 5 Continued (Table 5.1.7)

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
GROUP 2 CONTINUED										
Oakland	07 08-16-87	69	Res. Well Cooley Lake Rd 63-03N-09E-28DC Waterford	Unknown	Unknown	Toluene, Xylene, Benzene, Dichloro- ethane	Groundwater	Res. Well	42 38 19	83 21 41
Oakland	11 08-11-87	70	Res. Wells Maybee & Sashabow Rd 63-04N-09E-34AB Independence	Unknown	Unknown	Benzene, Xylene, Ethyl- benzene	Groundwater, Res. Well		42 43 15	83 22 25
Oakland	08 08-16-87	71	Vinewood St. 63-04N-10E-09AB Pontiac	Unknown	Unknown	Flourotri- chloro- methane	Groundwater, Res. Well		42 46 47	83 17 01
Oakland	07 08-10-87	73	Total Gas Station Rochester & Tienken Rd. 63-04N-11E-11BB Avon	Gas Station	Unknown	Petroleum	Groundwater, Soil		42 41 53	83 07 56
Oakland	07 9-29-87	74	Buy-Rite Ser. Stat. 63-03N-10E-23CC Pontiac	Gas Station	Underground Tank	Benzene, Toluene, Xylene	Groundwater, Soil		42 38 25	83 14 51
Oakland	07 10-1-87	75	Kenneth Rd. LF 63-03N-10E-18BC Pontiac	Landfill	Landfill	Heavy Mfg. Waste		Surface Water, Ground- water	42 40 48	83 18 11

*The common site name is for identification only and is not necessarily a party responsible for contamination.

Table 5.1.7 continued

MICHIGAN SITES OF ENVIRONMENTAL CONTAMINATION IN
CLINTON RIVER/SECTION 6 WATERSHED

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
GROUP 1										
Macomb	0428 01-28-85	09	South Macomb Disp 9 and 9A, 50-03N-13E-15BC Macomb	Landfill	Landfill	Methyl Ethyl Ketone, Ethyl Ether Styrene	Groundwater, Soil, Air, Res. Well	Surface Water	42 41 02	82 54 40
Macomb	0392 01-21-87	07	Res. Well Card Rd 50-03N-13E-15DA Macomb	Unknown	Unknown	Benzene	Groundwater, Res. Well		42 40 33	82 54 03
Macomb	0232 08-08-85	11	Res. Well Foss Rd 50-03N-13E-10DC Macomb	Unknown	Unknown	Tetra-chloro-ethylene	Groundwater, Res. Well		42 41 21	82 54 23
GROUP 2										
Macomb	07 10-10-84	35	Res. Wells 32 Mile Rd 50-05N-13E-33 Armada	Oil Drilling	Geologic Fm	Brine, Chlorides	Groundwater		42 48 47	82 55 59
Macomb	07 01-22-86	38	Washington Twp Sec 8 Landfills 50-04N-12E-09 Washington	Landfill	Landfill	Lead, Chromium, Cadmium, Zinc, Iron, Nickel, Manganese	Groundwater	Surface Water, Soil	42 46 53	83 03 59

Section 6 Continued (Table 5.1.7)

County	SAS Screen & Date Screened	Map Code Number	Common Site Name* & Location Code & Township	Source of Contamination	Point of Release	Pollutant	Resource Affected	Resource Potentially Affected	Latitude	Longitude
Macomb	08 08-01-85	27	Mt. Clemens Coatings and Plastics 50-02N-13E-02DC Clinton	Auto Mfg	Pit, Underground Tank	PCB, Phthalates, Methyl-Ethyl Ketone, Tetrahydro-furan	Surface Water	Sediment, Groundwater	42 36 57	82 53 47

*The common site name is for identification only and is not necessarily a party responsible for contamination.

TABLE 5.1.8 ACTIVE HAZARDOUS WASTE TREATMENT, STORAGE, OR DISPOSAL FACILITIES WITHIN THE CLINTON RIVER WATERSHED BY RIVER SECTION

Map ID Number	Section Number Facility Name EPA ID Number	Latitude	Longitude	Street Address City	Date Notified	Type of Facility T	S	D	UIC	Part A Date	PAS	NON	RCRA Pmt. Status	State Pmt. Status
HW01	Section 1 Safety Kleen Corp. MID098673890	42 37 17	82 52 56	44043 N. Grossbeck Hwy Mt. Clemens	85/04/03		X			Closure Proposed			CPR	NI
HW02	Section 1 Selfridge Air National Guard (SANG) MID099113128	42 36 17	82 49 23	Detachment 1/DDE Mt. Clemens	80/08/18		X			80/11/18	I		NCI	NI
HW03	Section 3 US Chemical Co., Inc. MID003523355	42 30 30	82 57 30	29163 Callahan Rd Roseville	80/09/03	X	X			80/10/21	I		I	NI
HW04	Section 4 Ford Motor Company Sterling Axle Plant MID044255420	42 35 00	83 02 50	3900 Mound Road Sterling Heights	80/08/18	X	X	X		Closure Proposed			NCI	NI
HW05	Section 4 Vickers, Inc. MID001722552	42 32 34	83 10 36	1401 Crooks Rd. Troy	80/08/18		X			Closure Proposed			NCI	NI
HW06	Section 4 BASF Wyandotte Corp. MID057007478	42 32 55	83 08 05	1700 Blaney Dr. Troy	80/08/12		X			80/11/19	I		NCI	NI
HW07	Section 4 DuPont E I De Nemours MID099124349	42 32 30	83 07 03	945 Stephenson Hwy. Troy	80/08/11		X			80/11/18	I		NCI	NI

Table 5.1.8 continued

Map ID Number	Section Number Facility Name EPA ID Number	Latitude	Longitude	Street Address City	Date Notified	Type of Facility T	S	D	U I C	Part A Date	P A S	N O N	RCRA Pmt. Sta-tus	State Pmt. Sta-tus
HW08	Section 4 Gage Products Company MID005338801	42 27 19	83 06 56	625 Wanda Ave Ferndale			X			85/09/22	I		AUR	NI
HW09	Section 4 Reichhold Chemicals, Inc. MID020087128	42 28 00	83 08 00	601 Woodward Heights Ferndale	80/08/12		X	X		80/11/11			NI	NI
HW10	Section 4 GMC Technical Center MID050615996	42 30 40	83 02 50	30800 Mound Road Warren	80/08/11		X			80/11/17	I		AUR	NI
HW11	Section 4 US Army Tank Automotive Command MID210022701	42 29 44	83 22 12	6501 E 11 Mile Rd Warren	80/08/11		X			Partial Closure			NI	NI
HW12	Section 4 OMI Int'l Corp. Udylite Sel-Rex MID056717747	42 27 15	83 00 38	21441 Hoover Rd Warren	80/08/18		X			80/11/07	I		AUR	NI
HW13	Section 4 Amchem Products, Inc. MID005362223	42 28 00	83 02 20	23343 Sherwood Warren	80/08/07		X			80/11/13	I		NCI	NI
HW14	Section 4 General Electric Co MID044254423	42 27 02	83 00 46	11177 E. 8 Mile Rd Warren	80/08/18		X			80/11/19	I		NCI	NI

Table 5.1.8 continued

Map ID Number	Section Number Facility Name EPA ID Number	Latitude	Longitude	Street Address City	Date Notified	Type of Facility T	 S	 D	 UIC	Part A Date	PAS	NON	RCRA Pmt. Status	State Pmt. Status
HW15	Section 4 MacDermid Incorp MID005338371	42 27 17	83 08 09	1221 Farrow St Ferndale	80/08/18		X			80/11/07	1		NCI	NI
HW16	Section 4 Parker Chem Co MID057676124	42 31 58	83 07 15	32100 Stephenson Hwy Madison Heights	80/08/18		X			Closure Proposed	1		NCI	NI
HW17	Section 5 GMC CPC - Fiero Assembly MID005356910	42 39 41	83 17 40	900 Baldwin Ave Pontiac	80/08/12		X			80/11/19	1		CPR	NI
HW18	Section 5 GMC Pontiac Motor Div. MID005356886	42 38 02	83 17 05	One Pontiac Plaza Pontiac	80/08/12		X			80/11/19	1		NCI	NI
HW19	Section 5 GMC Truck & Coach Div. Pontiac West MID980568836	42 37 10	83 17 15	275 Franklin St Pontiac	80/08/14		X			80/11/17	1		AUR	NI
HW20	Section 5 GMC Truck & Coach Div. Pontiac East MID005356902	42 36 58	83 15 33	660 S. Boulevard E Pontiac	80/08/13	X	X			Partial Closure	1		AUR	NI
HW21	Section 5 GMC Whg & Distribution Division MID056331289	42 40 31	83 19 00	1251 Joslyn Rd Pontiac	80/08/13					Closed	1		NCI	NI

Table 5.1.8 continued

Map ID Number	Section Number Facility Name EPA ID Number	Latitude	Longitude	Street Address City	Date Notified	Type of Facility T	S	D	UIC	Part A Date	PAS	NON	RCRA Pmt. Status	State Pmt. Status
HW22	Section 5 Safety Kleen Corp 4-055-02 MID000722686	42 37 29	83 18 54	751 Orchard Lake Rd Pontiac	80/08/18		X			Closure Proposed			NI	NI
HW23	Section 5 GMC Wgh & Dist. Div. Drayton Plains MID003912920	42 41 35	83 23 46	5260 Williams Lake Rd Drayton Plains	80/08/18		X			80/11/18	1		NCI	NI
HW24	Section 6 GMC GMAD Lake Orion Twp MID000718544	42 43 10	83 15 13	4555 Giddings Rd Lake Orion	80/08/18	X	X			80/11/19	1		NCI	NI
HW25	Section 6 Ford Motor Company Romeo Tractor Plant MID078400165	42 48 21	82 59 43	701 E 32 Mile Rd Romeo	80/08/15	X	X	X		Closure Proposed	1		CPR	NI

Code Key:
T = Treatment Facility
S = Storage Facility
D = Disposal Facility

UIC = Underground Injection Facility

PAS = Part A Status
Part A Date = Date Facility/Installation submitted Part A
Part A Facility Status Indicator
1 = Existing
2 = New
3 = Closed

RCRA and State Permit Status:
I = Permit Issued
AUR = Application Under Review
CI = Application Called In Not Yet Received
NCI = Application Not Called in to Date
CPR = Closure Plan Under Review
PR = Permit Revoked
PD = Permit Denied
NI = Not Issued

5.2 SECTION 4 - RED RUN AND ITS TRIBUTARIES

5.2.1 Point Sources

In Section 4 of the Clinton River watershed (Red Run), there are 10 continuous direct industrial dischargers, two intermittent direct industrial dischargers (GM Tech Center and Borg Warner), one continuous direct municipal discharge (Warren WWTP), and one intermittent municipal direct discharge (Southeast Oakland County Sewage Disposal System/Pollution Control Facility - SOCSDS/PCF) (Table 5.1.1) (Map 6.5). Of these, only the Warren WWTP is considered by the MDNR as a major discharger.

5.2.1.1 Continuous Industrial Dischargers

Flow, outfall type, and parameters limited or monitored for each discharger are shown in Table 5.1.1. Effluent limits are found in Appendix 5.1.

All industrial facilities discharge non-contact cooling water. Ford Motor Company-Sterling Axle Plant, and Chrysler/Volkswagen discharge the greatest amounts, 8.5 and 3.5 mgd respectively. General Electric Carboloy Systems also discharges 0.664 mgd noncontact cooling water. All others discharge 0.1 mgd or less.

In addition to noncontact cooling water, Schenck Treble discharges 0.00017 mgd cooling tower blowdown water, Union Carbide discharges 0.05 mgd holding pond lime slurry water, and Chrysler/Volkswagen discharges some coal storage runoff with its non-contact cooling water from outfall 001.

5.2.1.2 Intermittent Industrial Dischargers

Undetermined amounts of permitted stormwater are intermittently discharged from General Electric, Big Beaver Specialties, Chrysler/Volkswagen, Borg Warner, Ford Motor Company, and the G.M. Tech Center.

5.2.1.3 Continuous Municipal Discharges

The only continuous point source municipal discharge to Section 4 of the Clinton River (Red Run) is the Warren WWTP. This facility is a publicly owned tertiary wastewater treatment system with a design capacity of 60 mgd, but the annual average flow is 31 mgd. The plant serves a separated collection system with two main interceptors and one remote lift station. About 25% of the plant inflow is non-domestic wastewater.

Incoming wastewater flows through a bar screen before entering seven raw sewage pumps. Under most conditions, one or two pumps are used at a time. The screened wastewater is pumped to three grit chambers. Normally, only two grit chambers are used, the third discharges to a 50 million gallon raw sewage retention/equalizer basin and is used only during high flow periods.

Primary clarification is performed in eight rectangular settling tanks. Secondary treatment and nitrification is accomplished by the single state activated sludge process in six aeration tanks. Ferric chloride is added to the discharge from the aeration tanks for phosphorus removal. A polymer may also be added at this point. Secondary clarification is performed in eight circular settling tanks. All eight are routinely used but only six are needed to treat dry weather flows. Tertiary treatment is provided by twelve high rate, mixed media filters. Filter backwash water (chlorinated effluent) is recycled to the head of the aeration tanks. Tertiary effluent is chlorinated and discharged to Red Run via outfall 001.

Waste activated sludge (WAS) is thickened by one of three air-flotation units. Thickened WAS is stored and then combined with primary sludge and vacuum filtered. A cationic polymer is added as a filtering aid. The filtered sludge is incinerated. The ash is sluiced to an ash lagoon. Air flotation underflow, vacuum filter filtrate and ash pond effluent are all discharged to the influent.

Warren has permit limits for several standard conventional parameters and monitoring requirements for five heavy metals and cyanide one to seven times per week (Appendix 5.1, Table 5.2.0). Loadings of conventional pollutants from all dischargers except Warren and SOCSDS are minimal. Loadings based on Monthly Operating Reports (MORs) between 1982 and 1986 for selected water quality parameters from the Warren WWTP are presented in Table 5.2.1.

Wastewater monitoring of the Warren WWTP was performed during one twenty-four hour survey period starting May 18, 1986 to determine facility compliance with water discharge regulations (Stone, 1987c). Survey results were compared to the Final National Pollutant Discharge Elimination System (NPDES) permit limits and monthly operating reports. The Warren WWTP was in compliance with its limits. The effluent was also analyzed for other parameters not limited by their permit including metals, organics and nutrients. Loadings are shown in Table 5.2.0 (point source survey) and 5.2.1. (MOR's).

Table 5.2.1 indicates that flow remained constant with an average of 117,347 m^3/d (31 million gallons per day) ranging from an average of 105,991 m^3/d (28 million gallons per day) in 1984 to 120,754 m^3/d (31.9 million gallons per day) in 1985.

Annual average suspended solids loadings were lowest in 1982 - 33,619 kg (74,117 pounds) and highest in 1986 - 55,714 kg (122,829 pounds) with a mean of 42,364 kg/y (93,397 pounds per year). Average suspended solids loadings in 1985 and 1986 were over 50,588 kg/y (111,529 pounds per year) compared to an average of 36,880 kg/y (81,308 pounds per year) for the three previous years.

BOD_5 loadings remained stable from 1982 to 1986. The lowest carbonaceous BOD_5 loading was in 1986 with 41,510 kg/y (91,515 pounds per year) and the highest was 54,377 kg/y (119,881 pounds per year) in 1984. The mean BOD_5 load for the five year period was 47,184 kg (104,024 pounds).

Total phosphorus loadings increased over the five-year period with 1985 and 1986 loadings greater than 30,400 kg/yr (66,000 pounds per year) as

Table 5.2.0 Permitted and Estimated Loadings from Municipal Facilites in Section 4 of the Clinton River, Red Run.

Conventional Loading	Warren Waste Water Treatment Plant: Annual Permitted Loading lbs/year	Ave. Annual Estimated Loading lbs/year**	Annual Estimated Loading lbs/year***	Loading lbs/day***	Conc. ug/l***	Southeastern Oakland Co. Sewage Disposal System Pollution Contol Facility: Annual Permitted Loading lbs/year	Ave. Annual Estimated Loading lbs/year*
Suspended Solids	4653720	93409			<4000		1708003
Dissolved Solids			42809025	117285			
BOD-5		109454	349305	957			456364
BOD-5(Carbon)	1951680	95880					
COD			2533465	6941			
TOC			751535	2059			
NO2+NO3			768690	2106			
NH3-N	763750		8724	23.9			
Total Kjel. Nitrogen			139759	382.9			
Total Phosphorus	94367	59859	32339	88.6			
Orthophosphorus			20951	57.4			
CN(total)		944	621	1.7			
Cl			6639715	18191			
Na			5207090	14266			
Metal Loading							
Silver		944*****			<0.5		
Aluminum			9965	27.3			
Arsenic					<2.5		
Barium			2519	6.9			
Beryllium					<1.0		
Cadmium		368	51	0.14			
Cobalt					<10		
Chromium		944****	368.65	1.01			
Hex. Chromium					<5.0		
Copper		793	496.4	1.36			
Iron			5241	14.36			
Mercury		39.6*****			<0.5		
Lithium					<8.0		
Manganese			365	1			
Molybdenum			1029	2.82			
Nickel			2281	6.25			
Lead			131	0.36			
Antimony					<2.5		
Selenium					<2.5		
Titanium					<10		
Vanadium					<10		
Zinc		5190****	4544	12.45			
Organic Loading							
Phthalates			245	0.67			
HCB							
PCB			4.7	0.013			
TCE							
Toluene							
Xylene							
Phenol					<5.0		

*=Results based on Monthly Operating Reports from Jan.1, 1976 to Dec. 31, 1986. Overflow averaged 1364 million gallons year.
**=Results based on Monthly Operating Reports from Jan.1, 1982 to Dec. 31, 1986. Flow averaged 31 mgd for the 5 year period.
***=Results based on sampling done May 18-19, 1986. Flow was measured at 28.7 mgd.
****=Data was reported until Jan. 1, 1985.
*****=Data was reported starting Jan. 1, 1985.

Table 5.2.1

Warren WWTP Monthly Discharge Rates into Red Run Drain From 1982 to 1986
Metal Results in ug/l

Year	Month	Flow Conduit (mgd)	Solids-Suspended (lbs./mo.)	BOD-5 Carbon (lbs./mo.)	BOD-5 (lbs./mo.)	Phosphorous Total (lbs./mo.)	Phosphorous Total (ave. mg/l)	Cyanide-Free(cn) (ave. mg/l)	Cadmium Total	Copper Total	Mercury Total	Silver Total	Chromium Total	Zinc Total
1982														
	January	28.3	3902		6260	4607	0.7	0.01	3.00	7			8	69
	February	24.9	3265		6408	4593	0.8	0.01	4.00	9			7	83
	March	42.3	26135		25418	5331	0.6	0.01	3.00	6			6	52
	April	34.3	5547		11139	4812	0.6	0.01	4.00	6			5	57
	May	26.3	5771		6971	4599	0.7	0.01	3.00	6			6	59
	June	26.0	4716		5989	4333	0.6	0.01	3.00	10			5	62
	July	28.9	4466		4803	4676	0.6	0.01	3.00	7			5	49
	August	25.0	3426		5444	4597	0.7	0.01	3.00	8			7	48
	September	24.3	3633		4953	5384	0.9	0.01	4.00	6			6	43
	October	22.4	4104		5559	5255	0.9	0.01	3.00	7			7	56
	November	31.0	4306		6942	4393	0.6	0.01	3.00	7			8	45
	December	35.0	4846		8569	4372	0.5	0.01	4.00	8			9	45
	Annual Total:		74117		98535	56952								
	Annual Ave:	29.1					0.7	0.01	3.33	7			7	56
1983														
	January	26.5	3505		6783	4161	0.6	0.01	2.00	8			6	48
	February	27.1	3621		7559	4048	0.6	0.01	3.00	5			8	70
	March	29.0	4270		8575	4015	0.6	0.01	3.00	6			7	66
	April	39.4	12498		12971	4160	0.4	0.01	4.00	6			6	53
	May	38.0	19283		13259	4574	0.5	0.01	3.00	6			4	39
	June	29.8	5073		8238	4383	0.6	0.01	2.00	5			9	35
	July	37.0	8256		9162	4573	0.5	0.01	3.00	7			10	27
	August	31.7	9775		10325	4649	0.6	0.01	3.00	8			8	32
	September	24.7	5009		6030	4632	0.8	0.01	2.00	5			8	42
	October	27.0	6772		8074	5476	0.8	0.01	2.00	5			10	45
	November	34.5	7239		10337	4271	0.5	0.01	4.00	7			16	54
	December	35.0	10242		8632	3802	0.5	0.01	4.00	8			11	56
	Annual Total:		95543		109945	52744								
	Annual Ave:	31.6					0.6	0.01	2.92	6			9	47
1984														
	January	23.7	4146		9752	4731	0.8	0.01	4.00	7			26	7
	February	28.9	4934		11066	4199	0.6	0.01	4.00	9			17	102
	March	37.7	18835		17710	4790	0.5	0.01	4.00	14			19	82
	April	29.8	5676		11981	4559	0.6	0.01	5.00	8			19	82
	May	28.4	5789		8485	4460	0.6	0.01	4.00	7			12	79
	June	25.9	4978		8635	4942	0.8	0.01	3.00	10			11	57
	July	22.8	4243		9540	4848	0.8	0.01	1.00	5			5	50
	August	27.7	5192		10025	4606	0.6	0.01	2.00	3			6	46
	September	27.8	4414		11158	4041	0.6	0.01	4.00	10			12	60
	October	25.6	4606		6332	4855	0.8	0.01	3.00	5			12	44
	November	28.3	5261		7444	4758	0.7	0.01	10.00	7			10	62
	December	28.9	6192		7753	4821	0.7	0.01	10.00	6			12	56
	Annual Total:		74266		119881	55610								
	Annual Ave:	28.0					0.7	0.01	4.50	8			13	61

Table 5.2.1 cont.

Warren WWTP Monthly Discharge Rates into Red Run Drain From 1982 to 1986
Metal Results in ug/l

Year	Month	Flow Conduit (mgd)	Solids-Suspended (lbs./mo.)	BOD-5 Carbon (lbs./mo.)	BOD-5 (lbs./mo.)	Phosphorous Total (lbs./mo.)	Phosphorous Total (ave. mg/l)	Cyanide-Free(ox) (ave. mg/l)	Cadmium Total	Copper Total	Mercury Total	Silver Total	Chromium Total	Zinc Total
1985														
	January	31.1	11406	9431		5119	0.7	0.01	10.00	7	NA	<30		
	February	30.5	9679	7324		3817	0.6	0.01	10.00	7	NA	<30		
	March	42.3	14045	13256		6034	0.6	0.01	10.00	8	0.00	<30		
	April	37.4	6195	10487		4820	0.7	0.01	<10.00	9	<0.20	31		
	May	24.9	7902	5786		5298	0.8	0.01	<10.00	4	<0.20	<30		
	June	26.9	7412	5170		5638	0.9	0.01	<10.00	4	0.20	<30		
	July	28.0	5875	5584		5746	0.8	0.01	<10.00	13	0.30	10		
	August	30.1	5025	7766		6134	0.8	0.01	<10.00	13	<0.20	<10		
	September	30.1	8028	7389		6456	0.9	0.01	<10.00	11	0.20	<10		
	October	28.3	7079	7913		5703	0.8	0.01	<10.00	<10	0.46	<10		
	November	40.9	9068	11437		5290	0.5	0.01	0.12	14	0.35	<10		
	December	31.8	8514	8702		6341	0.7	0.01	0.60	<10	0.42	<10		
	Annual Total:		100228	100245		66396								
	Annual Ave:	31.9					0.7	0.01	8.39	9	0.25	20		
1986														
	January	28.0	7754	6671		6183	0.9	0.01	1.00	<10	0.25	<10		
	February	34.0	13262	8172		4901	0.6	0.01	0.32	<10	0.84	<10		
	March	38.7	32088	11962		5562	0.6	0.01	0.49	<10	0.25	<10		
	April	31.9	7476	6634		6656	0.9	0.01	0.62	12	0.65	<10		
	May	26.4	7065	7032		5516	0.8	0.01	0.68	11	2.68	<10		
	June	33.1	12607	9733		6633	0.8	<0.01	0.62	11	<0.20	<10		
	July	30.6	6949	6647		6470	0.9	0.01	0.52	<10	0.22	<10		
	August	25.8	5778	4859		5079	0.8	0.02	0.42	<10	<0.20	<10		
	September	29.4	5262	5809		5395	0.8	0.01	0.51	<10	<0.20	<10		
	October	33.6	11233	10912		5436	0.7	0.01	0.96	13	0.51	<10		
	November	25.3	4756	4704		5081	0.8	0.05	0.54	12	0.68	<10		
	December	31.9	8599	8380		4679	0.6	0.01	0.10	22	<0.50	<10		
	Annual Total:		122829	91515		67591								
	Annual Ave:	30.7					0.8	0.01	0.57	12	0.59	<10		

compared to 1982 through 1984 loadings of less than 25,855 kg/yr (57,000 pounds per year). The total phosphorus concentration changed little during this period ranging from 0.60 mg/l in 1983 to 0.80 mg/l in 1986.

The free cyanide concentrations remained at or below the detection level of 0.01 mg/l in 1982 and 1986.

Total copper concentrations increased from an annual average of 7 ug/l in 1982 to 12 ug/l in 1986. Total chromium levels also increased from an annual average of 7 ug/l in 1982 to 32 ug/l in 1984. Total cadmium concentrations increased from an average of 3.3 ug/l in 1982 to 8.39 ug/l in 1985 and then dropped drastically to 0.57 ug/l in 1986. Total mercury concentrations were only measured for 2 years, but appeared to increase from 0.25 ug/l in 1985 to 0.59 ug/l in 1986. Total silver concentrations were at or near the detection level of 10 ug/l. Total zinc averaged 55 ug/l from 1982 through 1984 and varied little. The lowest zinc concentration was 47 ug/l in 1983 and the highest was 61 ug/l in 1986.

The City of Warren operates a separated storm and sanitary sewer system and therefore there are no combined sewer overflows from Warren to Red Run.

The Warren WWTP receives effluent from nearly 2400 businesses and industrial facilities. These non-domestic users were required to list the materials they discharged to the Warren sewer system. Then Warren was required to develop a pretreatment program with specific limits which must be met prior to discharge to the municipal system. Many of these non-domestic users discharge metals to the WWTP.

Warren's industrial pretreatment program was approved in 1985. One thousand six hundred and thirty (1,630) of the nondomestic users were defined as major significant users. After field surveillance and effluent monitoring, 93 were determined to be regulated by conditions of the approved pretreatment program (Table 5.2.2).

In 1987, 42 of these were audited for compliance with pretreatment standards requirements. Of these, 33 were in compliance but nine were in significant non-compliance (Table 5.2.2). A list of those in non-compliance was published in the local newspaper and enforcement action initiated. Actions varied from verbal and written notification to enforceable compliance schedules.

Violations included excessive discharges for nickel, zinc, chromium and cyanide. Some dischargers have already initiated new treatment facilities to remediate these problems. Specific details are listed in Warren's 1987 IPP Annual Report (Herriman, 1987).

5.2.1.4 Intermittent Municipal Dischargers

One intermittent point source (SOCSDS/PCF) and nonpoint (urban stormwater) sources represent the most significant pollutant transport mechanisms in Section 4. The hydrodynamics of the channeled portions of Red Run exacerbate the pollutant transport process by rapidly transporting high volumes of stormwater and combined sewer and storm water into

Table 5.2.2. Major or Significant Nondomestic Users Regulated by the City of Warren's Pretreatment Program.

Not Tested	Compliance	Significant Non-Compliance
Acco Company	Ace Finishing	Creative Electroplating
Ajax Metal Processing	Amchem Products, Inc.	Detroit Rustproofing
Allied Materials Corp. No. 2	B & L Plating	Enamelcote
American Metal Processing	Bundy Tubing Mfg. - Mfg. Bldg. & Plating Building	Fini-Finish
Beta Manufacturing Corp.	Cadillac Plating	Kencoat Company
Cadillac Gauge - Machine Assembly & Engineering	Cadmet Corp.	Modern Hard Chrome
Chrysler Corp. - Truck Assembly	Chrysler Stamping	Norbrook Plating
Cold Heading - Plant II	Colt Industries	Peninsular Plating & Chemical Products
Color Custom	Copper Brazing	Sta-Brite
Condamatic Company	Detroit Arsenal	
Copco Door Co.	Detroit Radiator Repair	
Creative Products	Elias Brothers Wholesale	
Cross & Trecker Corporation	Essex Brass	
DAK Plastics Company	Everfresh Juice Co.	
Dy-Chem Products Co.	Formsprag Co. - 23601 Hoover Rd	
Dyneer-Tractech, Inc.	Formsprag Co. - 23501 Hoover Rd	
Equipment Mfg	Freshman Lab	
F. Jos. Lamb Co.	G.E. Carboloy	
Farathane	General Motors Hydramatic	
General Polymers of Michigan	General Motors Tech Center	
Harper Steel Service Center	Leebert Silversmiths	
Hercules Machine	Michigan Controls	
Holley Carburetor Div.	Mold-Tech	
Hoover Steel Treating	Mortell Co.	
Hydra-Lock Corporation	Quin Tech	

Table 5.2.2 continued

Not Tested	Compliance	Significant Non-Compliance
Ideal Polishing Company	Super Steel Treating	
Induction Services, Inc.	Superior Enameling	
Industrial Foamcraft	Superior Polishing #2	
Jaloy Mfg., Co.	Sure Coat Enameling	
Kent-Moore Corp.	Udylite Corp. (OMI)	
Keo Cutters	Warren Custom Plating	
LaSalle Machine	Wolverine Die Cast Corp.	
Lincoln Gage Co.		
Mahon Rolling Door		
Metal Specialists, Inc.		
Metallurgical Processing		
Michigan Rivet		
Nitro-Vac Heat Treat		
Paint Work Inc.		
Patterson Heat Treat		
Plymouth Shafting		
Prince Macaroni		
R & B Metal Finishing		
Resin Services		
Ring Finishing		
Ring Screw Products		
Rod Conversion, Inc.		
Saturn Ceramic Coating Co.		
Schwarb Founding Co.		
Volkswagen - Eleven Mile Rd		
Volkswagen - Parkview		
Weldaloy Products		
Welform Electrodes		

Section 3. The significant contribution of Red Run to the flow of the Clinton River is evident even during drought flow (Figure 3.7). Drought flow from Red Run is primarily treated wastewater effluent from Warren.

The Southeast Oakland County Sewage Disposal System/Pollution Control Facility (SOCSDS/PCF) is the intermittent discharger to Section 4. To understand the source and magnitude of the discharge, a short history is presented which begins in the 1920's.

Red Run has been a major concern within the Clinton River drainage basin for many years. In the 1920s, Red Run was an open drain serving the rapidly growing Royal Oak and immediately adjacent areas via the Royal Oak Drain. Through the years, additional urbanized areas added their insult to Red Run. By 1947, flooding caused increased concern because of the immense volume of runoff draining to the Clinton River via Red Run. The widening and straightening of Red Run channel from the intersection of Campbell and Twelve Mile Road to the Clinton River was authorized in 1948 and completed in 1954 by the U.S. Army Corps of Engineers (USCOE, 1979).

This flood control measure caused Red Run to be a totally artifical system to handle increased flow. This 19.3 km (12 mile) distance was widened to bottom widths of 12.2 m (40 ft) upstream of Bear Creek, 24.4 m (80 ft) below Bear Creek, 30.5 m (100 ft) below Beaver Creek, and 28.1 m (125 ft) below Plum Brook. (USCOE, 1976). At the same time (1952) a spillway was constructed on the lower Clinton River to help alleviate flooding problems in Section 1 (USCOE, 1979).

The Royal Oak area continued to grow, requiring better drainage and resulted in the construction of the 12 Towns Drainage System in 1965 at a cost of $38,536,000 (D. Snyder, personal communication 1987) (Figure 5.2.1). This project enclosed and increased the volume of many natural and previously existing enclosed drains. Normal flow was discharged through the Southeast Oakland County Sewer Interceptor along Stephenson Highway which goes to the Detroit Wastewater Treatment Plant (Figure 5.2.2). The system drains all or parts of Hazel Park, Madison Heights, Troy, Ferndale, Royal Oak, Clawson, Berkley, Huntington Woods, Oak Park, Pleasant Ridge, Beverly Hills, Royal Oak Township, Southfield and Birmingham (C. McKinnen, personal communication 1987).

The capacity of the 12 Towns system is 123,348 m^3 (32.5 million gallons). Volumes in excess of this amount overflow from the outlet structure (Figure 5.2.3) of the 12 Towns system, located immediately downstream of Stephenson Highway, into the then open portion of Red Run. This large combined sewer system discharged an enormous load to Red Run, affecting its entire length and several miles of the Clinton River downstream of its confluence. Because of the degradation from this facility, the Michigan Water Resources Commission required better facilities to handle the wastewater (D. Snyder, personal communication 1987).

To meet this need, the Southeastern Oakland County Sewage Disposal System Pollution Control Facility (SOCSDS/PCF) was built in 1973 for greater storage capacity, to reduce the number and amount of overflows to Red Run, to provide primary treatment and to route its daily discharge to the

CLINTON RIVER DRAINAGE BASIN (760 SQ. MI.)

TWELVE TOWNS DRAIN DISTRICT (38 SQ. MI.)

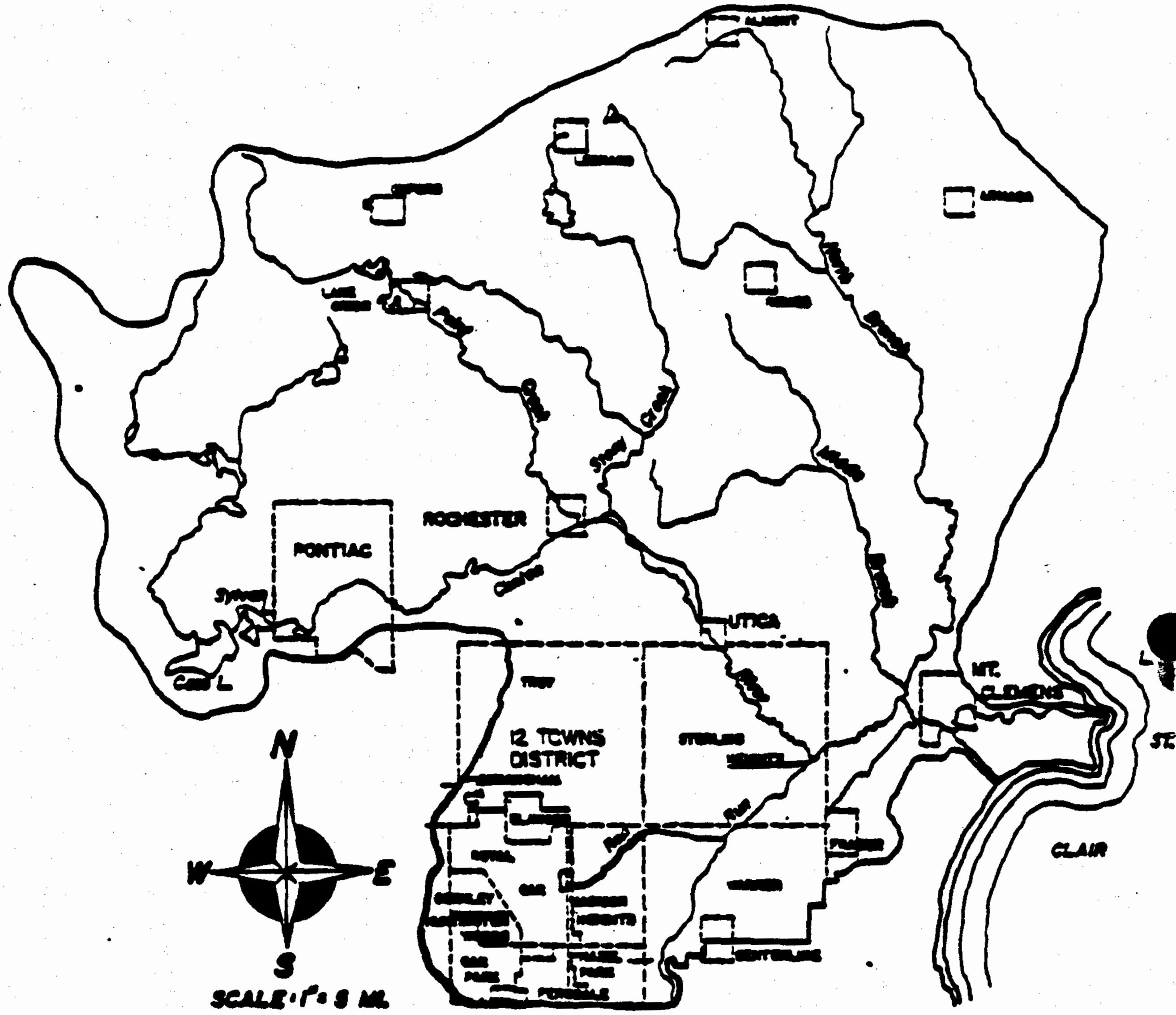


Figure 5.2.1 Twelve Towns Sewer District in the Red Run Watershed, Section 4.

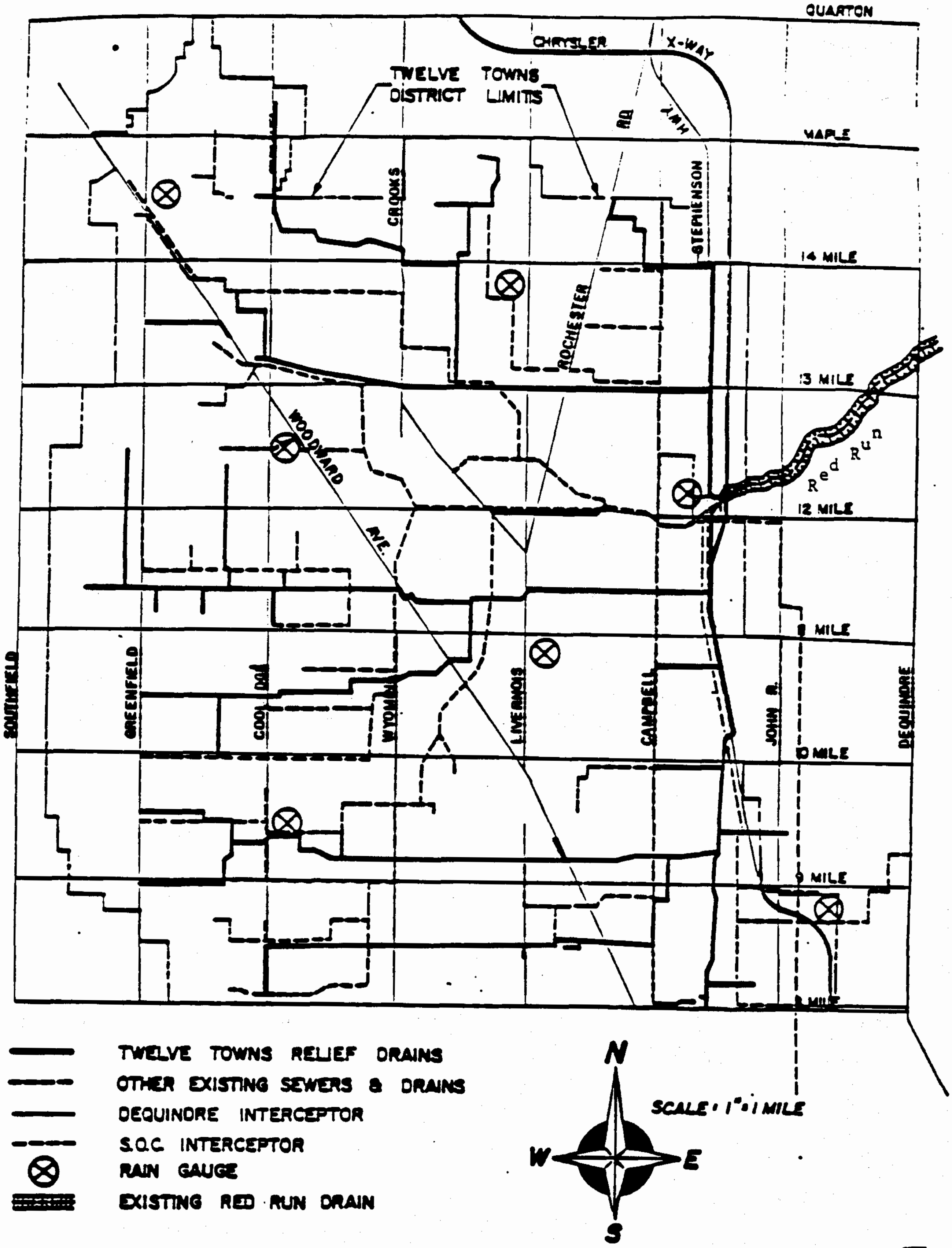
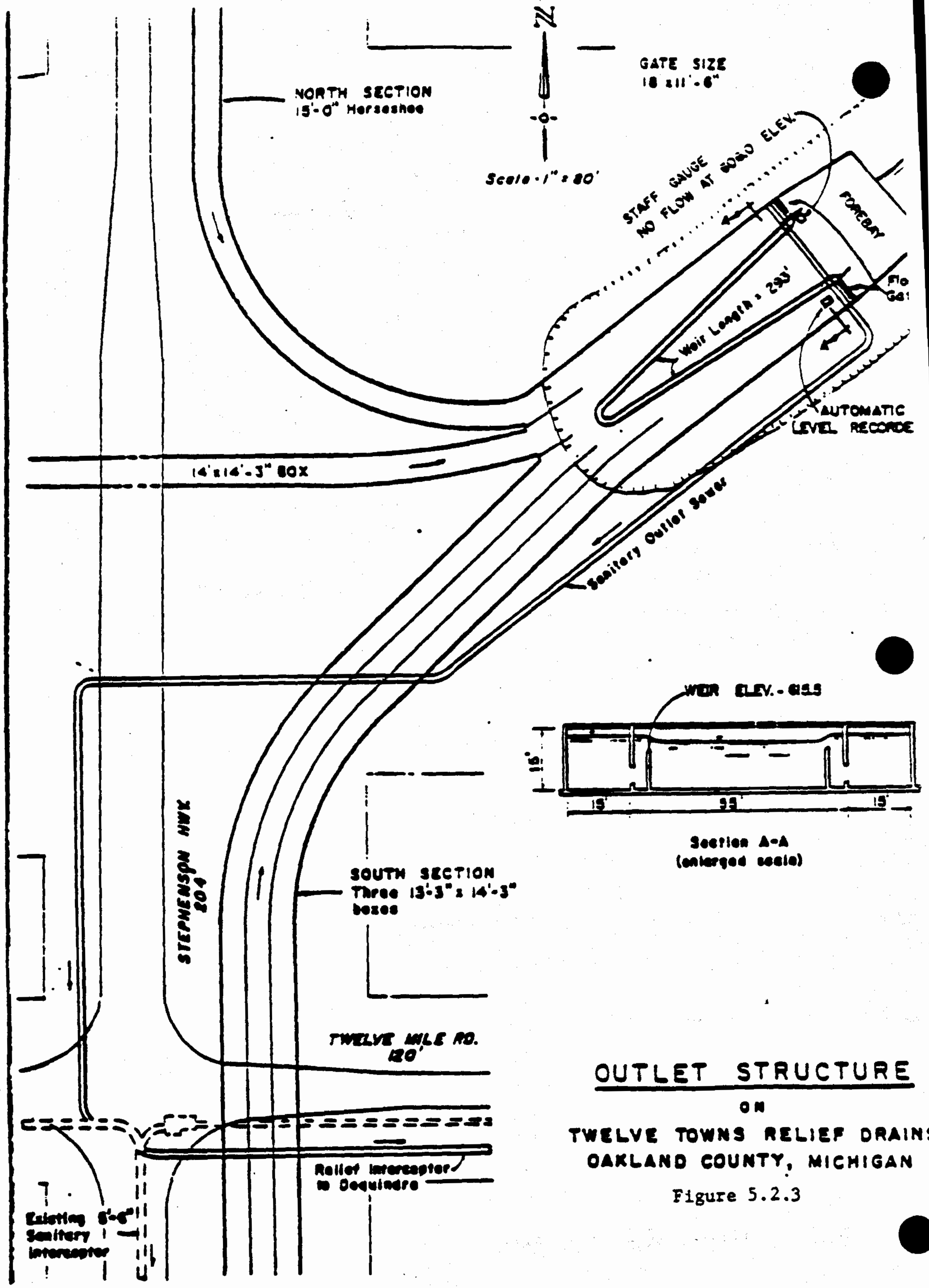


Figure 5.2.2 Sewer System Servicing the Twelve Towns Sewer District prior to 1973.



OUTLET STRUCTURE

ON

TWELVE TOWNS RELIEF DRAINS
OAKLAND COUNTY, MICHIGAN

Figure 5.2.3

Detroit Wastewater Treatment Plant via the Dequindre Road Interceptor. The SOCSDS/PCF is a 235,453 m^3 (62.2 million gallons) underground gravity storage structure with a high weir and skimmer, chlorination facilities at the outlet structure, and a dewatering pump at Dequindre Road (Figure 5.2.4) (Hubbell, Roth, and Clark 1969).

Approximately 3.4 kilometers (2.1 miles) of Red Run from Stephenson Highway (the downstream end of the 12 Towns System) to Dequindre Road in Madison Heights were enclosed in concrete (Figure 5.2.4) with two parallel separate 15 foot high by 30 foot wide sections running lengthwise within the structure at a cost of $25 million (D. Snyder, personal communication 1987).

The total capacity of the pollution control facility is 235,453 m^3 (62.2 million gallons). The facility discharges 169,901-198,218 m^3 per day (44 to 52 mgd) to the Detroit wastewater treatment plant via the Dequindre interceptor during dry weather and up to 594,654 m^3 (157 mgd) a day during wet weather.

When the facility is full, the excess overflows at the Dequindre Road outfall to Red Run. The facility provides a more stable system and primary treatment and chlorination for overflows which occur only during wet weather. Overflows from this system occured 10 to 12 times per year between 1973 and 1978 (SEMCOG 1978).

When SOCSDS/PCF overflows, several water quality parameters are measured. Concentrations and loadings of these parameters at the overflow from 1976 through 1986 are shown in Table 5.2.3 based on monthly operating reports submitted to the Michigan Department of Natural Resources. This table does not include the regular flow of up to 198,218 m^3/day (52 mgd) to the Detroit wastewater treatment plant via the Dequindre Interceptor.

The number and volume of each overflow varied widely from year to year depending on the duration and frequency of storm events. The average number of days overflowing per year was 11. The total annual overflow ranged from 2,710,346 m^3 (716 million gallons) in 1980 to more than 15,520,140 m^3 (4,100 million gallons) in 1976. The annual average for the 11 year period was 7,434,526 m^3 (1,964 million gallons).

BOD_5, total suspended solids, and phosphous loadings to Red Run were estimated at 511, 1192, and 27 metric tons per year between 1973 and 1976, respectively (SEMCOG, 1978a). The BOD_5 loading represents the third highest BOD_5 source to the lower river.

Annual BOD_5 loadings decreased from 742,497 kg (1,636,934 lbs/yr) in 1976 to 126,891 kg/yr (279,748 lbs/yr) in 1986 (Table 5.2.4). BOD_5 loadings between 1982 and 1986 were less than 136,077 kg/y (300,000 lbs/yr) compared to the average for the 11 year period of 207,002 kg/yr (456,364 lbs/yr). The generally recommended MDNR BOD_5 effluent limits for secondary wastewater treatment plants is 30 mg/l as a seven day average and 25 mg/l as a 30 day average. The seven day average was exceeded from 1976 to 1978 with mean annual BOD_5 concentration of 30 mg/l or more for each year. Between 1979 and 1986, mean annual BOD_5 concentrations were less than 30 mg/l with the lowest in 1984 (18 mg/l).

Figure 5.2.4 SOCSDS/PCP Storage Structure, Dewatering Pump, and Dequindre Road Interceptor, where the open portion of Red Run used to be located.

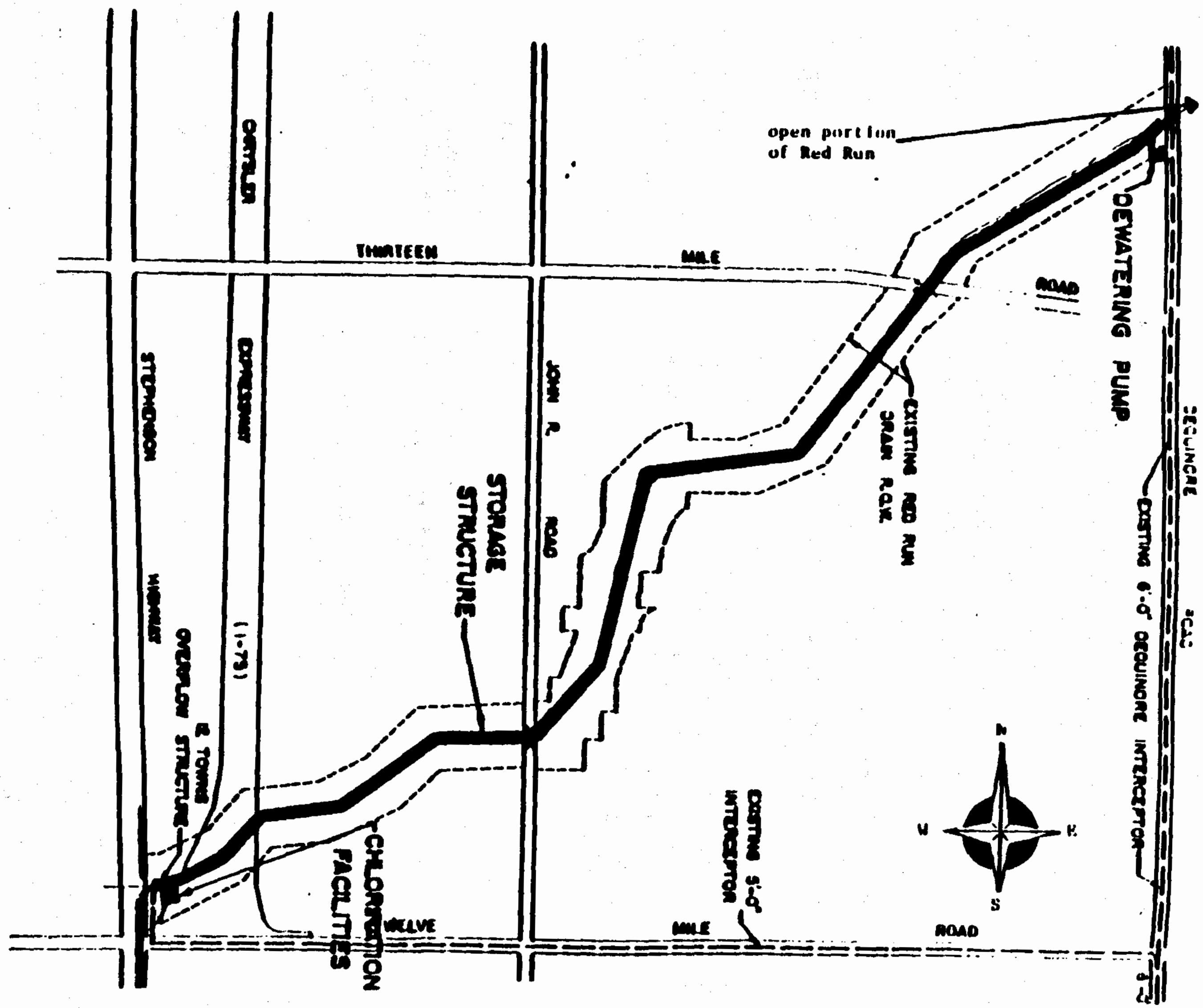


Table 5.2.3

Southeastern Oakland Co. Sewage Disposal System
Monthly Discharge Rates into the Red Run from 1976-1986

year	month*	No. of Days Discharging	BOD-5 Loading** lbs./mo.	BOD-5 Concentration Ave. mg/l	Suspended Solids Loading** lbs./mo.	Suspended Solids Concentration mg/l	pH Range	Coliform-Fecal Ave. or Range MF/100ml	Total Flow in Millions of Gallons
1976									
	February	6	155333	36	468541	74	7.0-7.8	<10	535
	April	1	166800	50	233520	70	7.5	10	400
	May	2	187650	45	195990	47	7.3	10	500
	June	1	264795	50	868528	164	7.8	100	635
	July	1	750600	60	1976580	158	7.5	<10	+1500
	August	1	17514	30	46704	80	7.2	<10	70
	September	1	52542	30	210168	120	7.4	1600	210
	October	1	41700	20	467040	224	7.6	70	250
	Total:	14	1636934	40	4467071	117	7.0-7.8		+4100
1977									
	February	1	25520	36	94993	134	7.5	<10	85
	March	2	168885	75	416833	106	7.0-8.0	15	390
	April	3	174515	30	847261	194	6.8-7.5	<100	740
	September	2	37155	30	160145	142	6.7-6.9	510	164
	December	2	47872	31	72558	47	7.5-8.0	82	210
	Total:	10	453947	40	1591790	125	6.7-8.0		1589
1978									
	March	2	71516	22	225680	69	6.6-7.0	33	385
	May	3	110213	85	261409	152	6.8-6.9	7	307
	June	2	17014	18	25354	33	7.0-7.2	148	120
	Total:	7	198743	42	512443	85	6.6-7.2		812
1979									
	January	1	18615	18	66186	64	6.9	<100	124
	March	1	31525	42	87070	116	6.8	80000	90
	April	4	101248	23	164465	27	7.2-7.5	<100	740
	May	1	10141	38	8006	30	7.1	27500	32
	June	1	?	25	?	66	7.2	56000	***
	July	1	?	17	?	62	7.6	100000	***
	November	2	47955	57	190986	229	6.9-7.1	220	100
	December	2	857561	15	846427	71	7.3-7.4	<100	1525
	Total:	13	1067045	29	1363140	83	6.8-7.6		+2611
1980									
	March	2	25520	20	105084	71	7.1	<100	160
	April	2	17898	14	181445	94	6.7-7.0	<100	197
	May	1	38531	42	102749	112	6.9	25	110
	June	3	20975	27	89238	118	7.0-7.8	690 & 50	90
	July	1	4979	21	9174	44	6.0	40000	25
	August	2	12452	14	154774	112	6.4-6.8	1400	123
	September	1	2294	25	2569	28	7.4	50	11
	Total:	12	122049	23	645033	83	6.0-7.8		716
1981									
	February	4	45853	20	133190	52	7.0-7.1	0	293
	April	2	32301	35	63017	69	6.9-7.1	<100	109
	July	1	21767	15	118995	82	6.9	<100	174
	September	3	167734	11	1985420	132	7.0-7.8	100	1818
	October	1	30958	32	81265	84	6.9	<100	116
	Total:	11	298613	23	2381887	84	6.9-7.8		2510

Table 5.2.3 cont.

Southeastern Oakland Co. Sewage Disposal System
Monthly Discharge Rates into the Red Run from 1976-1986

year	month*	No. of Days Discharging	BOD-5 Loading** lbs./mo.	BOD-5 Concentration Ave. mg/l	Suspended Solids Loading** lbs./mo.	Suspended Solids Concentration mg/l	pH Range	Coliform-Fecal Ave. or Range MF/100ml	Total Flow in Millions of Gallons
1982									
	January	1	6334	16	6539	16	6.6	9600	49
	March	8	222686	22	519132	58	6.2-7.4	?	1432
	June	1	29357	92	130271	142	7.2	200	110
	July****	2	12010	16	72058	96	7.5	2400	93
	November	2	49473	43	51041	42	6.4-6.7	12200&1370	148
	Total:	14	319860	26	779041	71	6.2-7.5		1832
1983									
	April	3	31492	27	?	*****	6.9-7.4	<10	280
	May****	2	69389	10	166533	24	7.2	<10	835
	June	1	8232	21	36062	92	6.7	10	47
	July	1	36696	22	226848	136	6.9	<10	200
	October	1	33026	33	154123	154	7.3	<100	120
	December	1	16513	18	27522	30	6.8	10	110
	Total:	9	195348	22	611088	87	6.8-7.4		1592
1984									
	March	2	78955	15	792117	141	6.8-7.3	<100	667
	May	1	18431	17	271050	250	7.3	<100	130
	July	1	914	22	3586	86	7.2	5180	5
	August	2	41984	29	405090	203	7.2	<100	198
	September	2	6505	9	85068	103	7.4-7.5	100	90
	November	1	19816	18	44035	40	7.5	<100	132
	Total:	9	166005	18	1600946	137	6.8-7.5		1222
1985									
	January	1	21071	8	168134	64	7.4	0	315
	February	1	?	******	587636	52	7.4-7.6	0	1355
	March	4	19632	12	97978	55	6.9-7.9	1, 7	238
	April	1	112090	21	555110	104	7.8	1, 500	640
	May	1	9174	22	73392	176	6.9	<100	50
	July	2	53668	53	125809	96	7.4-7.6	<100	190
	August	1	8073	11	51374	70	7.3	0	88
	September	1	12010	36	24686	74	7.8	0	40
	October	1	13427	7	153456	80	7.1	3	230
	November	2	32566	17	152972	47	7.2-7.4	15,4,2	303
	Total:	15	281711	21	1990547	82	6.9-7.9		3449
1986									
	March	2	17030	18	212790	55	7.3-7.4	<100	110
	June	3	117127	16	1039681	792	6.8-7.4	100	438
	July	1	44285	18	1112056	452	6.9	<100	295
	September	3	50132	20	388577	151	7.0-7.4	100	228
	October	1	51174	59	91940	106	7.2	<100	104
	Total:	10	279748	26	2845044	311	6.8-7.4		1175

* Reported only months that had discharges
** Loadings based on individual concentrations times the flow value
*** Flow recorder was out of order
**** 3 million addition gallons of discharge was reported but no parameters were measured
***** Suspended solids not measured
****** BOD incubator broken due to freezing

Table 5.2.4 Comparison of Flow and Loadings into Red Run by Southeastern Oakland County Sewage Disposal System and Warren WWTP

Year	Facility	Total Flow in Million Gallons	BOD-5 Loadings lbs./year	Suspended Solids Loadings lbs./year
1982				
	S.O.C.S.D.S./P.C.F.	1832	319860	779041
	Warren WWTP	10619	98535	74117
1983				
	S.O.C.S.D.S./P.C.F.	1592	195348	611088
	Warren WWTP	11561	109945	95543
1984				
	S.O.C.S.D.S./P.C.F.	1222	166005	1600946
	Warren WWTP	10202	119881	74266
1985				
	S.O.C.S.D.S./P.C.F.	3449	281711	1990547
	Warren WWTP	11625	100245*	100228
1986				
	S.O.C.S.D.S./P.C.F.	1175	279748	2485044
	Warren WWTP	11208	91515*	122829
Overall Annual Mean Per Year				
	S.O.C.S.D.S./P.C.F.	1854	248534	1565333
	Warren WWTP	11043	104024	93397

* BOD-5 Carbon

Suspended solids loadings varied with the lowest loading in 1978 [232,439 kg (512,443 lbs)] and the highest in 1986 [2,026,219 kg (4,467,071 lbs)]. The average annual suspended solids load for the 11 year period was 774,733 kg (1,708,002 lbs). The suspended solids loadings were not directly correlated with overflow volume. Suspended solids concentration varied greatly from year to year with the highest concentration in 1986, (average 311 mg/l), three times higher than the average for the other ten years (95 mg/l).

The pH range for the 11 year period was between 6.0 and 8.0. The pH values in their NPDES permit is 6.5 to 9.0. The majority of pH values fell within this range. The only months during this period that were below this limit were July of 1980 and March of 1982.

Fecal coliform bacterial counts in the overflow to Red Run were under 200 mf/100 ml (Water Quality Standard) 80% of the time during the 11 year period from 1976 through 1986. Highest counts were between 1979 and 1982, where counts were up to 100,000 mf/100 ml. From 1983 to 1986, fecal coliform bacterial counts exceeded 200 mf/100 ml on only two out of 43 days of overflow.

Comparison of Intermittent and Continuous Municipal Loadings

Loadings and flow to Red Run between 1982 and 1986 from the SOCSDS/PCF and Warren WWTP are compared in Table 5.2.4. Overflow to Red Run from the SOCSDS/PCF averaged 7,018,132 m^3 (1,854 million gallons per year) compared to 41,802,172 m^3 (11,043 million gallons per year) discharged from Warren WWTP. The Warren WWTP discharges approximately 117,347 m^3day (31 mgd) while SOCSDS/PCF flows ranged from 4,447,845 m^3yr (1,175 million gallons per year) in 1986 to 13,055,845 m^3/yr (3,449 million gallons per year) in 1985. The Warren WWTP flow varied little between 1982-86, ranging from 38,618,650 m^3/yr (10,202 million gallons per year) in 1984 to 44,005,275 m^3/yr (11,625 million gallons per year) in 1985. The Warren WWTP flow averages six times the flow of the SOCSDS/PCF.

Annual BOD_5 loadings from the SOCSDS/PCF averaged 112,733 kg (248,534 pounds), well over twice as much as Warren's annual BOD_5 load of 47,184 kg (104,024 pounds).

Mean annual SOCSDS/PCF suspended solids loadings were nearly 17 times higher [710,019 kg (1,565,333 lbs)] than Warren's mean annual suspended solids load [42,364 kg (93,397 lbs)].

These data reveal that the SOCSDS/PCF contributes far more BOD_5 and suspended solids to Red Run than Warren although its annual flow is six times less.

5.2.2 Nonpoint Sources

5.2.2.1 Urban Stormwater

The major nonpoint source of pollutants in Section 4 is urban stormwater (Table 5.1.5). Industrial site runoff, contaminated groundwater discharges, and atmospheric loadings have not been investigated.

The hydrodynamics of Red Run influence downstream Clinton River water quality. A serious pollutant transport results from the SOCSDS/PCF, an intermittent municipal source also called a CSO, as well as urban stormwater runoff.

The Red Run watershed is presently more than 75% developed with projections of nearly 100% development by the year 2000. Residential uses comprise over 45% of all land use, with commercial and industrial uses at 17%, and public land use at 11% (USCOE, 1979). The great extent of sealed surfaces in this highly developed area has led to severe flooding problems. During major rain events, water levels in Red Run rise very quickly, conveying huge amounts of stormwater to Red Run via drains.

Many drains carry stormwater to Red Run. One large drain project was the Henry Gram Drain, which began in 1972 and was completed in 1974. This drain enters Red Run downstream of Warren's discharge, transfers stormwater from Madison Heights and Troy and was built to handle up to 173 m^3/s (6,100 cfs) assuming that a proposed Red Run expansion project would be soon implemented. This project was to further widen and straighten Red Run downstream of Dequindre to the Clinton River at the cost of $150,000,000. In November 1986, Public Law 99-662 deauthorized the project, but a smaller widening project was undertaken in 1976. Since the original Red Run project was not built, the Henry Gram Drain was limited to 14 m^3/s (480 cfs). This flow was increased to 23 m^3/s (800 cfs) after widening Red Run an average of 1.5 meters (5 feet) between Dequindre and Mound Roads in 1976. Other major stormwater drains discharging to Red Run include the Schoeherr Drain from Warren and the 15½ mile Road Drain from Sterling Heights and Warren. Numerous other small drains carry large amounts of stormwater to Red Run.

The Red Run Channel capacity is presently 142 to 170 m^3/s (5,000 to 6,000 cfs) at Dequindre Road. The eastern limits of the open portion of Red Run increase to 227 m^3/s (8,000 cfs) at its confluence with the Clinton River. The slope of Red Run falls less than 0.57 meters per km (3 feet per mile) (USCOE 1979).

The Inner County Drainage Board has assigned the responsibility for basic maintenance of Red Run, including periodic shoal removal, to the Oakland County Drain Commissioner. The Commissioner has authorized periodic dredging in Red Run to maintain rapid conveyance of stormwater out of Section 4 into the Main Branch (Section 3). Table 5.2.5 lists the times, dredging locations, approximate costs and disposal location of sediments dredged from Red Run.

Red Run is included in a list of priority stormwater areas (Figure 5.2.5), a designation for areas of future development in the Clinton River Basin (SEMCOG 1981a). Quantitative characterizations of urban stormwater runoff in Section 4 have not been attempted, but SEMCOG (1978a) estimated that each year 18,223 metric tons of suspended solids, 620 metric tons of BOD_5, 78 metric tons of nitrogen, and 34 metric tons of phosphorus were discharged via urban stormwater runoff to Red Run (Table 5.1.5). Suspended solids and BOD_5 estimates from Section 4 stormwater were second only to loadings estimated from active cropland along the North Branch.

Table 5.2.5 Red Run Shoal Removal by the Oakland County Drain Commisioner

When	Where	Cu. Yds. Dredged	Cost	Where Spoils Placed	MDNR Permit #	Contractor
1965 thru 1975	?	approximately 10,000 per year	?	On the banks of Red Run	None	*
1976 thru 1981	**					
10-4-82 thru 12-10-82	***	27,215	$63,398	On the banks of Red Run	None	Guymann Constr. Co
10-18-83 thru 11-17-83	800 ft E. of Ryan Rd to 1250 ft E. of Ryan Rd 25 ft W. of railroad bridge by Mound Rd to 500ft West 900 ft E. of Mound Rd to 750 ft East	10,635	$19,960	On the banks of Red Run	None	Guymann Constr. Co
1984 thru 1985	?	approximately 17,000	approximately $90,000	On the banks of Red Run	None	Guymann Constr. Co
1986 thru 8-24-87****	**					

*=The Oakland County Drain Commisioner had its own equipment and staff from 1965 to 1975. During that time periodic shoal removal was done on a as needed basis.

**=No shoal removal done during this time period.

***=A total of 54 shoal areas were removed.

**=Future plans call for more shoal removal ov[illegible] 3-5 year period at an estimated cost of $450 [illegible]

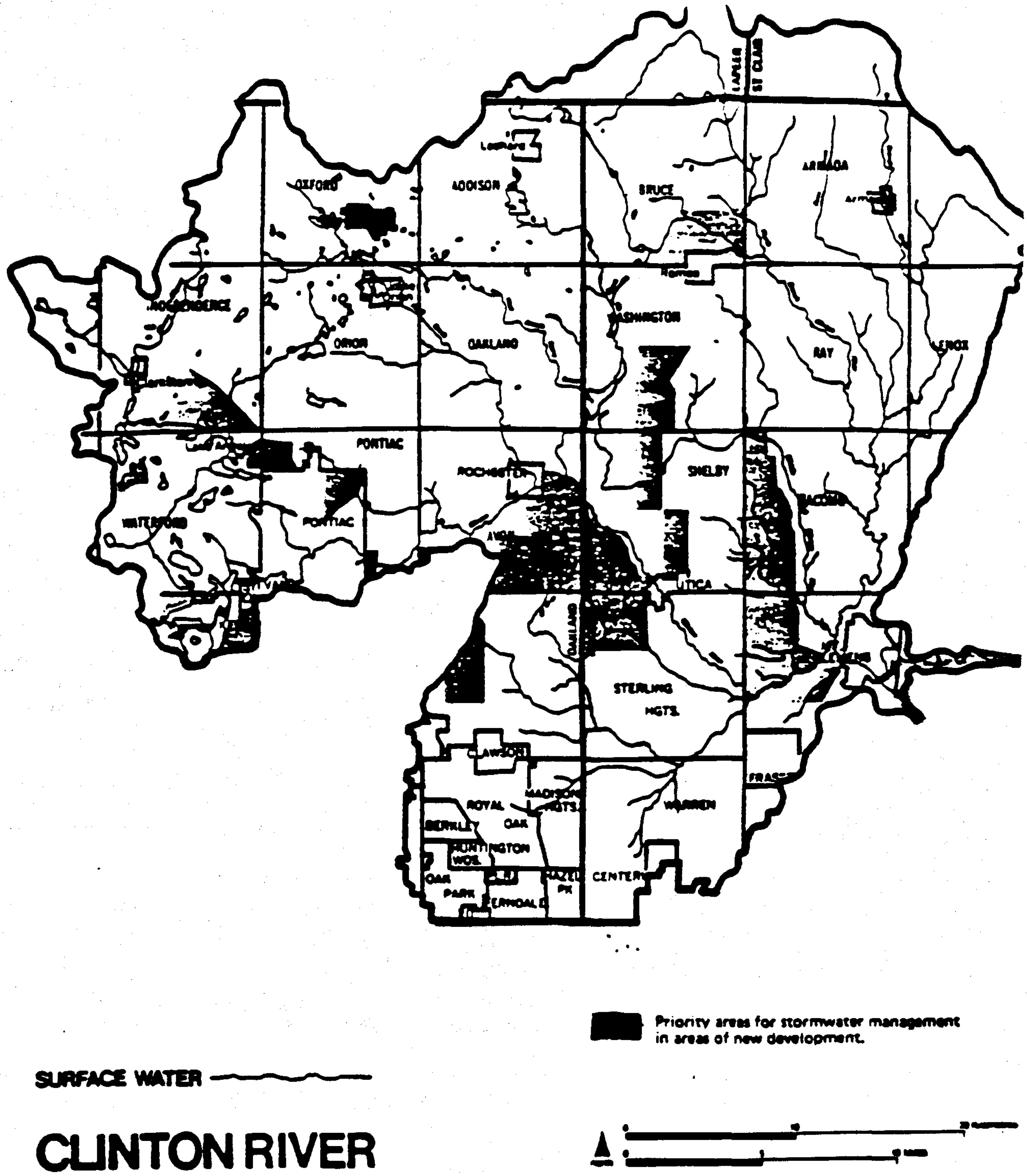


Figure 5.2.5 Priority Stormwater Management Areas in Areas of Future Development of th Clinton River Basin

Source: SEMCOG 1981

Several industrial dischargers have NPDES permits for stormwater runoff through specified outfalls. NPDES permits do not presently require dischargers to report flow frequency, duration, quantity, or water quality of stormwater discharged.

Clearly, SEMCOGs estimates implicate urban stormwater runoff as a major pollutant source and transport mechanism in Section 4.

5.2.2.2 Rural and Suburban Runoff

No quantitative estimates of rural and suburban runoff are available, but SEMCOGs estimate of runoff from grassland provides the closest indication for this pollutant source (Table 5.1.5). Section 4 is largely an urban area with negligible rural or suburban runoff.

5.2.2.3 Industrial Site Runoff

Industrial site runoff may be a significant source of pollutants to Section 4. However, site runoff has not been clearly distinguished as a pollutant source or its contribution measured.

5.2.2.4 Landfills, Dumps and Other Sites of Potential Environmental Contamination

Waste Disposal Site

Thirteen waste disposal sites are located in the Section 4 watershed (Table 5.1.6). The six located in Macomb County include the Hayes Road Site 8, South Macomb Disposal Authority Site 6, Wiegland Disposal Inc., the City of Warren DPW garage, the City of Warren Refuse Transfer Station and the G.M. Tech Center Refuse Processing Station (Map 6.6). The first four are closed and no monitoring exists, while the last two are open and monitored (Table 5.1.6).

Seven waste disposal sites, located in the Oakland County portion of the Section 4 Watershed include the Southeastern Oakland County incinerator at Royal Oak and Troy, the Northeast Landfill Inc., the Cleary Property, and three unnamed sites. Five are type 2 landfills, and are closed with no monitoring, one incinerator (in Royal Oak township) is open with monitoring and one transfer station, located in Troy township, is open and monitored.

Since most sites have no monitoring, little is known about the impact of these facilities on the Clinton River, and no impacts have been documented from these sites.

Act 307 Sites of Environmental Contamination

The only Group 1 Act 307 site in Section 4 watershed is in Macomb County. This site, known as the Red Run Drain Landfills, which was scored in January 1987 at 815, includes seven areas along Red Run (Table 5.1.7). Macomb County Group 2 sites (screened but not scored) in Section 4 watershed include the Clark Gas Station, G.E. Carboloy, Fini Finish Products, Tuff Kote Dinol, Inc. in Warren, the Koch Road Dump in Sterling

Heights, Amoco Gas Station #5414, the Mobil Oil Station at 12 mile and Ryan Road and the Mobil Oil Station #04LCW (Map 6.7). Davis Mfg. Clawson, Howard Plating, Howard Gas and Go, the Ethyl Corporation, and the Old Fons Sanitary Landfill, are the Group 2 Oakland County 307 sites located in the Section 4 watershed.

The Clark gas station, both Mobil Oil stations and Howard Gas and Go have affected soil and groundwater by gasoline spills from underground tanks. G.E. Carboloy spilled acetone from an underground tank and has affected the groundwater. Fini Finish Products has affected the surface water and soil with chrome and cyanide from an unpermitted surface discharge (Appendix 5.2). Tuff Kote Dinol has potentially affected groundwater and air from light industrial wastes. The Koch Road dump has potentially affected surface water, groundwater and soils from heavy manufacturing wastes in barrels and other general landfill materials.

The Old Fons Landfill may have potentially affected surface water and groundwater by ammonia. The Ethyl Corporation may potentially affect groundwater and soil from chemical manufacturing products discharged to a pit. Howard Plating has affected groundwater and soils with cyanide and heavy metals by discharging its waste to the ground. The Davis Mfg, Clawson site has TCE impacted soil from discharges to the ground. The Amoco Station #5414 discharged gasoline to the ground from a pipeline affecting groundwater and soil. The extent of impact from each site is unknown.

Funding was allocated to conduct Remedial Investigation Feasibility Studies for the Red Run Landfills site. According to a site description and summary prepared by MDNR (1984b; Appendix 5.2), there are at least five, and possibly seven landfills along Red Run in a three-mile stretch (Figure 5.2.6). Nine leachate outbreaks were visible. Outbreaks may be due to natural bank erosion, dredging activities, or movement of materials from the landfill into Red Run. The property along the Red Run and its tributaries was used for disposal of municipal, industrial, and household wastes (E.C. Jordan Co., 1986). The following paraphrase from the Work Plan states:

> Following closure, two landfills were partially developed into public parks. The remaining undeveloped parcels are popular local recreation areas. The adjoining property has been developed for residential use. Leachate seepage at several locations has triggered complaints by local citizens. Local governments addressed such complaints by regrading and improving localized drainage. Methane gas is emerging from the ground in the vicinity of one landfill, and complaints about landfill gas have been reported.
>
> Some leachate samples collected by the Michigan Department of Natural Resources (MDNR) in 1983 and 1984 contained phthalate, dichlorobenzene, and dinitro-o-cresol. Lead, nickel, and chromium were also present in some leachate locations. The site was scored and placed on the State's Act 307 List requiring evaluation and interim response activities.

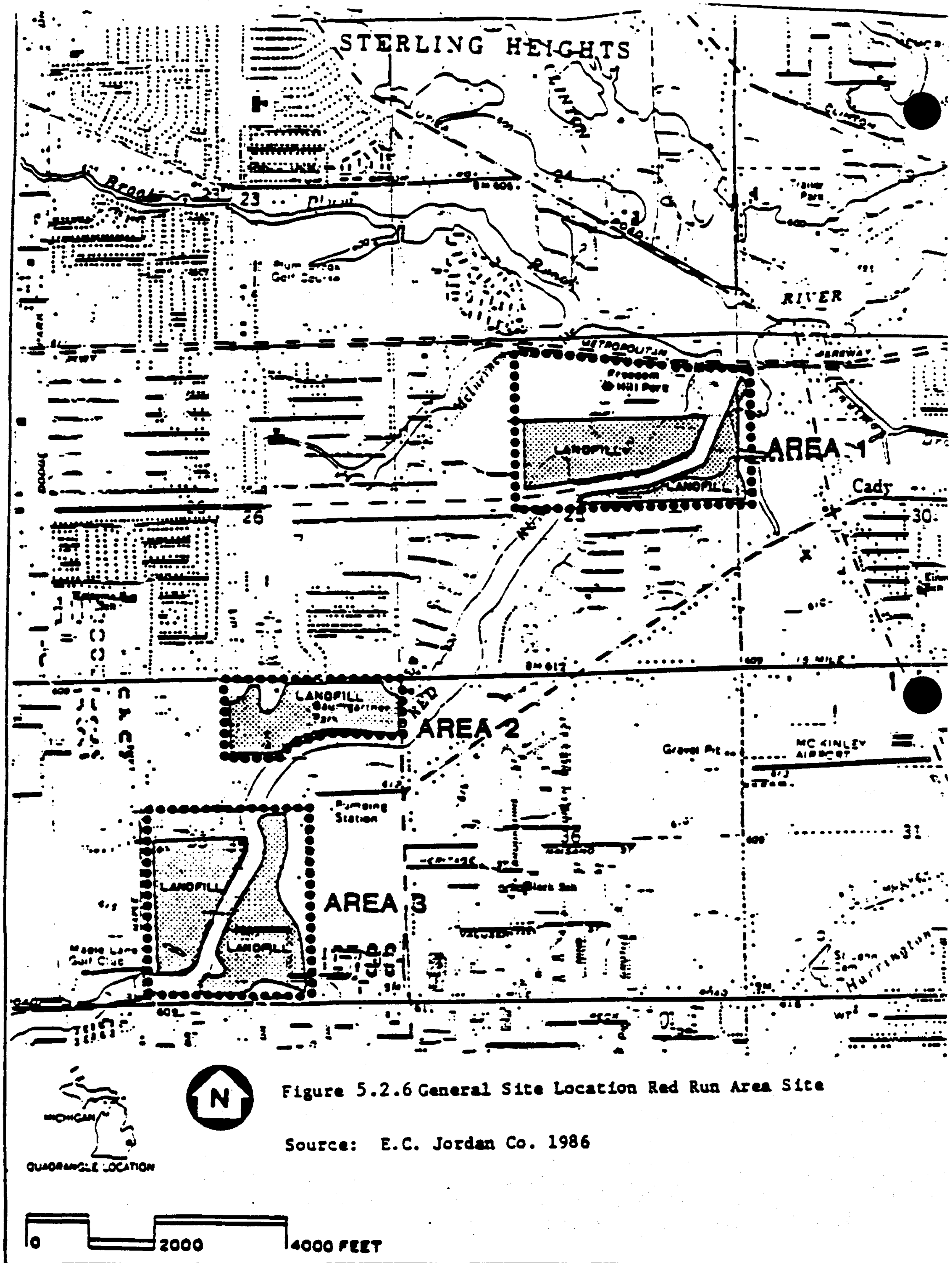


Figure 5.2.6 General Site Location Red Run Area Site

Source: E.C. Jordan Co. 1986

Gas, groundwater, air and soil samples were collected during 1988. A consultant is presently preparing a document containing the results of the Remedial Investigation which should be completed by February of 1989 for two of the landfills. The remaining landfills were not surveyed because the property owners denied the study team access.

The remaining thirteen Act 307 sites received screening scores less than nine, and therefore have not been evaluated by the SAS risk assessment model.

Hazardous Waste Treatment, Storage or Disposal Sites

There are 12 active Hazardous Waste Storage sites in the Section 4 watershed (Map 6.8). Two are proposed for closure and one has already been partially closed (Table 5.1.8). None of these facilities have been issued State permits although all have filed the appropriate applications. There has been no documented impact upon the Clinton River or its tributaries from these facilities to date.

5.2.2.5 Atmospheric Deposition

Section 4 is highly industrialized and emissions from industries and automobiles may be pollutant sources, but no atmospheric loadings data exist.

5.2.2.6 Sediments

Deposition and transport of sediments in Red Run is an intermittent occurrence. During low flow, sediments are largely exposed and shallow areas support submerged aquatic vegetation and macrophytic algae. The hydrodynamics of the drain cause significant resuspension and transport of sediments to downstream areas. The volume of sediment transported and distance traveled before settling is dependent on the velocity and duration of stormwater discharge. However, when sediments are resuspended during a storm event, it is likely that some sediment contaminants are released and transported downstream. The impact of sediment contaminants on the aquatic life and water column is unknown. (See Section 5.6.2.4 for a discussion on sediments as a source of contaminants to the water column).

5.3 SECTION 6 THE NORTH AND MIDDLE BRANCHES OF THE CLINTON RIVER AND THEIR TRIBUTARIES

5.3.1 Point Sources

There are three continuous municipal dischargers (Almont, Armada and Romeo) and two continuous industrial dischargers (Ford Motor Proving Grounds and TRW Seatbelt Division) to Section 6 which includes the North and Middle Branches of the Clinton River. Almont, Armada, and Romeo WWTPs, and Ford Motor Company monitor for $CBOD_5$, ammonia, nitrogen, total suspended solids, total residual chlorine, total phosphorus, pH, fecal coliform bacteria and dissolved oxygen. Ford Motor Company Michigan Proving Grounds, discharges cooling water from a car wash to a septic tank, tile field, and pond, to East Pond Creek. TRW Seatbelt discharges noncontact cooling water with observations for oil and grease. These small volume discharges total 2.5 mgd with the Romeo WWTP discharge (1.6 mgd) comprising over one third of the total permitted point source discharge flow to Section 6 of the Clinton River.

The South Macomb Disposal Authority landfill 9 and 9A has an NPDES Permit to discharge collected leachate but it has never been formally used.

5.3.1.1 Continuous Municipal Point Source Dischargers

Romeo WWTP

The Romeo WWTP discharges 1.6 mgd to East Pond Creek which flows into the North Branch of the Clinton River. The plant receives mostly domestic wastes and can treat a peak of 3.3 mgd. Wastewaters pass through a partial flume, bar screen, grit chamber, an equalization basin, a primary settling tank, another partial flume to the biodisks, through a mechanical flocculation chamber to the settling tank and chlorine contact chamber. Romeo's WWTP serves a mostly separated sewer system. Final effluent limits were issued February 21, 1986. Permitted and estimated loadings are summarized in Table 5.3.1.

There are presently no industries discharging to the Romeo WWTP so no pretreatment is required. In the past, the Ford Romeo Tractor plant discharged a significant portion of the total flow. The Romeo WWTP was in compliance with all limits except suspended solids during the last MDNR point source wastewater survey, completed in February 1982.

Almont WWTP

The Almont WWTP is a secondary facility discharging an average of 0.16 mgd with a design capacity of 0.32 mgd. An overflow occurs when the inflow reaches 0.6 mgd. Almont is served by nearly completely separated storm and sanitary sewer systems. The city is presently completing this separation. Normally, wastewater flows to a wet well, is pumped into the primary tank, and then to a trickling filter. Then it flows to the secondary tank, where it is chlorinated and discharged to the North Branch of the Clinton River.

The wastewater is primarily domestic with no industrial flow, so no pretreatment is required. The results of a twenty-four hour MDNR point source wastewater survey conducted September 22-23, 1980, indicated that the plant was out of compliance for the seven day average for suspended solids and BOD_5 (MDNR, 1981b).

The Almont WWTP was chronically out of compliance with their old permit between 1980 and 1985 for BOD (1-3 months/year), suspended solids (1-4 months/year), and fecal coliform bacteria (1-8 months/year). In 1985, Almont received a modified permit. Since 1985, Almont has violated their limits for BOD for two months, and suspended solids and fecal coliform bacteria for three months. Almont is upgrading their WWTP to a tertiary facility with phosphorus removal and rapid sand filtration. They are under court order to meet their final effluent limits by April 1989 and

Table 5.3.1 Permitted and Estimated Loadings from Municipal Facilities in Section 6, North and Middle Branches of the Clinton River.

	Romeo WWTP*				Armada WWTP**				Almont WWTP***			
Conventional Loading	Annual Permitted Loading lbs/year	Annual Estimated Loading lbs/year	Loading lbs/day	Conc. ug/l	Annual Permitted Loading lbs/year	Annual Estimated Loading lbs/year	Loading lbs/day	Conc. ug/l	Annual Permitted Loading lbs/year	Annual Estimated Loading lbs/year	Loading lbs/day	Conc. ug/l
Suspended Solids	136035	8067	22.1		23165	18506	50.7		11870	56210	154	
Dissolved Solids		1610015	4410			8104825	2205			627800	1720	
BOD-5		8067	22.1			9673	26.5			40150	110	
BOD-5(Carbon)	93570	6424	17.6		32120				24565	40150	110	
COD		71540	196							112785	309	
TOC		160965	441			13834	37.9			33799	92.6	
NO2+NO3		18506	50.7			10476	28.7			15330	42	
NH3-N	9635	80.3	0.22		5225	2336	6.4		9538.4	7665	21	
Total Kjel. Nitrogen		2409	6.6			5074	13.9			14491	39.7	
Total Phosphorus	4854	12885	35.3		109.5	2482	6.8		985.5	5694	15.6	
Orthophosphorus										3614	9.9	
CN(total)		7.3	0.02			14.6	0.04					
Cl		482895	1323							120815	331	
Na												
Metal Loading												
Silver												
Aluminum												
Arsenic						8.03	0.022					
Barium												
Beryllium												
Cadmium				<20				<20				<0.02
Cobalt												
Chromium				<50				<50				<0.05
Hex. Chromium												
Copper						47.5	0.13			65.7	0.18	
Iron						949	2.6					
Mercury				<0.5		0.37	0.001					
Lithium												
Manganese				<20								
Molybdenum												
Nickel				<50				<50				<0.05
Lead				<50				<50				<0.05
Antimony												
Selenium												
Titanium												
Vanadium												
Zinc		113	0.31			54.8	0.15			80.3	0.22	
Organic Loading												
Phthalates						6.9	0.019					
HCB												
PCB				<0.1				<0.51				<0.1
TCE												
Toluene												
Xylene												
Phenol		3.56	0.01			16.1	0.044					

*=Results based on sampling done Feb. 2-3, 1982. Flow was measured at 0.56 million gallons per day.
**=Results based on sampling done on July 10-11, 1984. Flow was measured at 0.24 million gallons per day.
***=Results based on sampling done on Sept. 22-23, 1980. Flow was measured at 0.43 million gallons per day.

are presently on schedule. Permitted and estimated loadings from the Almont WWTP are shown in Table 5.3.1. Effluent limits are shown in Appendix 5.1.

Armada WWTP

The Village of Armada is served by a 0.25 mgd wastewater treatment plant with a maximum design flow of 0.35 mgd, which receives combined storm and sanitary sewage. There are no industries discharging to the Armada WWTP so there is no pretreatment required. The wastewater passes through grit chamber and bar screen, through a primary clarifier, to a stone media trickling filter. Water is then pumped to a final clarifier which acts as a chlorine contact chamber prior to discharge to the East Branch of Coon Creek, a tributary to the North Branch of the Clinton River.

The results of a MDNR twenty-four hour point source survey conducted July 10-11, 1984, indicated that the Armada WWTP was in compliance with its interim permit limits (MDNR, 1984c). The interim and final permit loadings are summarized in Table 5.1.1. The 1984 loadings for the permitted parameters are shown in Table 5.3.1. Effluent limits are shown in Appendix 5.1.

5.3.1.2 Intermittent Point Sources

Intermittent point sources in Section 6 occur from combined sewer overflows at Armada, and unintentional bypasses and overflows may occur at Armada, Almont and Romeo during very rainy weather. The occurrence, frequency, and duration of unintentional overflows from these municipal systems is not known.

Combined Sewer Overflows

The only combined sewer overflows in Section 6 are at Armada. The Village is authorized to discharge combined sewage from eight CSOs to the East Branch of Coon Creek in excess of its treatment capabilities until an effective CSO control program is implemented. The Village was to submit a CSO Management Plan by July 31, 1985, but has not met their compliance order. Consequently, some combined sewer overflows remain. Because there is significant infiltration and inflow to this system, the city may try to separate the sewers.

South Macomb Disposal Authority Landfill 9 and 9A

The South Macomb Disposal Authority Landfill 9 and 9A has a leachate collection system which is designed to intercept landfill leachate before it reaches McBride Drain. Although it has an NPDES permit, it has never been formally used since the system is supposed to be periodically pumped out and treated at a local WWTP. Spills have occurred from this site (see Spills Section 5.7, Table 5.7.1) and the state is presently in court with SMDA concerning groundwater and possible surface water contamination.

5.3.2 Nonpoint Sources

The major nonpoint source in Section 6 is agricultural runoff followed by urban stormwater (SEMCOG 1978a). Contaminated groundwater may be a source because of high nitrates thought to originate from agricultural areas. In addition, several landfills exist in this section of the watershed which may contribute contaminants to ground or surface waters.

5.3.2.1 Urban Stormwater

SEMCOG (1978) (updated in 1988 to reflect current NPDES loadings) estimated that urban stormwater runoff accounted for 32% of the suspended solids, 17% of the BOD, 4% of the nitrogen, and 14% of the phosphorus in Section 6 (Table 5.1.5).

5.3.2.2 Rural and Suburban Runoff

Rural runoff in Section 6 is largely from active cropland and grassland (Table 5.1.5). SEMCOG (1978) estimated total suspended solids and BOD loadings from these sources at 27,245 and 2,121 metric tons per year, respectively. The nitrogen and phosphorus contributions (1,226 and 137 metric tons per year, respectively) from these sources are one to two orders of magnitude higher than other River Sections (SEMCOG 1978a).

Major agricultural activity occurs in the North Branch watershed. The runoff from active cropland accounts for 64% of the total suspended solids, 78% of the BOD, 90% of the total nitrogen and 76% of the total phosphorus loading to Section 6, and 28% of the suspended solids, 40% of the BOD, 59% of the total nitrogen load, and 38% of the total phosphorus loading to the entire Clinton River Basin (Table 5.1.5).

5.3.2.3 Industrial Site Runoff

Very little is known about industrial site runoff not regulated by MDNR's NPDES permit system. The Mt. Clemens Coatings Company, formerly Ford Paint and Vinyl, discharges stormwater to Greiner Drain, which flows into the North Branch of the Clinton River (Figure 5.3.1). No NPDES permit has been issued for this stormwater discharge but there have been documented losses of toxic chemicals, including tetrahydrofuran, cathodic e-coat resin, butyl alcohol, methyl ethyl ketone, and PCB from this facility to Greiner Drain via a stormwater outfall (MDNR 1980).

Recommendations of a biological survey conducted in 1979 on Greiner Drain and North Branch, above and below the confluence with Greiner Drain, to evaluate the impacts from Mt. Clemens Coatings are listed below.

Summary and recommendations (MDNR 1980)

1. Greiner Drain has not adversely affected the water quality, sediment quality, and/or the benthic macroinvertebrate community of the North Branch Clinton River immediately downstream from their confluence.

2. High levels of PCB-1242 (13 mg/kg) and total lead (100 mg/kg) are measured in Greiner Drain sediments downstream of the Ford Paint and Vinyl Plants stormwater outfall. These concentrations fall in the

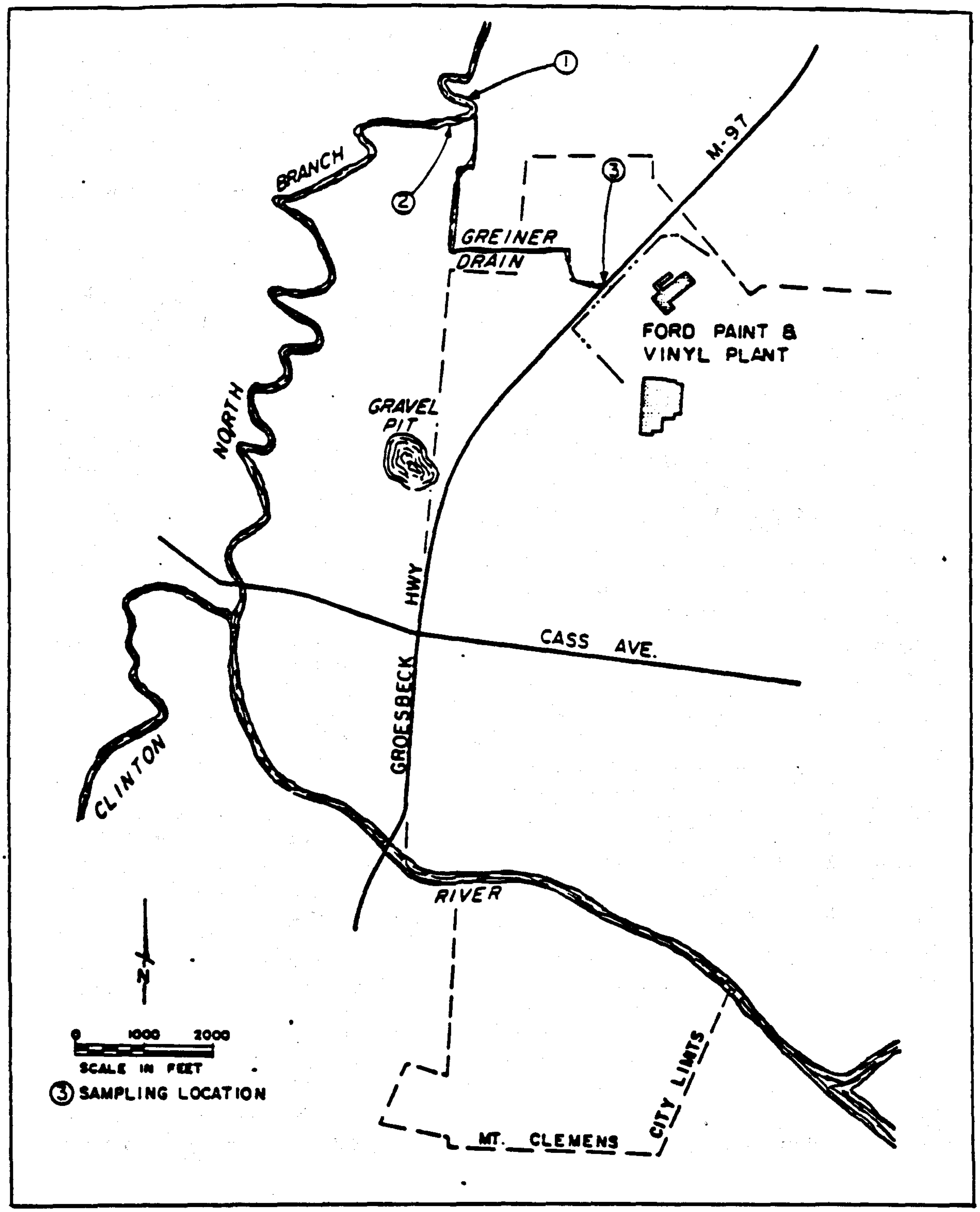


Figure 5.3.1 Sampling Stations for the Biological Survey Conducted on the North Branch, Clinton River, and Greiner Drain, Macomb County, August 30, 1979

Source: MDNR 1980

"heavily polluted" category of EPA's Guidelines for the Pollutional Classification of Great Lakes Harbor Sediments.

3. Additional sediment samples should be collected from Greiner Drain and analyzed for PCB, cadmium, lead, and oils to evaluate the zone of contamination. Contaminated Greiner Drain sediments should be dredged and disposed in a manner considered appropriate for a hazardous waste. Sites used previously by the Macomb County Drain Commission to dispose of dredge spoils from Greiner Drain should be investigated as potential sources of groundwater and/or surface water contamination.

4. Additional monitoring of wet and dry weather discharges from the Ford Paint and Vinyl Plants stormwater outfall for PCB, cadmium, lead, oils, and total phosphorus should be conducted to determine whether the elevated concentrations of these contaminants found in Greiner Drain sediments are the result of historical or present practices. If present discharges are found to be contaminating Greiner Drain sediments, the Department should consider issuing an NPDES permit for the Ford Paint and Vinyl Plants stormwater discharge. Routine monitoring requirements for total lead, total cadmium, PCB, oil and grease, and total phosphorus should be included in the permit.

No additional survey work has been conducted and no known cleanup action has occurred at this location. Spills have also occurred at this site since this survey (Table 5.7.1). The present status is unknown, but the site is now listed as a Group 2 307 site (See Section 5.3.2.4).

Although this site received a low 307 screening score (08), the plant's history of stormwater and toxic discharges to the Clinton River via Greiner Drain suggests a high potential for continued contamination of Greiner Drain waters and sediments (MDNR 1985c). The Site Description/ Executive Summary prepared by the Environmental Response Division, MDNR is presented in Appendix 5.2.

5.3.2.4 Landfills, Dumps and Other Sites of Potential Environmental Contamination

Waste Disposal Sites

There are 14 waste disposal sites in the Section 6 watershed (Table 5.1.6), all of which are in Macomb County. There are three type II and three type III landfills that are closed but have no groundwater monitoring. There are seven closed landfills that are monitored. There are no open landfills in the watershed but there is one refuse transfer station in Ray Township that is open and does not require groundwater monitoring. The closed landfill sites in Section 6 are located in Armada, Chesterfield, Lenox, Macomb, Ray, Richmond, and Washington Townships (Map 6.6). Impacts on the Clinton River from these waste disposal sites have not been documented.

Act 307 Sites of Environmental Contamination

Three Group 1 sites were placed on the 1987 Act 307 List (Table 5.1.7), including South Macomb Disposal Landfill (SMDA) 9 and 9A, and residential wells on Koss and Card Roads (Appendix 5.2).

SMDA is presently installing an underdrain and slurry wall along the northern boarder of SMDA Landfill 9. A similar action is presently being sought for the east boundary of SMDA Landfill 9. SMDA Landfill 9 has had some impacts on 3 aquifers and has had periodic documented discharges to McBride Drain. The State of Michigan is presently in court with SMDA and hopes to develop a consent agreement with SMDA. In addition, SMDA Landfills 9 and 9A have been classified as superfund sites and as of October 1, 1988, an EPA contractor has been on site conducting a Remedial Investigation Feasibility Study.

Four additional sites have been identified, screened and placed in Group 2. Residential wells at 32 Mile Road, Washington Township Section 8 Landfills, G and L Industries in Mt. Clemens, and Ford Motor Paint and Vinyl Plant, now called Mt. Clemens Coatings impact groundwater, soils, surface water and sediment in localized areas in the Section 6 watershed (Map 6.7). Contaminants from Group 1 and Group 2 sites include chlorides, metals, solvents and organic chemicals from landfills, and automobile and fiberboard manufacturers. Sources for residential well contamination are unknown.

Hazardous Waste Treatment, Storage or Disposal Sites

There is one hazardous waste storage facility in the Section 6 watershed (Map 6.8), the General Motors Corporations GMAD Lake Orion Township facility (Table 5.1.8). There have been no documented impacts from this facility on the Clinton River or its tributaries.

No compliance actions are pending that would have significant impact on the groundwater or surface water in this watershed. This is not to minimize the potential impact these facilities may have based on the wastes handled or the cumulative effect due to the sheer number of facilities (L. AuBuchon, MDNR Detroit District Waste Management Division, personal communication, 1987).

5.3.2.5 Atmospheric Deposition

Data on atmospheric deposition as a source of pollution is very limited. Air quality in Macomb County is improving in terms of total suspended particles (MDNR, 1985a). All sampling sites met the secondary 24-hour standard for suspended particulates in 1985. Sulfur dioxide and lead standards are met consistently. Carbon monoxide was only infrequently exceeded at Warren (MDNR 1985a).

5.3.2.6 Sediments

Greiner Drain sediments degraded by Mt. Clemens Coatings have been described in 5.3.2.3. The impact of these sediments on the Clinton River is unknown.

5.4 SECTION 3 - MAIN BRANCH CLINTON RIVER BETWEEN RED RUN AND THE SPILLWAY

5.4.1 Point Sources

5.4.1.1 Continuous Point Source Discharges

There are no continuous municipal point sources and only one continuous industrial point source, the Molloy Manufacturing Company in Section 3 (Map 6.5). Molloy Manufacturing Company discharges a maximum of 0.2 mgd of noncontact cooling water from outfall 002 to Section 3 via Tesk and Harrington Drains. The outfall is monitored weekly for flow, temperature and pH and daily for unusual visual characteristics (Table 5.1.1). This discharge is unlikely to have a significant impact on the Clinton River.

5.4.1.2 Intermittent Point Source Dischargers

There are no intermittent municipal or industrial point source discharges to Section 3. There are no CSOs in Section 3.

5.4.2 Nonpoint Sources

5.4.2.1 Urban Stormwater

Urban stormwater from Section 3 watershed is a suspected source of pollutants but no direct loading data exist. (See Section 3.4.7, Table 3.4 for loadings developed by SEMCOG (1978)).

5.4.2.2 Rural and Suburban Runoff

Rural and suburban runoff loading data are not available for Section 3.

5.4.2.3 Industrial Site Runoff

Industrial site runoff loading data are not available for Section 3.

5.4.2.4 Landfills, Dumps, and Other Sites of Potential Environmental Contamination

Waste Disposal Sites

All six Section 3 watershed waste disposal sites are in Macomb County (Map 6.6). The Clinton River Road disposal area, M-97 Landfill, Fourteen Mile Road site and Louis Marsack and Sons disposal site are all Type 2 landfills which are closed and have no monitoring (Table 5.1.6). Three are in Clinton Township. The Grosse Pointe Clinton Reduction site is a closed incinerator which is not monitored. The Roseville South Macomb Disposal Authority in Roseville Township is an open site, but has no monitoring since it is only a transfer facility.

Act 307 Sites of Environmental Contamination

One Act 307 site is located in the Section 3 drainage area in Macomb County (Map 6.7). The Clinton River Road Disposal Area is a Group 2 site which has been screened but not scored (Table 5.1.7). The resources potentially affected by phenols are groundwater and soils.

Hazardous Waste, Treatment, Storage or Disposal Sites

There is one active Hazardous Waste Treatment and Storage site in the Section 3 watershed, which is the U.S. Chemical Company in Roseville (Map 6.8). This site is six to eight miles from the Clinton River and, therefore, very unlikely to impact the River (Table 5.1.8).

5.4.2.5 Atmospheric Deposition

There is no information on atmospheric loadings to Section 3.

5.4.2.6 Sediments

Sediment loading data are not available for Section 3. See Section 5.6.2.4 for a discussion on sediment loadings to surface water. (See also Tables 4.8 through 4.12 for sediment data)

5.5 SECTION 2 - CLINTON RIVER SPILLWAY

5.5.1 Point Sources

The spillway watershed is primarily urban residential with no continuous or intermittent industrial or municipal point source discharges.

5.5.2 Nonpoint Sources

5.5.2.1 Urban Runoff

Urban runoff has not been quantified for Section 2. A rough estimation of urban stormwater is given in Section 5.3.2.1.

5.5.2.2 Rural and Suburban Runoff

No estimates of rural or suburban runoff are available.

5.5.2.3 Industrial Site Runoff

No estimates of industrial site runoff are available.

5.5.2.4 Landfills, Dumps and Other Sites of Potential Environmental Contamination

Waste Disposal Sites

There are no waste disposal sites in the Clinton River Section 2 watershed.

Sites of Environmental Contamination - Act 307 Sites

The only 307 site in the Section 2 watershed is the John March Gasoline Station at 16 Mile Road and Gratiot where an underground tank has leaked, releasing benzene, toluene, and xylene to the land and groundwater (Map 6.7). It is a Group 2 site and the extent of contamination is unknown (Table 5.1.7).

Groundwater contaminant loadings are estimated as extremely small to none since there are no known sources in or near the spillway and groundwater water movement is slow due to soil type and very low soil permeability.

Hazardous Waste Treatment, Storage or Disposal Sites

There are no active hazardous waste treatment, storage or disposal sites in the Section 2 watershed.

5.5.2.5 Atmospheric Deposition

There are no data for atmospheric loadings.

5.5.2.6 Sediments

Contaminated sediments in the spillway may contribute a minimal amount of metals to the spillway water column, but these loadings have not been, and probably cannot be, quantified (See Section 5.6.2.4 Sediments and Tables 4.8 through 4.12 for sediment chemical data).

5.6 SECTION 1 - MAIN BRANCH OF THE CLINTON RIVER (NATURAL CHANNEL) BETWEEN SPILLWAY AND THE MOUTH

5.6.1 Point Sources

5.6.1.1 Continuous Point Source Dischargers

The Mt. Clemens WWTP is the only continuous point source discharge to the Clinton River in Section 1 (Table 5.1.1) (Map 6.5). Sewage is treated by primary and secondary clarifiers and trickling filters, final clarification (two tanks), and chlorination. The sludge is digested and dried, then landfilled, used agriculturally, or held on plant property.

Mt. Clemens discharges 6 mgd from outfall 001 and up to 4 mgd from outfall 002, its wet weather facility. Parameters limited by the NPDES permit are shown in Table 5.1.1. Mt. Clemens final NPDES permit (effective April 1988) contains effluent limits for heavy metals and conventional pollutants from outfall 001 and some conventional pollutants from outfall 002. Groundwater monitoring around the wet weather facility will be required for several cations, nutrients (N and P), methylene blue active substances, chloride, specific conductance, and static elevation.

Results of the MDNR point source wastewater survey conducted at the Mt. Clemens WWTP on May 18, 1986 indicated that during the survey, the facility met their NPDES interim permit effluent limitations (Stone, 1987d). The self-monitoring data as reported in the facility's monthly operating report were similar to the survey data. During 1986, Mt. Clemens exceeded the interim limits for total suspended solids during 7 of the 12 months. Permitted and estimated loading from the Mt. Clemens WWTP are shown in Table 5.6.1.

Table 5.6.1 Permitted and Estimated Loadings from Mt. Clemens WWTP in Section 1, Main Branch of Clinton River between Spillway and Mouth.

	Mt. Clemens WWTP* Annual Permitted Loading lbs/year		Annual Estimated Loading lbs/year	Loading lbs/day	Conc. ug/l
Conventional Loading	Interim**	Final***			
Suspended Solids	618676	331826	342735	939	
Dissolved Solids			5571725	15265	
BOD-5	691680		492750	1350	
BOD-5(Carbon)		162110			
COD			1285895	3523	
TOC			289080	792	
NO2+NO3			3749	10.27	
NH3-N		186750	107164	293.6	
Total Kjel. Nitrogen			160600	440	
Total Phosphorus		18265	25733	70.5	
Orthophosphorus			15002	41.1	
CN(total)			84	0.23	
Cl			121509	322.9	
Na			210897	557.8	
Metal Loading					
Silver		7.3	110	0.3	
Aluminum			5694	15.6	
Arsenic					<2.5
Barium			2967	8.13	
Beryllium					<1.0
Cadmium		29	7	0.02	
Cobalt					<10
Chromium			33	0.09	
Hex. Chromium		1224			<5.0
Copper			321	0.88	
Iron			11023	30.2	
Mercury			7	0.02	
Lithium					<8.0
Manganese			1059	2.9	
Molybdenum			442	1.21	
Nickel			62	0.17	
Lead		456	215	0.59	
Antimony					<2.5
Selenium					<2.5
Titanium					<10
Vanadium					<10
Zinc		6155	876	2.4	
Organic Loading					
Phthalates			350	0.96	
HCB			0.037	0.0001	
PCB			6.69	0.0183	
TCE			177	0.485	
Toluene			22	0.6	

*=Results based on sampling done May 18-19, 1987. Flow was measured at 3.52 million gallons per d[illegible]
**=Effective until April 1, [illegible]
***=Effective after April 1, [illegible]

Mt. Clemens Toxics Substances Monitoring Report (TSMR) and pretreatment data indicated benzene in the effluent at 2 to 4 ug/l. Acrylonitrile was also present in one of five samples at 14 ug/l. Acrylonitrile is a monomer used in plastics synthesis which may or may not be polymerized in wastewater. When discharged, the polymerized acrylonitrile cannot be easily degraded by biological activity. Hexachlorobenzene (HCB) and PCB were also of concern since HCB and PCB were detected in sludge (Zabik et al, 1981) at 48.7 mg/kg and 6.11 mg/kg respectively. Hexachlorobenzene is found in wastewater from factories that synthesize organics, seed fungicides and wood preservatives. PCB was detected in the effluent at 2.5 ug/l during a 1978 Point Source Study, but not in a 1980 survey (MDNR 1980). PCB was not analyzed in 1982 or 1984 but was detected again in 1986 at 0.624 ug/l in the Mt. Clemens effluent (Stone 1987d).

The Great Lakes and Environmental Assessment Section, MDNR, has recommended short-term effluent (six-week) monitoring for HCB and PCB, quarterly monitoring for acrylonitrile, and one-time sludge analysis for these chemicals (MDNR 1987).

Mt. Clemens has had a pretreatment program in place since 1985, which requires certain industrial discharges to pretreat their waste before discharging to the municipal system. There are 549 non-domestic users in the Mt. Clemens service area of which 52 were sent questionaires based on flow and probability of the presence of contaminants. Of these industries, 25 are subject to categorical pretreatment standards but only 11 discharge process wastewater to the WWTP (Table 5.6.2). The three major significant non-domestic dischargers are shown in Table 5.6.3 (Mt. Clemens Pretreatment Program 1985).

Table 5.6.2. Significant or Major Non-Domestic Dischargers to the Mt. Clemens Wastewater Treatment Plant, 1987.

Source	Address	Discharge
Mt. Clemens Coatings	400 N. Groesbeck	sanitary, metals, organics, solvent
Mt. Clemens Vinyl	151 Lafayette	sanitary, metals, organics, solvent
Mt. Clemens Car Wash	317 Crocker	nutrients
Michigan Car Wash Equipment	118-120 Grove Park	sanitary, nutrients
P.B.M. Company (Becon Plastics)	126 N. Groesbeck	organics, phthalates
Schneider Laundry	196 N. Groesbeck	sanitary, metals
Bedford Products, Inc.	146 N. Groesbeck	sanitary, metals
Action Ind., Inc.	101 S. Rose	sanitary, metals

Table 5.6.2 Continued.

Source	Address	Discharge
Lube Power, Inc.	25A N. Rose	sanitary, metals
Minowitz Mfg. Co.	138 N. Groesbeck	sanitary
Action International	261 Church Street	sanitary, metals, organics

Table 5.6.3 Major Significant Non-Domestic Dischargers to the Mt. Clemens WWTP.

Name	Location	Process	Water Discharged to WWTP
Action International	261 Church St.	Pottery Mfg. ceramic paints	15,895 GPD
Mt. Clemens Coating Inc.	400 Groesbeck Hwy.	Painting of auto parts	178,000 GPD
Mt. Clemens Vinyl Plant	151 Lafayette	Vinyl production	53,000 GPD

Mt. Clemens Coating Inc. was formerly Ford Motor Company - Paint and Vinyl Plant (Groesbeck Highway), Mt. Clemens Vinyl was formerly Ford Motor Company (Lafayette St.), and Action International was formerly Jamestown China Company.

5.6.1.2 Intermittent Point Sources - Combined Sewer Overflow

A combined sewer overflow is located at the retention basin directly across the river from the Mt. Clemens WWTP. This CSO is scheduled to be eliminated when the new WWTP is completed in 1988.

The retention basins were designed to eliminate overflows from 23 CSOs in Mt. Clemens and portions of Clinton and Harrison Townships. When storms in excess of the five-year high flow occur, the retention basin overflows. The overflows are chlorinated prior to discharge to the Clinton River. These overflows will be eliminated in late 1988. Overflows from this basin are regulated by the facility's NPDES permit through March 31, 1988. The retained combined sewage is treated at the Mt. Clemens WWTP at up to 4 mgd before discharge to the Clinton River. No studies characterizing the quantity, quality or frequency of discharges or their impact on the River have been conducted.

There are no known intermittent industrial discharges in the Clinton River Section 1.

5.6.2 Nonpoint Sources

5.6.2.1 Urban Runoff

Urban runoff enters the Clinton River directly over land and through storm sewers. There are no direct data to determine urban runoff loadings to Section 1. Urban stormwater was estimated to account for 93% of the suspended solids, 66% of the BOD, 25% of the nitrogen and 62% of the total phosphorus along the main branch of the Clinton River between Pontiac and the mouth which includes Section 1 (Table 5.1.5).

5.6.2.2 Rural and Suburban Runoff

Rural and suburban runoff is probably insignificant since this area is rapidly urbanizing.

5.6.2.3 Industrial Site Runoff

No industrial runoff data are available for Section 1.

5.6.2.4 Landfills, Dumps and Other Sites of Potential Environmental Contamination

Waste Disposal Sites

One waste disposal site is located in Section 1 of the Clinton River watershed (Map 6.6). The Metropolitan Beach Incinerator site is closed and has no monitoring. Impact from this site is undetermined but is unlikely to impact the Clinton River (Table 5.1.6).

Act 307 Sites of Environmental Contamination

The Clinton River water and sediments in Section 1 with a score of 750, and Selfridge Air National Guard Base (SANG), with a score of 891, are listed as Group 1 sites. (Table 5.1.7) (Map 6.7). Statewide Act 307 scores range from 163 to 1085. NI/Mirrex Industries is the only Group 2 site in Section 1.

The Clinton River - 307 Site

The Clinton River from Mt. Clemens to the mouth is on the 307 list because of elevated concentrations of metals, oil and grease, and PCB in the sediments. These sediments are classified as moderately to heavily polluted according to the USEPA 1977 Dredge Spoil guidelines used to determine whether sediments can be disposed of in open waters of the Great Lakes.

The magnitude of contaminant loss from sediment particles to the overlying water is uncertain and dependent on a variety of factors including, but not limited to, particle size and type, resuspension potential, chemical bonding properties of the contaminant to the sediment particles, the solubility of the chemical in the water, redox potential, the concentration of the contaminant in the sediment, and the overlying water, presence of iron, sulfur and other materials, and the pH of the overlying water.

Several laboratory methods of estimating the metals released to the water column are compared in Table 5.6.4.

Two laboratory studies attempted to determine the heavy metal concentrations in the water under resuspension conditions such as dredging or motor boat operation to answer the questions of possible metals loading to water from sediments. Both attempts fell far short of ideal or representative river conditions which occur during sediment resuspension activities.

Elutriate analyses were performed by the USCOE on Clinton River sediments in 1983 (USCOE, 1983)(Table 5.6.5). This method will show higher water concentrations than those actually present in the river because (1) the 30 minutes of shaking in the lab is much longer than boat propeller disturbances or dredging operations in the field, (2) the four parts water in the contaminants test is not being continually refreshed as is the case in the ambient river, (3) there may be some metals already in the ambient river water which would affect the dissociation of contaminants from the sediments.

Results of quadruplet EP Toxic Analyses performed by the MDNR at two sites in 1987 (Kenaga, 1988) are shown in Table 5.6.6, Figure 5.6.1. This method is even less representative of ambient conditions during sediment resuspension because of: (1) the drastic lowering of pH during the test (ambient river water pH is about 8.0), (2) the long period of shaking (24 hours), (3) the lack of refreshing water in the laboratory and (4) the use of deionized water instead of ambient water, which affects the partitioning of metals between dissolved and particulate phases (based on hardness).

Nevertheless, these data are helpful in estimating the relative magnitude that sediments may contribute to contamination of the overlying river water. The resultant concentrations would be most representative of the heavy metals in the sediment pore water or the microlayer immediately above the sediments rather than the whole river since dilution rapidly occurs as mixing occurs with the upper river water layers. Unfortunately, the EP Toxic tests were analyzed at high levels of detections so that cadmium, chromium, and lead were all reported as less than the detection limit of 0.100, 0.250 and 0.250 mg/l, respectively (Table 5.6.6). Copper averages were 0.0602 and 0.0616 mg/l, nickel averages were 0.3143 and 0.328 mg/l and zinc averages were 3.830 and 4.183 mg/l at stations COE 83-4 (sediment 113) and 83-7 (sediment 105), respectively.

As expected, elutriate results yielded lower metals concentrations with 0.025 mg/l for arsenic, 0.035 mg/l for cadmium, 0.005 mg/l for copper, 0.0085 mg/l for cyanide, 0.200 mg/l for iron, 0.040 mg/l for lead, 0.0002 mg/l for mercury, and 0.0188 mg/l for nickel.

Table 5.6.4. Comparison of various sediment analysis methods.

Yeilds highest concentrations of metals ------------to--------------> Lowest concentrations of metals

PARAMETERS	BULK SEDIMENT ANALYSIS	EP TOX TEST (METHOD 1310)	LEACHATE PROCEDURE	ELUTRIATE TEST
Mixing Time	* 50 minutes	24 Hours	48 Hours	30 minutes
pH (during mixing)	<< 1.0	5.0 +/- 0.2	not maintained	not maintained
Ratios (liquid:solid)	50 : 1	20 : 1	4 : 1	4 : 1
Water Source (in ratios)	Distilled H20	Deionized Water	Deionized Water	Site Water
Sample Storage	-	Freeze, not necessary	Refrigerated or iced (4 C)	Never Freeze
Acids Used	Ultra Nitric HCl & H2O2	Acetic	None	None

* Sample is actually heated for this amount of time.

Table 5.6.5. Results of ELUTRIATE tests on Clinton River sediments collected by the Corps of Engineers on September 22 1983, between Mt. Clemens and Lake St. Clair. Results are in mg/l.

Contaminant	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Mean	Std. Dev.	Range
Arsenic	0.001	0.002	0.003	0.003	0.003	0.003	0.002	0.003	0.0025	0.0008	0.001-0.003
Cadmium	0.004	0.004	0.003	0.003	0.003	0.003	0.004	0.004	0.0035	0.0005	0.003-0.004
Chromium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0050	0.0000	---
Copper	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0050	0.0000	0.000-0.005
Cyanide	0.010	0.010	0.030	0.030	0.370	0.030	0.120	0.080	0.0850	0.1211	0.010-0.370
Iron	1.200	0.320	0.170	0.057	0.120	0.035	0.220	0.120	0.2000	0.2920	1.200-0.120
Lead	0.060	0.050	0.040	0.040	0.020	0.030	0.040	0.040	0.0400	0.0119	0.020-0.060
Manganese	0.340	0.910	0.130	0.070	0.057	0.140	0.077	0.084	0.0840	0.0290	0.070-0.084
Mercury	0.002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.000-0.0002
Nickel	0.010	0.010	0.010	0.010	0.020	0.020	0.030	0.040	0.0188	0.0113	0.010-0.020
Oil/Grease	5.000	40.000	140.000	370.000	620.000	260.000	300.000	600.000	291.875	232.562	5.000-600.0
Total PCBs	ND	ND	ND	0.00104	0.00109	0.00043	0.00076	0.00270	0.00079	0.0009	<0.0002-0.0027

Aldrin, a-BHC, b-BHC, d-BHC, g-BHC, chlordane, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, dieldrin, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, heptachlor, heptachlor epoxide, and toxaphene were all not detectable (0.0001).

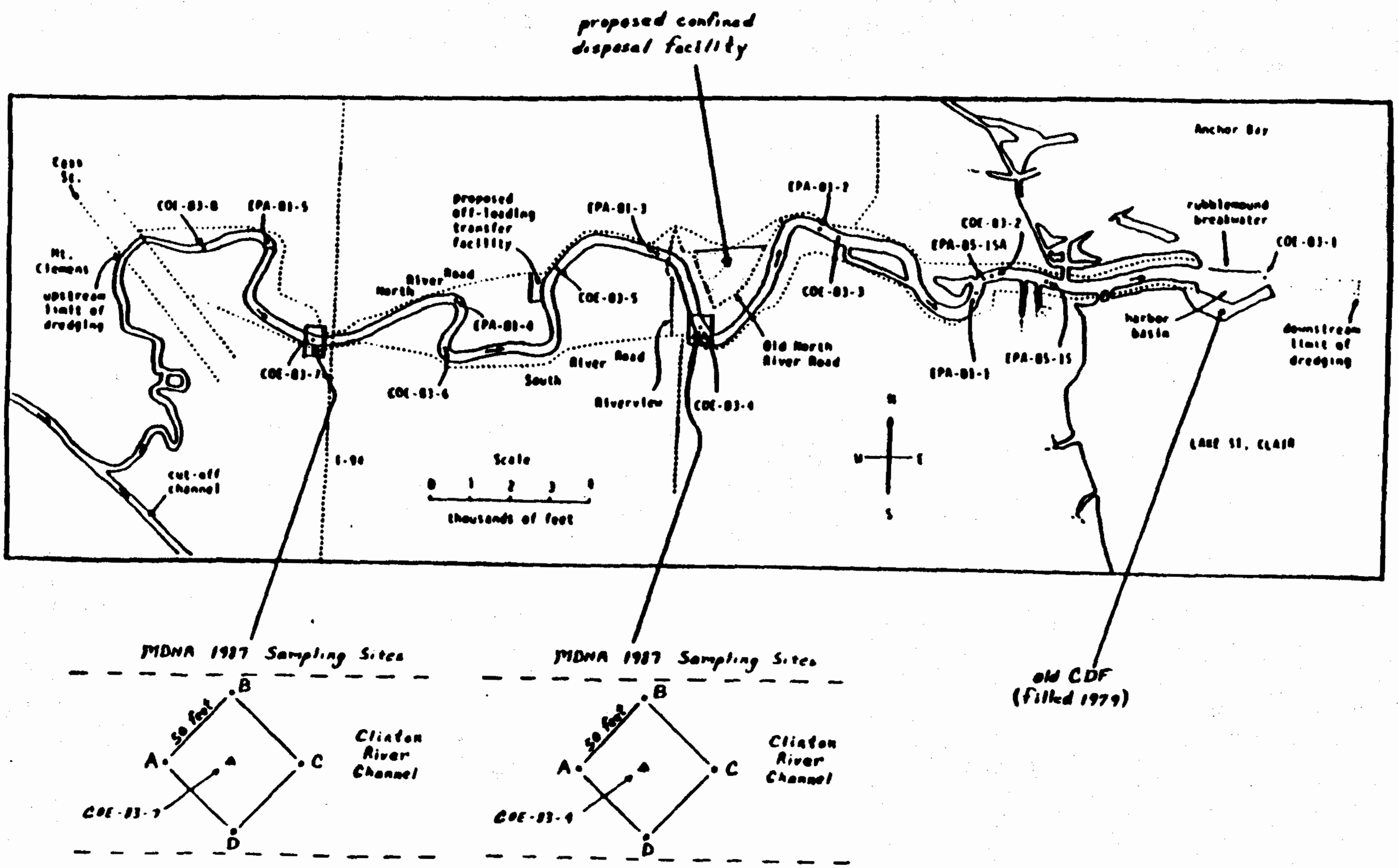
< = less than
ND = not detectable (0.0002)

Table 5.6.6. Results of EP TOXIC tests on Clinton River sediments collected by the MDNR on February 10, 1987 at stations COE-83-4 and COE-83-7, between Mt. Clemens and Lake St. Clair. Results are in mg/l.

	<------ COE 83-4			------>	<------ COE 83-7			------>			
Contaminant	Station A	Station B	Station C	Station D	Station A	Station B	Station C	Station D	Mean	Std. Dev.	Range
Cadmium	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	--	--
Chromium	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	--	--
Copper	0.0564	0.0763	0.0495	0.0587	0.0570	0.0562	0.0570	0.0765	0.0610	0.0099	0.0495 - 0.0765
Nickel	0.303	0.348	0.349	0.357	0.311	0.316	0.359	0.326	0.334	0.022	0.303 - 0.359
Lead	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	--	--
Zinc	3.460	3.900	3.860	4.100	4.110	4.130	3.970	4.520	4.005	0.300	3.460 - 4.520

< = less than
EP TOXIC CRITERIA for water in mg/l : Cadmium = 1.0, Chromium = 5.0, Copper = 100.0, Lead = 5.0, Zinc = 500.0

Figure 5.6.1. Sediment sampling locations, and the proposed and filled confined disposal facilities in and along the natural channel of the Clinton River, between Mt. Clemens and Lake St. Clair.



It is impossible to calculate metals loadings from sediments to water based on these data. Unfortunately, there is a paucity of Section 1 ambient metals water data. However, movements of metals are usually from water to sediments, which is why they are present in high concentrations in the sediments in the first place.

Periodically, sediment removal from portions of Section 1 have resulted in removal of some contaminants. The most recent recreational navigation channel dredging in the Clinton River downstream of the Cass Street Bridge in Mt. Clemens was completed by the Army Corp of Engineers in 1979 (ACOE 1987). Dredged spoils were placed in a 1.3 hectare (3.3 acre) confined disposal facility (CDF) near the river mouth (Figure 5.6.1). Dredging occurred between 1964 and 1979 via bucket and hydraulic methods and pumped to the CDF which was filled in 1979 (USACOE 1987).

There has been no monitoring of the CDF for possible leakage into Lake St. Clair. Sediment in the CDF may contain higher concentrations than sediments currently in the channel due to reductions in Clinton River contaminant loadings over the past decade.

<u>Selfridge Air National Guard Base 307 Site</u>

Selfridge Air National Guard Base occupies approximately 3,727 acres adjacent to the Clinton River and Lake St. Clair in Macomb County (Figure 5.6.2). Seven areas have been identified as contaminanted with the potential for releasing contaminants to the environment (R. Weston, personal communication 1986).

The following paraphase comes from the conclusions of the Phase II, Stage I Final Draft Report (R. Weston, 1986):

<u>HYDROGEOLOGY</u>

A confined or semiconfined aquifer occurs within 15 feet of the Selfridge ANGB in Pleistocene-age, unconsolidated sediments of glacial, lacustrine, and fluvial origin.

The aquifer(s) are the only significant source of potable groundwater in Macomb County. Yields from wells in these sediments are less than 10 gallons per minute with relatively thin production layers of sand and gravel at depths greater than 25 feet.

At the time of installation, saturated materials were encountered 8 to 14 feet below land surface. The static water levels in all of the base monitoring wells stabilized within 5 feet of the land surface.

Groundwater in the upper unconsolidated sediments flows towards Lake St. Clair away from the Clinton River (Figure 5.6.3). Local variations in groundwater flow direction may be induced by backfilled excavations and local topographic depressions.

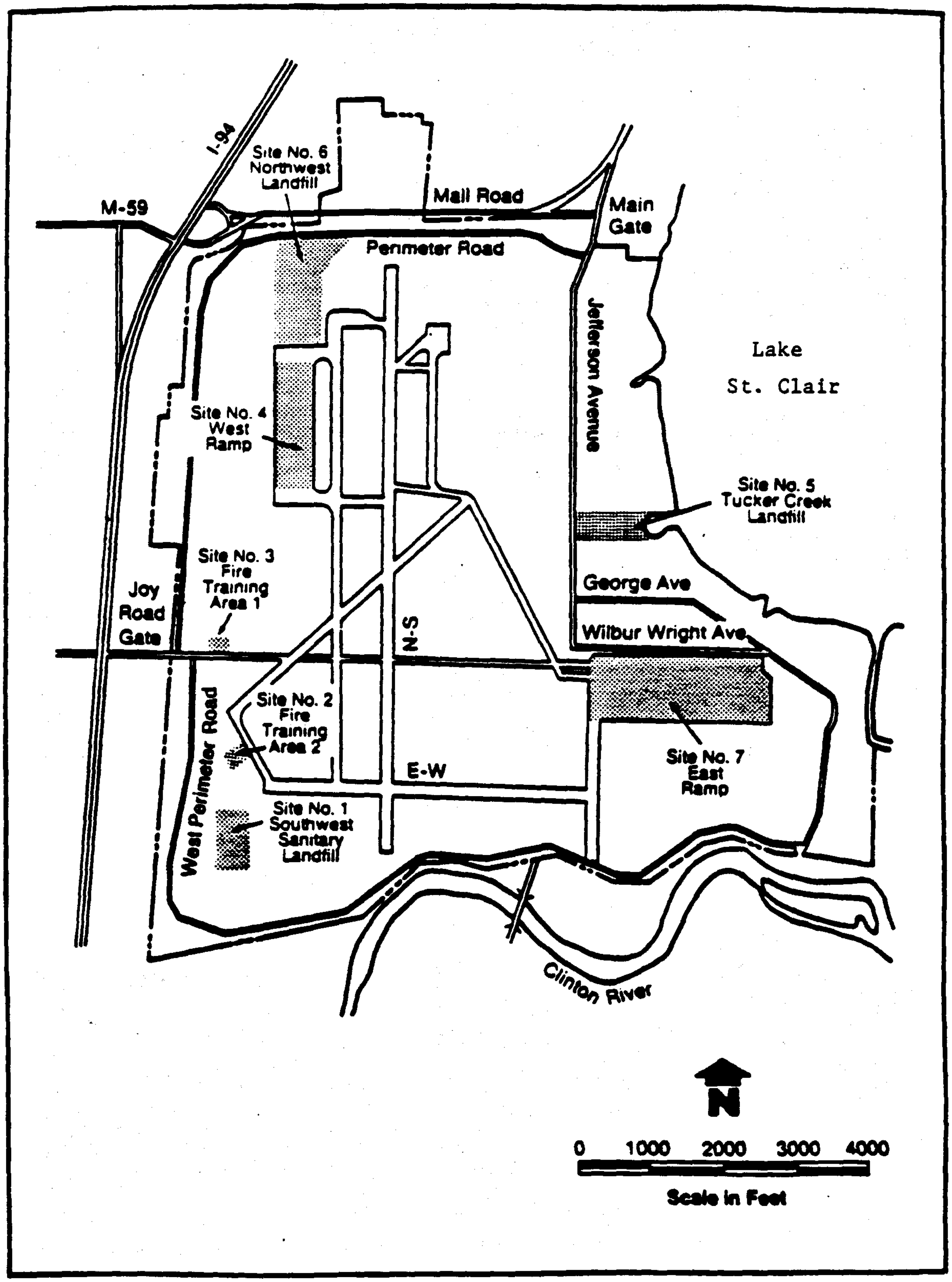


Figure 5.6.2 Landfills and Disposal Sites at the Selfridge Air National Guard Base, Harrison Township, Macomb County, Michigan 1986.

Source: Roy F. Weston 1986

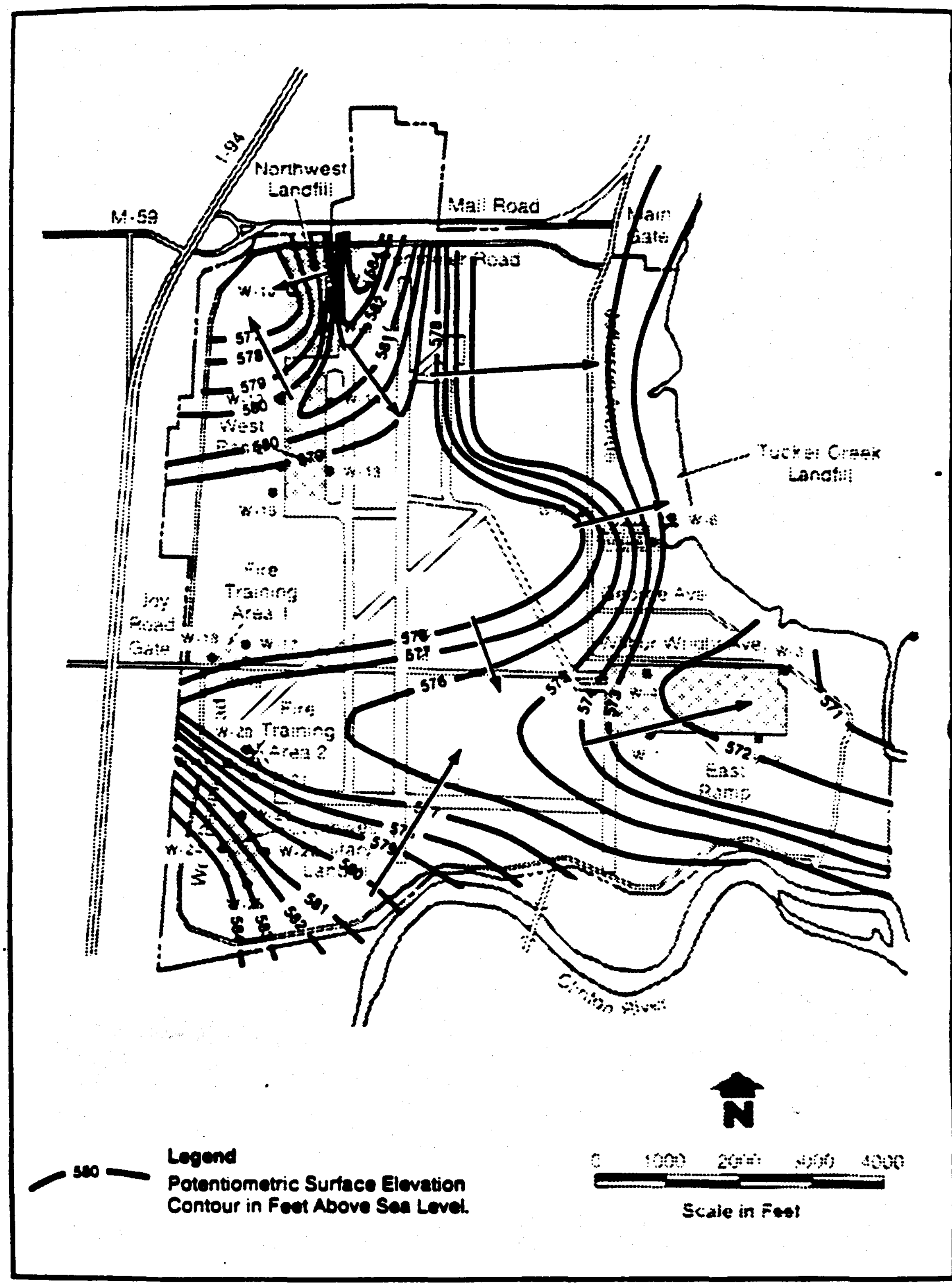


Figure 5.6.3 Groundwater flow direction at the Selfridge Air National Guard Base, Harrison Township, Macomb County, Michigan 1986.

Source: Roy F. Weston 1986

The low permeability of lacustrine clays at or near the land surface of the Base minimizes the potential for contamination of underlying aquifers. However, because surface water bodies are near, the potential for contaminant migration via surface runoff and/or groundwater flow is moderate to high (Figure 5.6.4).

WATER QUALITY

Soluble copper at each of the landfills and soluble cadmium at the Southwest Landfill are the only contaminants exceeding drinking water standards.

Soils and groundwater beneath and adjacent to the East and West Ramps have moderate to high contamination, suggesting that contaminants are associated with fuel handling and storage activities.

Elevated total organic carbon, chemical oxygen demand, phenols, petroleum, hydrocarbon, soluble copper and cadmium, and volatile organic chemicals in the western portion of the Southwest Sanitary Landfill indicate a contamination source in this area. Analyses of surface water samples from this site suggest that leachate from this landfill is affecting the quality of the adjacent surface water. Total organic carbon levels in the three ponds ranged from 6.8 to 11.5 mg/l, and chemical oxygen demand levels ranged from 27 to 42 mg/l. Soluble copper levels ranged from 13 to 34 ug/l. It is presumed that these ponds eventually discharge to the Clinton River.

Elevated TOC, phenol, and petroleum hydrocarbon concentrations in water samples from Fire Training Area-2 indicate that the aquifer beneath this facility is contaminated. The low permeability clays have probably prevented severe subsurface contamination at this site.

Subsurface contamination exists beneath, and adjacent to, the Northwest and Tucker Creek Landfills and Fire Training Area-1. Existing water quality information is not sufficient to determine the nature, extent, or severity of contamination.

Elevated COD levels in monitoring wells around the Base landfills suggest that anaerobic conditions requisite for methane generation are present at each site, but existing information is not adequate to assess the potential for methane accumulation.

It is suspected, on the basis of contamination in the upgradient well at Tucker Creek Landfill, that a fraction of the contaminants in runoff from the ramps, runways, and industrial operation areas may concentrate in the soils and groundwater near the drainage system catch basins.

"Based on the Phase II Stage I Investigation the site priority ranking is as follows:

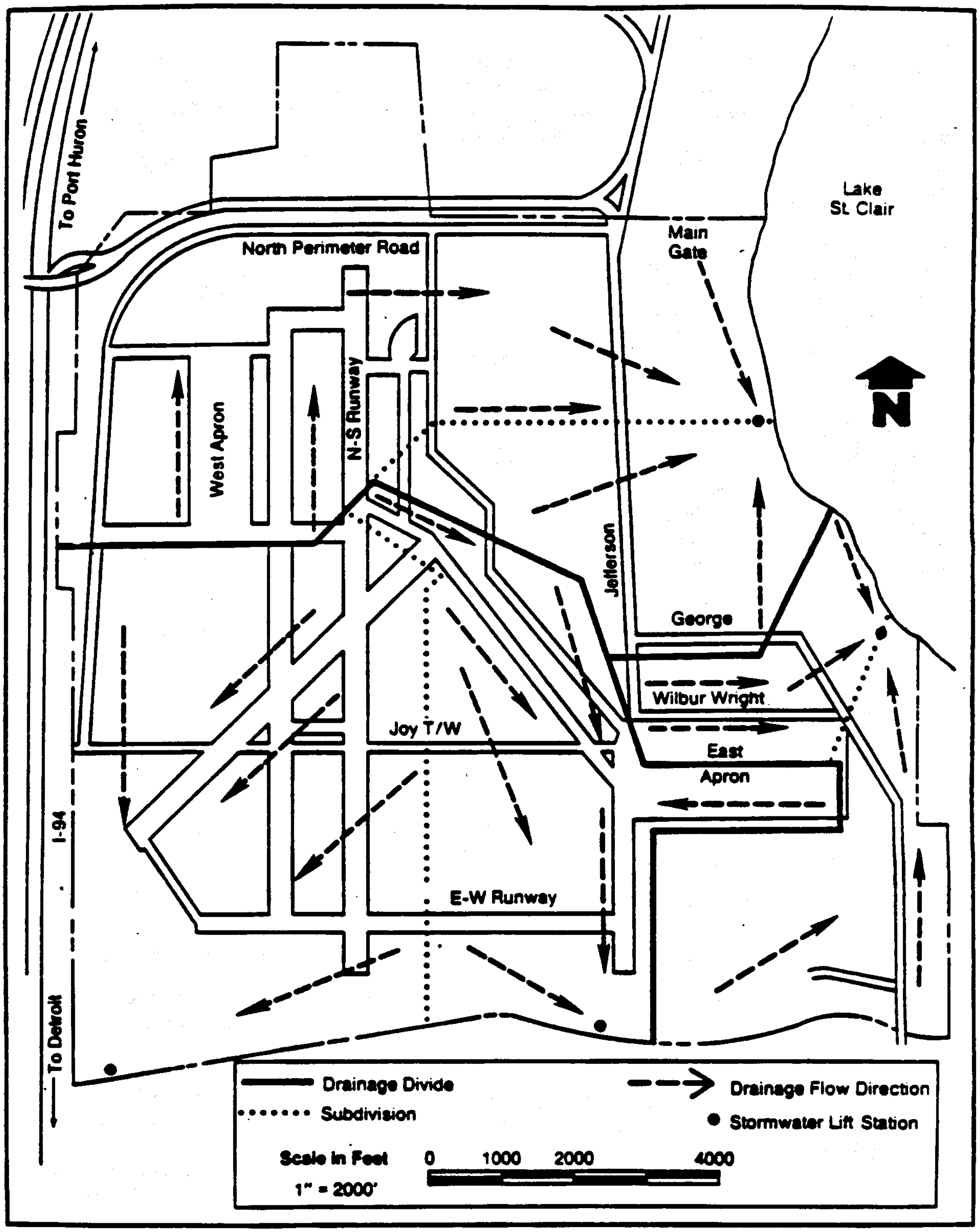


Figure 5.6.4 Surface Drainage Pattern at the Selfridge Air National Guard Base, Harrison Township, Macomb County, Michigan 1986.

Source: Roy F. Weston 1986

1. Southwest Sanitary Landfill
2. West Ramp
3. East Ramp
4. Fire Training Area -2
5. Tucker Creek Landfill
6. Northwest Landfill
7. Fire Training Area -1

The final work plan for the Remedial Investigation feasibility study was completed in October of 1987. Followup studies began in December of 1987 and work is ongoing as of October 1988.

c. NI/Mirrex Industries 307 Site

As the single Group 2 307 site in Section 1, NI/Mirrex Industries has spilled paints and paint products from barrels and cans onto the ground (Map 6.7). Some materials entered the air while others entered the ground and may potentially affect the groundwater (Table 5.1.7).

Hazardous Waste Treatment, Storage or Disposal Sites

There are two hazardous waste storage facilities within Section 1 of the Clinton River Watershed (Table 5.1.8). These sites are Safety Kleen Inc., which has proposed to close, and Selfridge Air National Guard Base, which was previously described (Map B).

5.6.2.5 Atmospheric Deposition

Atmospheric deposition has not been documented in Section 1.

5.6.2.6 Sediments

See Section 5.6.2.4 Clinton River 307 site.

5.7 Spills Reported Through the Pollution Emergency Alerting System

The Michigan Department of Natural Resources has a Pollution Emergency Alerting System (PEAS) which receives reports of all types of spills, accidents, discharges, and problems related to pollution reported by concerned citizens. In November 1986, MDNR reviewed all PEAS reports for the Clinton River Watershed between January 1, 1984 and October 31, 1986. These data show the discharges from a variety of different sources including industries, municipalities, and individuals (Table 5.7.1). GMC's Pontiac Motor Division had the most reports (four) of oil and chemical discharges, followed by the Ford Motor Company, now Mt. Clemens Coatings (three reports). Fifty-four percent of 62 reports dealt with fuel oil or oil discharges, and totaled 2,216 gallons for the known amounts. Twelve percent of the reports were for sewage discharges and five percent were related to chemicals. The remaining reports were other substances which are specifically listed in the footnotes of Table 5.7.1. The impact of these spills upon Clinton River sediment and water quality and biota are unknown.

TABLE 5.7.1 POLLUTION EMERGENCY ALERTING SYSTEM REPORTS
in the Clinton River Watershed,
1984 - 1986

This table summarizes the Pollution Emergency Alerting System reports for materials discharged directly into ditches, streams, or rivers in the Clinton River Basin between January 1, 1984 and October 31, 1986.

WATER BODY	PEAS #	SOURCE	VOL (gal)	FUEL	OIL	SEWAGE	CHEMICALS	OTHER
1. Clinton R	3812-84	?	?			x		
2. Clinton R	3796-84	?	?		x[1]			
3. Clinton R	3740-84	Ford Motor Co. Drain (?)	?		x[2]			
4. Clinton R	3143-84	?	?					x[3]
5. Clinton R	3006-84	Amoco gas station	~150	x[4]				
6. Clinton R	3381-84	?	?		x			
7. Clinton R	2949-84	?	?					x[3]
8. Clinton R	2751-84	?	?		x			
9. Clinton R	1356-84	?	?		x			
10. Clinton R	770-84	Rottee Septic Service	?		x			
11. Clinton R	1279-84	?	?		x			
12. Clinton R	735-84	Pontiac Motor Division	~75		x			
13. Clinton R	595-84	Resident, Sterling Hts.	100	x				
14. Clinton R	667-84	?	1	x				
15. Clinton R	177-84	Pontiac Motor Div. Complex	60				x	
16. Clinton R	1562-86	Macomb County Drain Cmmsr.	?			x		
17. Clinton R	242-84	Landfill ("overflowing")	?					x[5]
18. Clinton R	3566-84	Beyers Towing & Junkyard	?	x[4]				
19. Clinton R	3489-86	?	?		x			
20. Clinton R	2781-86	Heritage Manufacturing	?					x[6]
29. Clinton R.	2260-86	Rappie Septic Service	?			x		
30. Clinton R	2279-86	EMTS Leasing	10	x[7]				
31. Clinton R	1948-86	?	20	x[4]				
32. Clinton R	1707-86	?	?					x[8]
33. Clinton R	974-86	?	?					x[9]
34. Clinton R	977-86	?	?					x[9]
35. Clinton R	577-86	Porta-John Co.	?				x	
36. Clinton R	1272 86	unknown sewer system	?	x[10]				
37. Clinton R	1470-86	Rattie Farm	?			x		
38. Clinton R	975-86	?	?					x[9]
39. Clinton R	984-86	?	?					x[9]
40. Clinton R	139-86	?	?		x			
41. Clinton R	126-86	?	?		x			
42. Clinton R	179-86	?	?					x[11]
42. Clinton R	214-86	?	?			x		
43. Clinton R	415-86	Pontiac West Mfg. - GM	3,000				x	

TABLE 5.7.1 POLLUTION EMERGENCY ALERTING SYSTEM REPORTS (continued)

	WATER BODY	PEAS #	SOURCE	VOL (gal)	FUEL OIL	OIL	SEWAGE	CHEMICALS	OTHER
44.	Clinton R	786-85	?	?					x
45.	Clinton R	922-85	?	30	x				
46.	Clinton R	54-85	?	?					x
47.	Clinton R	528-85	?	?		x			
48.	Clinton R	407-85	?	30	x[4]				
49.	Clinton R	514-85	?	50		x			
50.	Clinton R	2734-85	Rochester WWTP	?			x		
51.	Clinton R	2675-85	?	?		x			
52.	Clinton R	2673-85	?	?	x				
53.	Clinton R	3635-85	?	?		x			
54.	N. Br. Clin.	748-84	Paint Creek Cider Mill	?					x[1]
55.	N. Br. Clin.	2757-84	?	?				x	
56.	N. Br. Clin.	221-85	?	~20,000			x		
57.	N. Br. Clin.	222-85	?	10,000+			x		
58.	N. Br. Clin.	359-85	?	?			x		
59.	N. Br. Clin.	2431-85	?	?			x		
60.	N. Br. Clin.	2677-85	?	?					x[1]
61.	Coon Creek	1235-85	?	?					x
62.	East Pond Crk	809-84	Storm pond overflow	?		x			
63.	East Pond Crk	2885-84	Ford Motor Company	<20		x			
64.	East Pond Crk	1150-85	Romeo WWTP	8,000			x[1,5]		
65.	Red Run Drn	996-84	U-Haul Rental	?					x[1]
66.	Red Run Drn	1344-84	?	?		x			
67.	Red Run Drn	2227-84	?	?		x			
68.	Bear Creek	509-84	?	?		x			
69.	Bear Creek	1910-84	Hydromatic Warren Planat	?	x				
70.	Bear Creek	3084-84	GM Technical Center	~30		x			
71.	Bear Creek	3682-84	?	?	x				
72.	Bear Creek	37-85	?	?		x			
73.	Harrington Dr	759-84	?	?		x			
74.	Harrington Dr	773-84	?	?		x			
75.	Galloway Crk	3801-84	Oakland Painting Co. (?)	?					x
76.	Galloway Crk	3879-84	Oakland Construction Co.	?					x[1]
77.	Galloway Lake	41-85	?	?			x		
78.	McBride Drn	2199-84	?	?					x[3]
79.	McBride Drn	3741-85	S. Macomb Disp'l Auth'ty	~3,000					x[1]
80.	Beaver Crk	241-86	TRW Plant	?		x			
81.	Plumbrook Drn	3231-85	Conrail	~200	x				

TABLE 5.7.1 POLLUTION EMERGENCY ALERTING SYSTEM REPORTS (continued)

WATER BODY	PEAS #	SOURCE	VOL (gal)	FUEL OIL	OIL	SEWAGE	HEMICALS
82. Greiner Drn?	375-86	Ford Motor Plant's Tank	1,000				x
83. Murphy Drain	492-84	?	?		x		
84. Sweeney Drn	3032-86	?	?		x		
85. Upr. Bushmn	1524-86	?	?		x		
86. Union Lake	2165-85	Little Round Jug Restrnt	10+			x	
87. Union Lake	1923-85	?	?				
88. Sylvan Lake	3604-85	?	?	x			
89. Sylvan Lake	842-86	?	?	x			
90. Deer Lake	3828-85	High School Bus Garage	20+	x[4]			
91. Cass Lake	2244-86	?	?	x[4]			
92. Eagle Lake	1538-86	?	?				
93. Elizabeth L	831.85	?	?		x		
94. Macyday Lake	1151-84	Unknown Chemical Truck	?				x
95. Lake Oakland	469-85	?	?		x		
96. Otter Lake	1106-85	?	300	x[4]			
97. Susan Lake	504-84	Armstrong Screw Products	?				
98. Unnamed Drn	1967-85	Place Machine Corp.	55		x		
99. Johnson Swr	3154-84	Pontiac Motors Division	<10	x[4]			
100. Mcmb Swg Dpt	3415-84	Machine Inc.	?		x		
101. Storm Sewer	1777-85	GM CPC Pontiac	?		x		
102. Unknown Crk	905-84	?	?		x		
103. Unknown Crk	391-86	Ford Motor Co.	<15	x[3]			
104. Unknown Crk	1566-86	?	?		x		
105. Unknown Crk	2119-86	Clinton Tool Co.	1,000		x		
106. Unknown Crk	1916-86	Vesitube Company	?		x		
107. Unknown Crk	2230-86	?	?		x		
108. Unknown Crk	2301-86	C & A Builders	300	x			
109. Unknown Crk	1120-85	Coach Works Collision Shp	?				
110. Unknown Crk	1824-85	?	?		x		
111. Unknown Crk	1824-85	?	?		x		
112. Unknown Crk	1749-85	?	?		x		

1. red-green color and oil-smell to water
2. muskrats covered with oil
3. fish dead and dying
4. gasoline
5. read and black leachate
6. steel shavings
7. diesel fuel
8. unknown white substance
9. "white water"
10. metal chips
11. "hazardous wastes"
12. cement
13. detergent and apple pulp
14. damming of river
15. digested swr sludge
16. foamy-like soap suds and gas
17. "contaminated" dirt
18. leachate
19. green film on lake
20. beige paint (?)
21. black substance

Where responsible parties are identified, the Detroit District Office follows up to see that the spills are cleaned up by the responsible party. Otherwise, where significant environmental damage may be imminent, the State will do the clean up and search for the sources. Eventually, some sites may be listed on the Act 307 sites of environmental contamination list.

6. MAPS

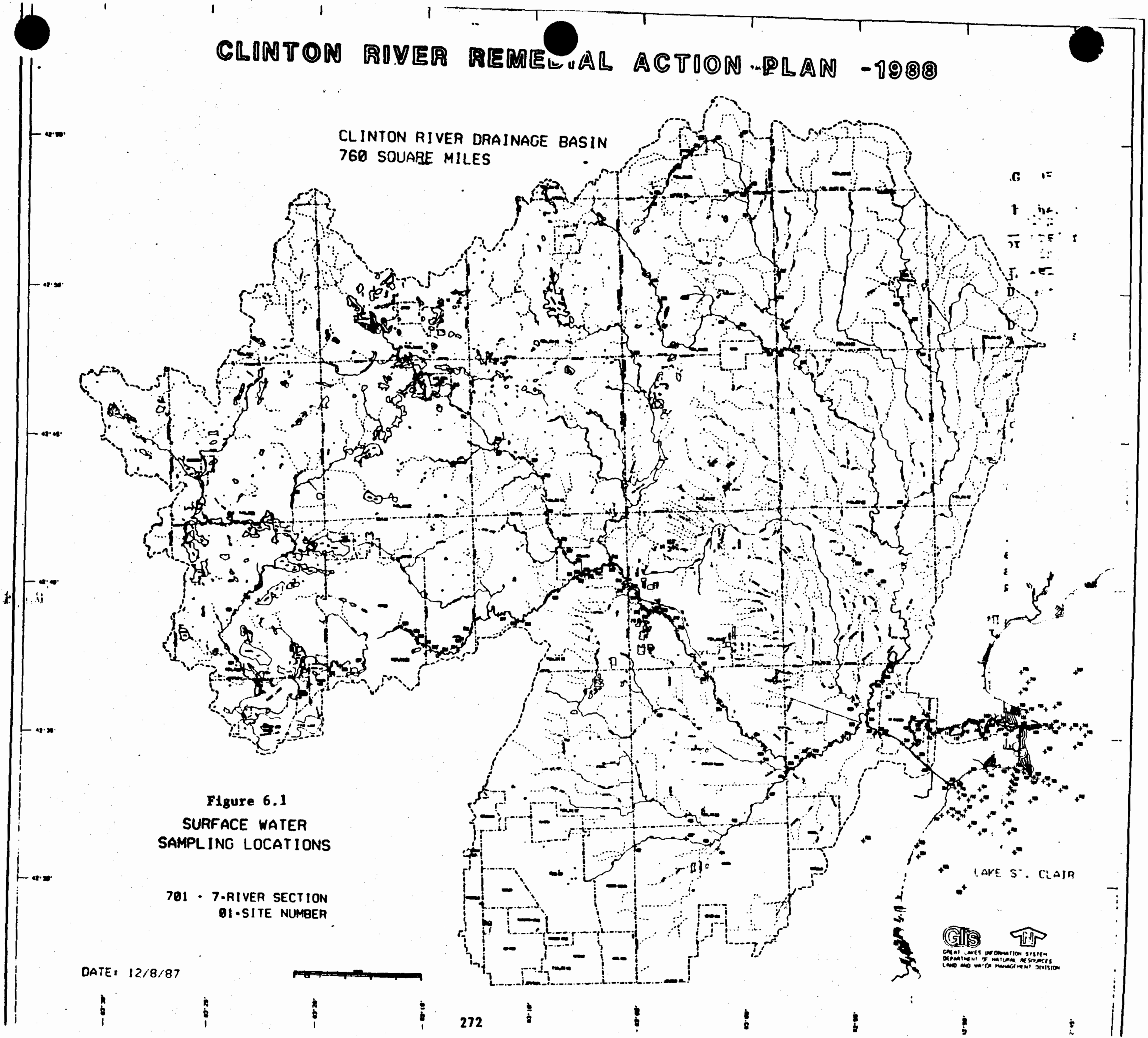

CLINTON RIVER REMEDIAL ACTION PLAN -1988
CLINTON RIVER DRAINAGE BASIN
760 SQUARE MILES
SURFACE WATER
SAMPLING LOCATIONS
701 - 7-RIVER SECTION
01-SITE NUMBER
DATE: 12/8/87
LAKE ST. CLAIR

Figure 6.1

CLINTON RIVER REMEDIAL ACTION PLAN - 1988

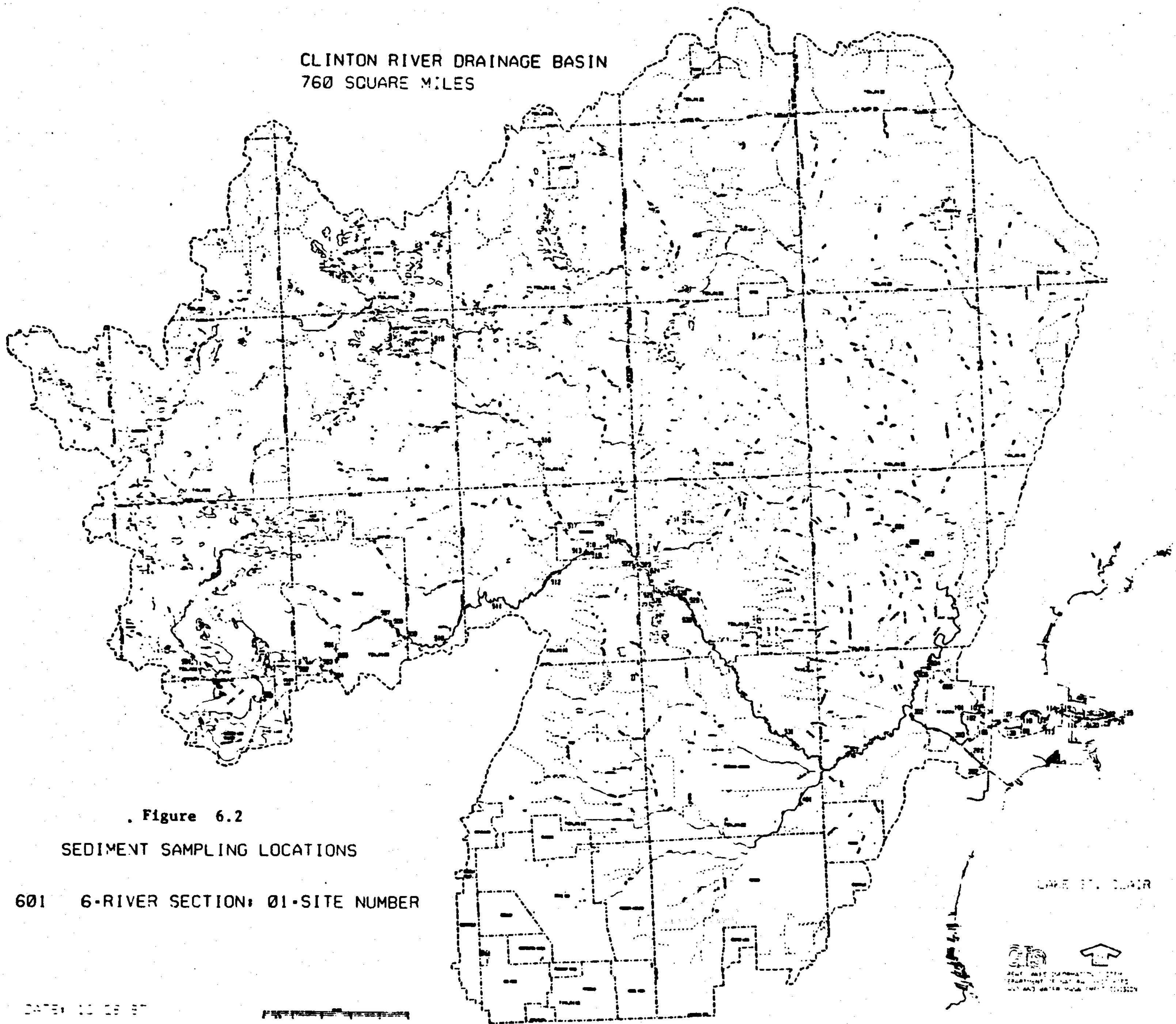


Figure 6.2

SEDIMENT SAMPLING LOCATIONS

601 6-RIVER SECTION; 01-SITE NUMBER

CLINTON RIVER REMEDIAL ACTION PLAN -1988

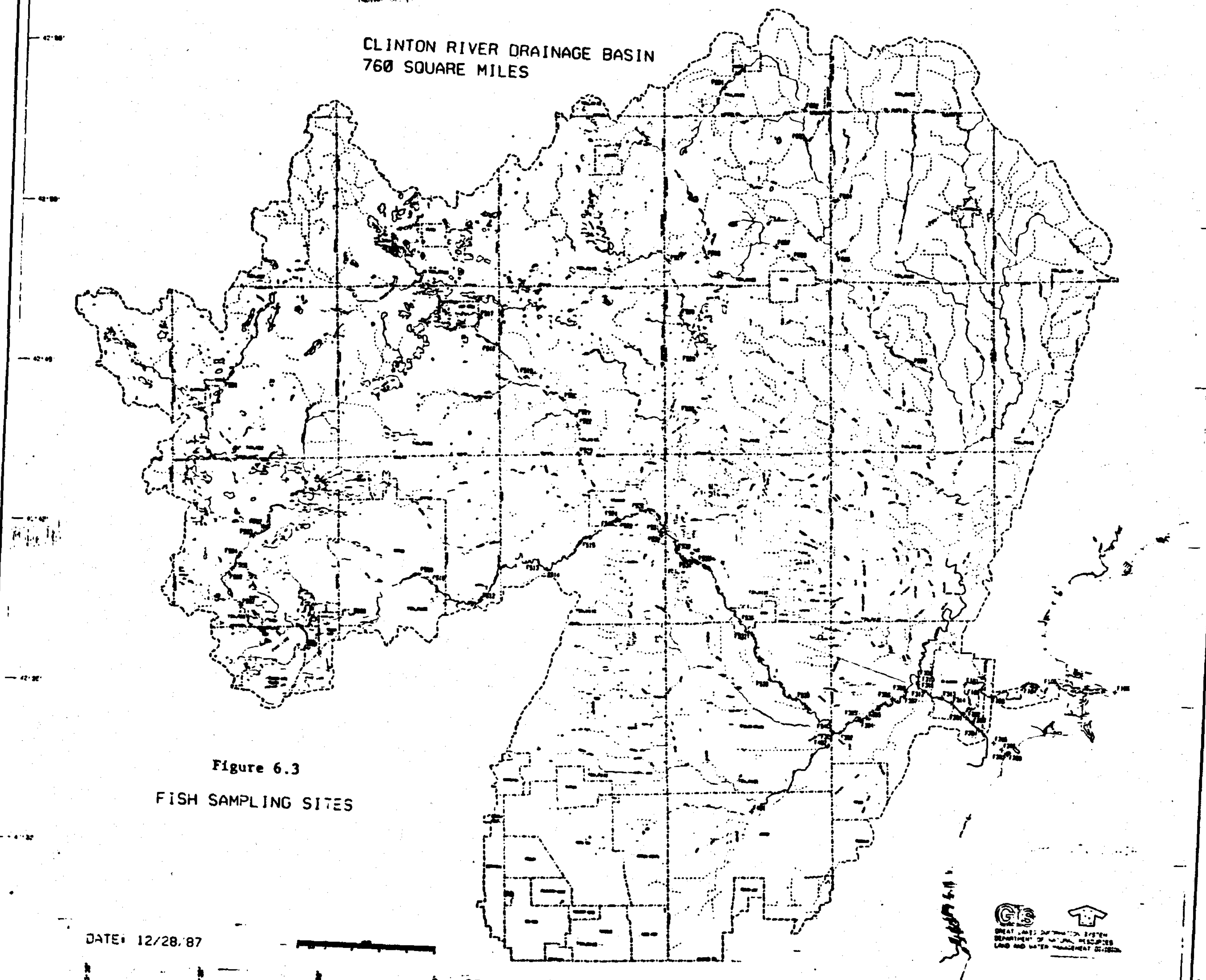


Figure 6.3

FISH SAMPLING SITES

CLINTON RIVER REMEDIAL ACTION PLAN -1988

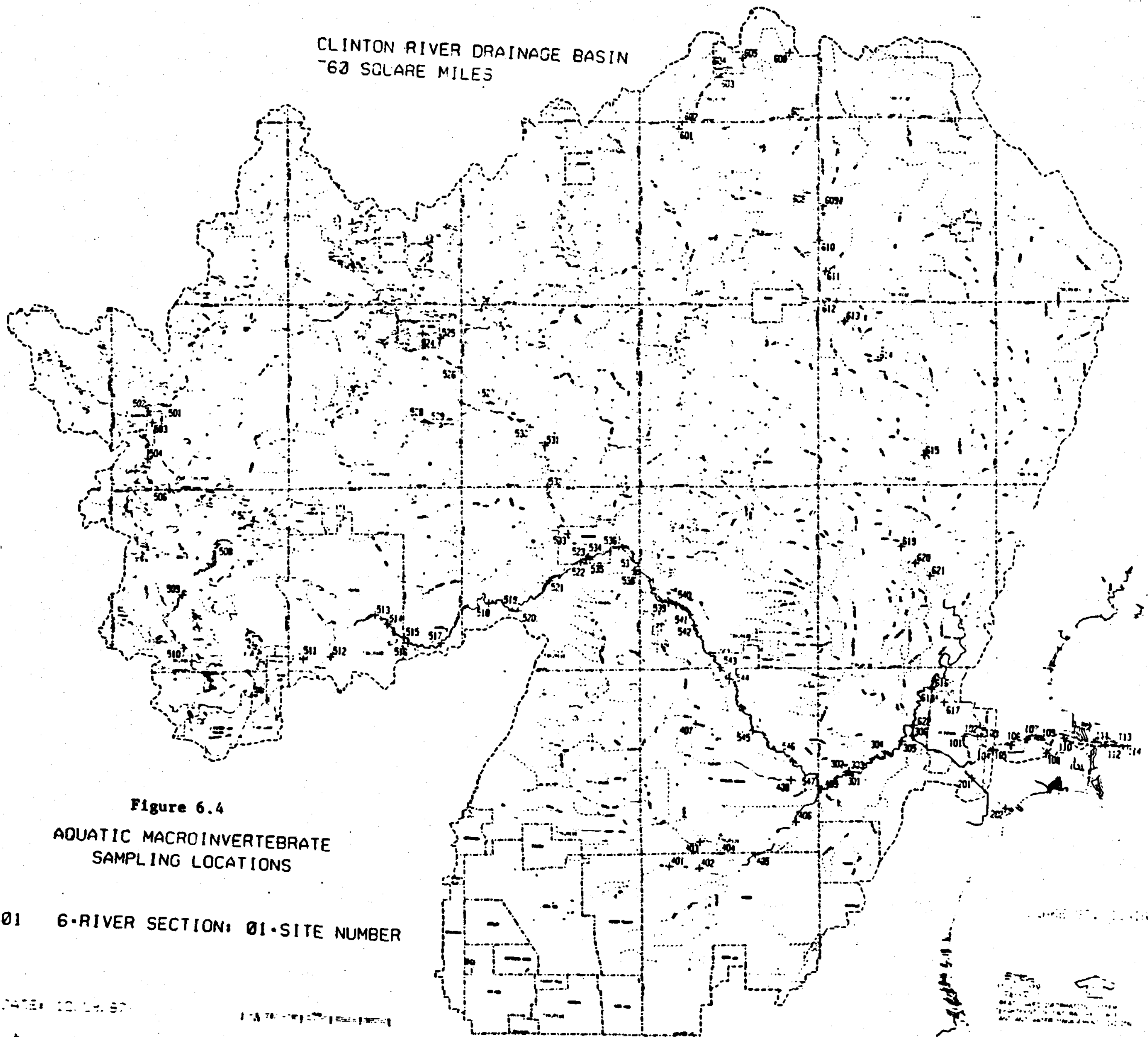


Figure 6.4

AQUATIC MACROINVERTEBRATE SAMPLING LOCATIONS

601 6-RIVER SECTION: 01-SITE NUMBER

CLINTON RIVER REMEDIAL ACTION PLAN -1988

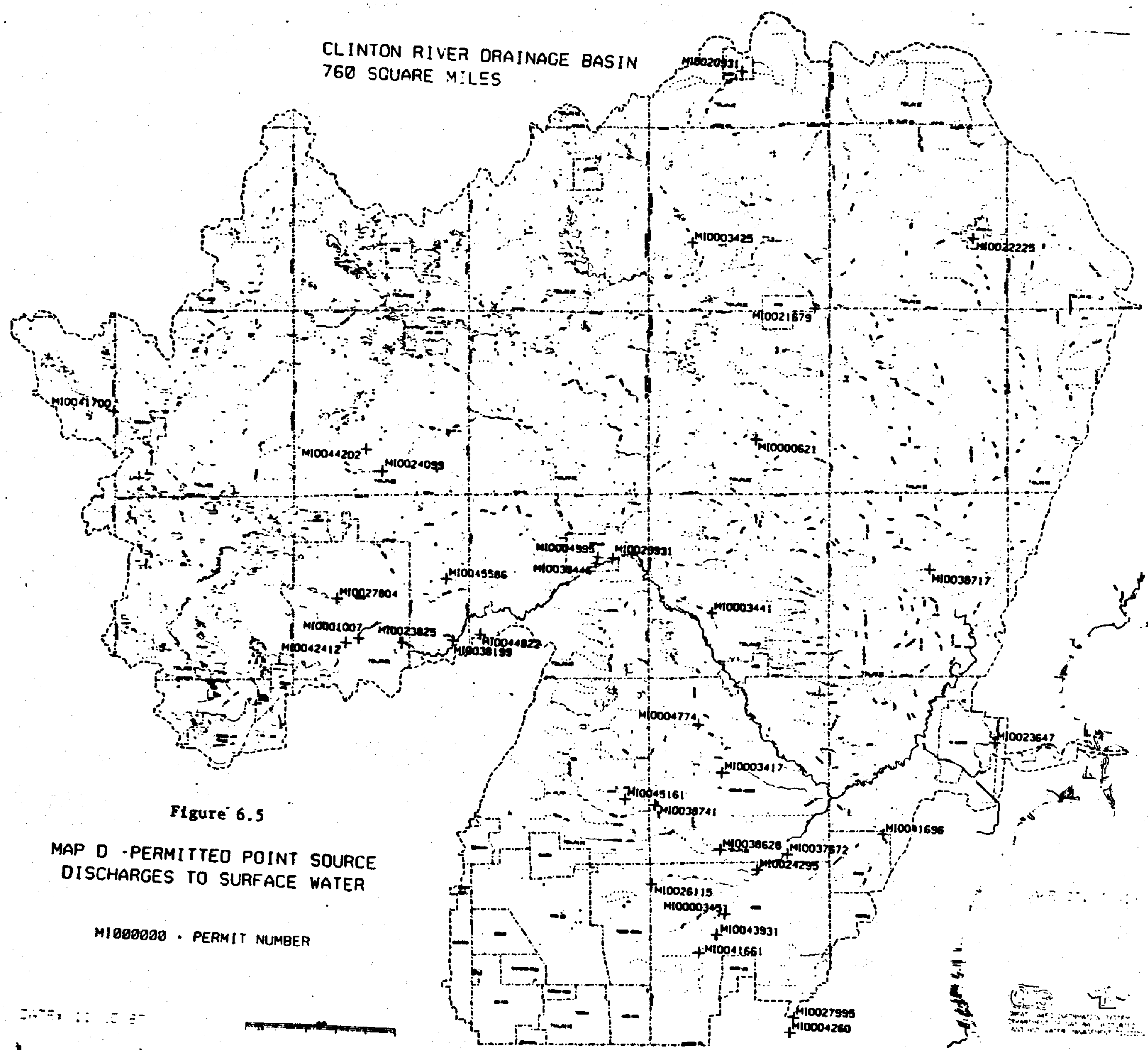


Figure 6.5

MAP D -PERMITTED POINT SOURCE DISCHARGES TO SURFACE WATER

MI000000 · PERMIT NUMBER

CLINTON RIVER REMEDIAL ACTION PLAN -1988

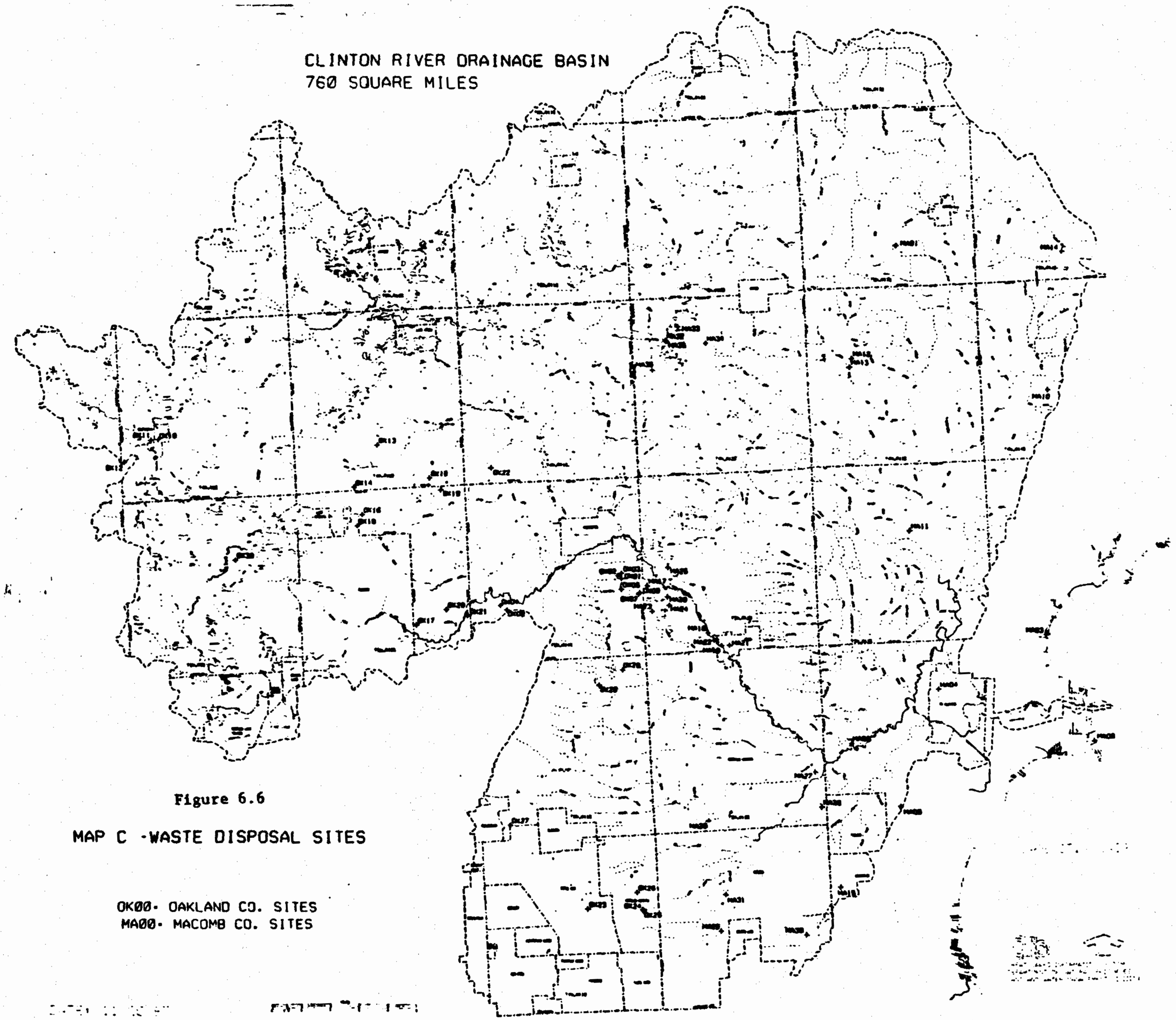


Figure 6.6

MAP C -WASTE DISPOSAL SITES

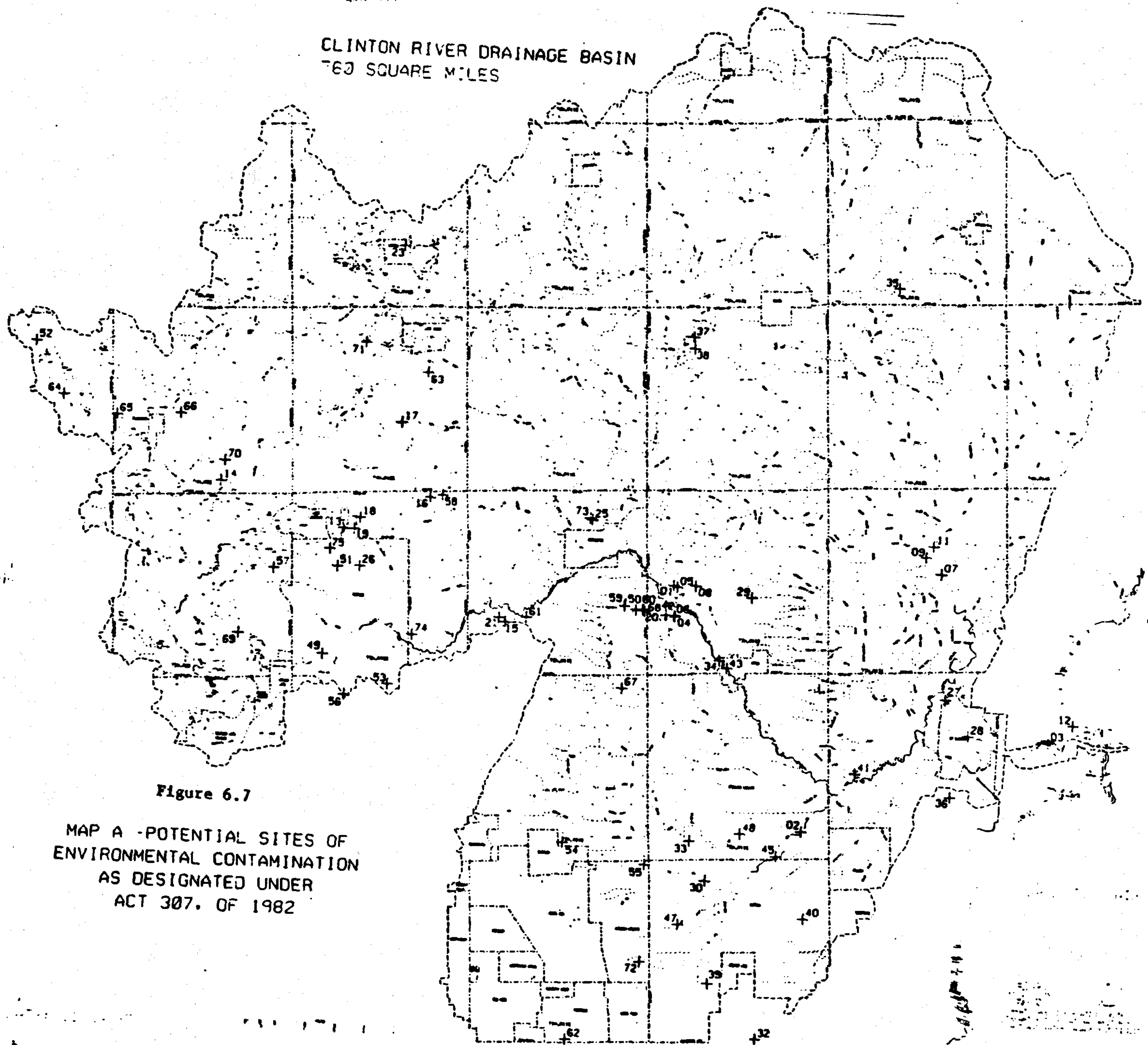


Figure 6.7

MAP A -POTENTIAL SITES OF ENVIRONMENTAL CONTAMINATION AS DESIGNATED UNDER ACT 307, OF 1982

CLINTON RIVER REMEDIAL ACTION PLAN -1988

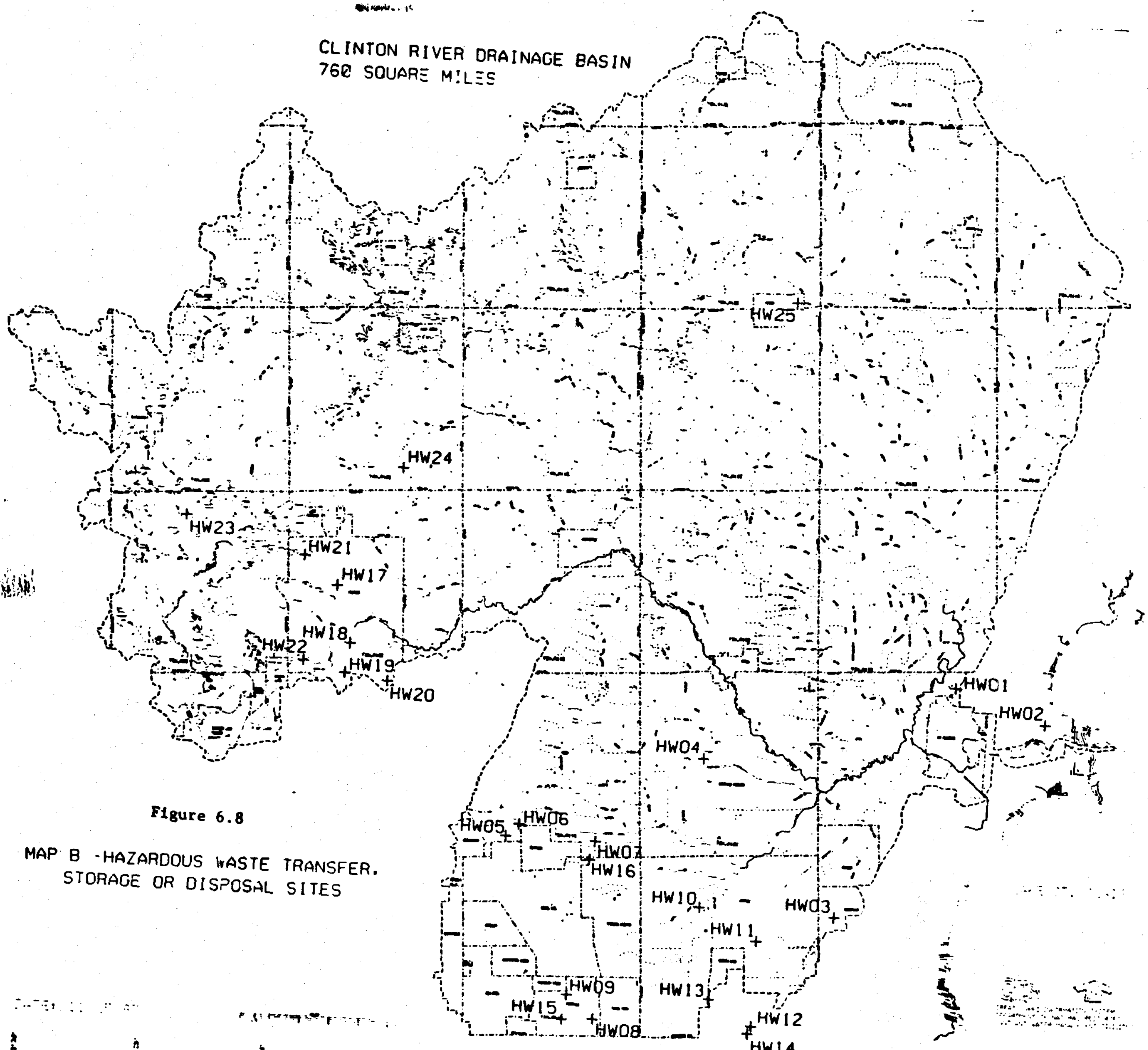


Figure 6.8

MAP B -HAZARDOUS WASTE TRANSFER, STORAGE OR DISPOSAL SITES

7. HISTORICAL RECORD OF REMEDIAL ACTIONS

7.1 COMPLETED ACTIONS

This section provides information on construction, management practices, administrative action, and legal actions taken to improve water quality in the Clinton River watershed. It also summarizes costs and sources of funds for some of these activities. Where actions have resulted in the restoration of designated uses, the benefits derived and uses restored are noted.

7.1.1 Construction of Wastewater Treatment Facilities and Collection System Improvements

The greatest factors in the recovery of Clinton River stream quality were the elimination of some discharges, the construction of new municipal WWTPs, the upgrading of others and the expansion and extension of collection facilities. Numerous southern lower Clinton River basin communities began discharging their industrial and residential effluents to the Detroit WWTP through the Clinton-Oakland interceptor (1972) and the Macomb Sanitary District in the mid-1970s (Peterson 1986) (See list in Chapter 3). By 1986, about 75 percent of the Clinton watershed population was served by the Detroit Wastewater Treatment Plant, which has removed an enormous wasteload from the Clinton River during dry weather (Peterson 1986). Overflows from the Southeast Oakland County Sewage Disposal System (SOCSDS) continue to discharge to Red Run during heavy wet weather.

Table 7.1 shows that $378 million of grant eligible construction has taken place in the Clinton River Basin since 1972. Of this amount, $229 million has come from federal grants and $50 million from State Clean Water Bond Fund grants with the remaining $99 million from local communities.

The remaining wastewater treatment plants with discharges to the Clinton River have all been upgraded, or are planning to upgrade.

7.1.1.1 Improvements In the Area of Concern

In the mid-1970s, the City of Mt. Clemens built an interceptor for combined sewage to prevent overflows and a wet weather flow retention basin and treatment facility. The Mt. Clemens WWTP continues to discharge secondary effluent to the Clinton River. Completion of the tertiary section of this facility is scheduled for December 1988.

7.1.1.2 Improvements In the Source Area of Concern

Improvements in the Pontiac WWTP have resulted in noticeable improvements in downstream water quality, largely due to nutrient reductions. In 1975, Pontiac added phosphorus removal facilities to its East Boulevard Treatment Facility. These projects were funded by Federal Step 3 grants in 1973 and 1975 amounting to over $18 million. (C. Sutfin, USEPA Region V, personal communication 1986). In 1977, secondary effluent from East

Table 7.1. CONSTRUCTION GRANTS ACTIVITIES - CLINTON RIVER BASIN, 1972 - 19[illegible]
(All dollar amounts represented in millions [M])

TREATMENT FACILITIES

PROJECT NO	NAME	FEDERAL GRANT	STATE GRANT	LOCAL FUNDS	TOTAL*
1304	Warren Retention Basin	3.44	1.56	1.25	6.25
1399-01	Warren AWT Treatment Facility	3.92	1.96	1.43	7.31
2220-01	Pontiac (included phosphorus removal)-AWT	7.91	.53	2.11	10.55
2332-01	Pontiac, CSO sewer separation, trunk sewers	10.64	.71	2.84	14.19
2491-02	Mt. Clemens upgrade STP, rehab of CS phosphorus removal	5.20	.35	1.39	6.94
2088-01	Mt. Clemens, CSO Retention Basin, interceptor, outfall sewer, chlorination facilities	9.35	.62	2.44	12.46
2495-03	Romeo, sewer rehab. STP upgrade/ expansion	4.89	.33	1.30	6.52
2846-02	Armada (currently under constr.) Sequence batch reactor STP	2.18	-	1.21	3.39
3399-02	Almont (currently under constr.) upgrade/expand WWTP - sewer separation, rehab.	1.96	-	1.42	3.3[illegible]
SUBTOTALS		49.49	6.06	15.44	70.99

*estimated (does not include non-grant eligible costs)

INTERCEPTORS TO TREATMENT+

Oakland County

PROJECT NO	NAME	FEDERAL GRANT	STATE GRANT	LOCAL FUNDS	TOTAL*
1549	Paint Creek (+Detroit)	4.14	1.88	1.50	7.52
1609	Pontiac Township (+Pontiac)	1.09	.50	.40	1.99
1533	Southeast Oakland County SDS (+Detroit)	11.74	5.34	4.27	21.35
1550	Waterford Township (+Detroit)	1.03	.47	.37	1.87
2208	Clarkston/Independence Township (+Detroit)	.84	.38	.31	1.53

Table 7.1. cont.

Macomb County

PROJECT NO	NAME	FEDERAL GRANT	STATE GRANT	LOCAL FUNDS	TOTAL*
3282-02	Bruce Township (+Romeo) (Includes collection sewer construction costs)	.97	.06	.26	1.29
SUBTOTALS		19.81	8.63	7.11	35.55

INTERCEPTORS CONSTRUCTED BY DETROIT TO SERVE:

Macomb County

PROJECT NO	NAME	FEDERAL GRANT	STATE GRANT	LOCAL FUNDS	TOTAL*
1146	15 MILE Interceptor	1.10	.50	.50	2.10
2382-02	North Interceptor - East Arm	32.43	2.16	8.65	43.24
2920-51	Romeo Arm Interceptor (15 Mile/Hayes Break)	3.65	.24	.97	4.86

Oakland County

PROJECT NO	NAME	FEDERAL GRANT	STATE GRANT	LOCAL FUNDS	TOTAL*
1109	Oakland Interceptor	13.61	6.18	4.95	24.74
BOTH COUNTIES					
1387	**Macomb, Corridor, Oakland Interceptors and N.E. Pump Station	25.67	11.67	7.78	45.12
1896 & 2076	**North Interceptor (2 grants)	38.94	6.93	11.47	57.34
SUBTOTALS		115.40	27.68	34.32	177.40

*Estimated (does not include non-grant eligible costs)
** Costs represent those portions of subject grant project impacting Macomb and Oakland Counties.

Table 7.1. cont.

COLLECTING SEWER CONSTRUCTION

Macomb County

PROJECT NO	NAME	FEDERAL GRANT	STATE GRANT	LOCAL FUNDS	TOTAL*
2490-02	Washington/Macomb Townships	6.70	.45	1.79	8.94

Oakland County

PROJECT NO	NAME	FEDERAL GRANT	STATE GRANT	LOCAL FUNDS	TOTAL*
2787-03	West Bloomfield Township	5.57	.37	1.49	7.43
2800-03 2800-05 2800-06	Waterford Township	22.35	1.50	5.96	29.81
2788-03	Avon Township	9.96	.66	2.64	13.22
CS-062	Lake Orion		1.00	2.92	3.92
CS-112	Orion Township		1.00	8.87	9.87
CS-114	Oxford Township		.65	5.70	6.35
CS-113	Pontiac Township		1.00	4.81	5.81
CS-264	Clarkston		.27	.66	.[illegible]
CS-268	Independence Township		.17	5.86	6.03
CS-269	Oxford		.67	1.46	2.13
SUBTOTALS		44.54	7.74	42.16	94.44

GRAND TOTALS	FEDERAL GRANT	STATE GRANT	LOCAL FUNDS	TOTAL*
	$229.24 M	$50.11 M	$99.03 M	$378.38 M

Boulevard was diverted to the Auburn Road plant, which provides tertiary treatment through mixed media filtration and effluent polishing. In the late 1970's, Pontiac also undertook a sewer separation project in the City's northwest corner to eliminate combined sewer overflows (SEMCOG 1978b).

The Village of Almont upgraded their WWTP to a secondary facility in the early 1980s and is presently finishing a sewer separation project.

The City of Rochester installed facilities to improve treatment plant reliability in the late 1970's.

The City of Romeo constructed an advanced wastewater treatment facility that went on line in the early 1980's. A grant for this project was closed out in 1985.

The WWTP for the City of Armada is currently under construction to achieve secondary treatment.

The City of Warren has an advanced wastewater treatment facility completed in the early 1980s.

7.1.2 Industrial Wastewater Pretreatment

Since the 1970s, redirection of industrial discharges to WWTPs has reduced wasteloads to the Clinton River system. In most cases, process wastewater is discharged to a municipal system, leaving only noncontact cooling water and stormwater discharges to Clinton River. Municipalities have subsequently required industries to pretreat so their effluent will not disrupt treatment plant operations.

MDNR approved industrial pretreatment programs in 1985 for Mt. Clemens, Pontiac, Rochester, Warren, and Romeo. The requirement for pretreatment at Armada was rescinded because only one industry discharges to the WWTP (MDNR and USEPA, 1986). Almont did not require a pretreatment program since it receives no industrial discharges. See Chapter 5 for further discussion on pretreatment.

7.1.3 Constructed Combined Sewer Overflow Projects

The Combined Sewer Overflow (CSO) control projects which have been completed and have had major influences on improved Clinton River water quality are listed below.

- The Southeast Oakland County Sewage Disposal System Pollution Control Facility - described in Chapter 5

- Mt. Clemens Retention & Treatment Facility - described in Chapter 5

- Pontiac and Mt. Clemens sewer separation projects - described in Chapter 5

A Michigan CSO policy is currently under development. In 1986, the Water Resources Commission appointed a CSO Policy Committee to work with DNR staff to develop a Strategy for CSO control. This Strategy, proposed in May, 1987, suggests a two-phased approach. Phase I calls for immediate improvements in operation and maintenance of combined sewer systems plus data collection while revisions to the applicable state regulations are promulgated. Phase II requires development and implementation of a long-term plan for system control consistent with the revised rules. The Strategy will identify needed facilities, schedule construction and provide for funding. It is suggested that there be assurance that once the strategy is approved, more stringent requirements will not be imposed for 20 years unless there is conclusive case specific evidence warranting such an imposition. It remains to be seen how these evolving policies will apply to the existing CSO control facilities on the Clinton River.

7.1.4 Stormwater and Runoff Pollution Control Measures

Remedial actions directed toward reducing contaminants to the Clinton River from stormwater and surface runoff included structural and non-structural measures. Over the past 20 years there has been a gradual movement away from single purpose, localized provision of stormwater channels or sewers for flood control to more integrated management systems of land use regulation, on-site structural measures such as retention or detention basins, and preservation of open spaces.

Since the early 1970s, the Oakland and Macomb County Drain Commissioners have been requiring stormwater detention in new developments in the upper watershed reaches. Detention requirements are counter-productive in downstream reaches where severe flooding potential exists and delayed release could coincide with the peak flow from upstream.

In addition, drain commissioners traditionally oriented toward flood control have been administering soil erosion control permits since passage of the Michigan Soil Erosion and Sedimentation Control Act in 1976.

The regional 208 plan "Water Quality Management for Southeast Michigan" was developed and adopted in 1978 by SEMCOG. The plan included numerous background assessment reports which were the basis for recommendations for institutional arrangements, municipal wastewater treatment facilities, nonpoint source management and waste management (SEMCOG, 1978a). Plan implementation steps have included:

- Adoption of a sewer service areas map to guide decisions of all levels of government on sewer extensions

- Establishment of the Areawide Water Quality Board - a 27 member regional board which meets quarterly and engages in conflict resolution of regional issues; develops policy positions to guide agency reviews of new developments, state and federal grants and permits; and provides recommendations on state legislation, agency programs, and enforcement actions.

- <u>Designated Management Agency agreements</u> which clarified the status-quo of agency roles/responsibilities

- <u>Educational materials</u> for local governments such as:

  1980 "Water Quality Guidelines for Development Plan Reviewers: A Handbook for Local Officials in Southeast Michigan"
  1983 Series of Technical Bulletins highlighting local government programs for water quality protection such as stormwater management planning, use of the natural drainage system, detention basin maintenance, septics management, cluster development, conservation easements, performance zoning, site plan reviews and groundwater protection strategies

- <u>Technical Assistance Projects</u> as state grants have been available such as:

  1981 Effective Stormwater Management Programs: Case Studies of Local Government Experiences
  1980 Institutional Alternatives for Septic System Maintenance Districts in Southeast Michigan
  1982 Genoa Township Policy Plan for Groundwater Protection
  1984 Environmental Standards for Site Plan Review in Springfield Township
  1984 Local Roles in the Groundwater Strategy for Michigan

In 1981, SEMCOG compiled information from the 208 planning work relevant to the Clinton River Watershed in the report "River Basin Management Strategy Framework for the Clinton River Basin". This report addressed management of point sources, septic tanks, groundwater protection, stormwater control, erosion control, wetlands protection, and agricultural problems.

In 1979, the Clinton River Watershed Council (CRWC) proposed a strategy for stormwater management in urbanizing watersheds, which was supported by the state and Great Lakes Basin Commission for federal funding. This project was completed in three phases 1981 through 1987 with EPA 205(j) funding through the MDNR. Products included a Stormwater Management Assessment Report for the basin, a Technical Assistance Directory and a "Guide for Stormwater Management for Michigan Communities" (CRWC, 1987). Work with three pilot municipalities produced local Master Stormwater Policy Plans and a Stormwater and Erosion Control Ordinance prescribing on-site stormwater control requirements, a precedent in Michigan.

In 1984, the CRWC also produced a stormwater primer to provide lay officials with the background needed to participate in management decision making along with the planners and engineers (CRWC and DNR Engineering and Water Management). Major emphasis in the 1987 Guide to Management of Stormwater Runoff is on erosion control, use of wetlands for stormwater management, on-site management for multiple purposes and maintenance of the stormwater system.

SEMCOG received a US EPA National Urban Runoff Program (NURP) grant for 1979-81 to evaluate (in cooperation with the Oakland County Drain

Commissioner) the effectiveness of previously constructed stormwater detention structures in Troy and of modifications in these structures on pollutant discharges. Since then, state-of-the-art guidance on urban runoff control and design of detention basins for water quality control has been provided by EPA in "Results of the Nationwide Urban Runoff Program, Final Report 1983" and "Methodology for Analysis of Detention Basins for Control of Urban Runoff Quality, September, 1986." SEMCOG participated in the development of the Michigan Nonpoint Strategy. With DNR, SEMCOG published the Michigan Urban Nonpoint Source Pollution Control Strategy in 1985.

The Drain Commissions and the US Army Corps of Engineers have been involved in several flood control planning studies and projects which also may impact water and habitat quality in the AOC. These projects relate to alleviating flooding and siltation due to the influence of the weir and spillway on water, habitat quality, and sedimentation in the natural channel of the Clinton River downstream from the spillway. The City of Mt. Clemens funded a dredging project in 1961 at Shadyside Park to allow river flow to continue down the Main Branch and to alleviate flooding.

Since the late 1970's, the Michigan DNR has been seriously concerned about reducing pollution entering the AOC from stormwater discharges from industrial sites.

In 1984, EPA published new regulations specifying that all stormwater discharges in urban areas and industrial discharges outside defined urban areas may be considered as point sources and permitted under the National Pollutant Discharge Elimination System (NPDES). These regulations were postponed and then rescinded in anticipation of amendments to the Clean Water Act in 1986.

Even before these regulations were issued, however, MDNR had begun to identify industries likely to have contaminated runoff, and has added stormwater monitoring requirements and some effluent limits for stormwater discharges to Clinton River basin industrial NPDES permits. Recently issued NPDES permits also contain standard management conditions that require approved containment facilities for accidental losses of polluting materials and immediate spill notification to the MDNR emergency response telephone line.

7.1.5 Dredging

In 1975, the Oakland and Macomb County Drain Commissions asked 30 communities in the Clinton River basin to share the cost of dredging 15 years of accumulated sediments from the Clinton River adjacent to Shady Side Park in Mt. Clemens. Since completion of the spillway, flow velocities in the river downstream of the spillway had slowed, causing suspended particles to drop out instead of being carried further downstream or out to Lake St. Clair. Shoals formed in the middle of the river and stagnant water pools with algae blooms were partly responsible for reducing dissolved oxygen levels in the river causing periodic fish kills and aggravating flooding (Sapp 1975).

When no cost sharing agreement for river dredging was worked out, the Clinton River Spillway Drainage Board (represented by the Macomb County Public Works Commissioner) paid the costs out of funds left over from the original spillway project. This expenditure was justified by the understanding that backup of the river and increased sedimentation had been caused by construction of the spillway (G. Winn, Macomb County Public Works Department personal communication, 1986). The river was dredged in 1976 and spoils were deposited in a bermed area between the spillway and the natural channel of the Clinton River (USCOE, 1975).

In October of 1987, the CRWC convened a meeting to review possible action steps to improve this river segment including construction of a variable weir to replace the present weir and arrangements for periodic removal of sediment deposits in this area to maintain flow through this natural channel. This area is upstream of the presently authorized federal navigation channel. Measures to reduce erosion and sedimentation throughout the river were also discussed (CRWC 1987).

While not a large-scale project, the dredging was significant because it was recognized that elimination of sediment shoals caused by upland erosion would improve water quality and aquatic habitat while simultaneously reducing flooding problems. Recently renewed concern for lack of enforcement of soil erosion control requirements has lead to new initiatives at the Council and municipal levels to provide for site inspections (CRWC memo to MERB/WRC 1986).

7.1.6 Enforcement

Point source discharges to the Clinton River system and the AOC are in substantial compliance with their NPDES permits. However, the Mt. Clemens Wastewater Treatment Plant was the subject of Federal enforcement action in 1984 for failing to analyze and report results of USEPA performance evaluation tests (part of a quality assurance program). In 1985, Mt. Clemens received two notices of noncompliance from MDNR and one also 1986.

Several NPDES permittees in the Clinton River basin have fallen behind their compliance schedules. Mt. Clemens WWTP missed compliance schedule deadlines for upgrading in 1983, 1984, and 1985. Rochester missed its 1984 and 1985 deadlines. Warren missed one compliance schedule deadline in 1984, Romeo missed one deadline in 1986, and Armada missed one in 1985. Notices of Noncompliance were sent to encourage compliance with these schedules.

Compliance schedule deadline violations by industrial dischargers include GM Truck and Bus (date unknown) and GM-CPC (1985, 1986); General Electric Carboloy Systems (1985); and Auburn Heights Manufacturing Company (1985, 1986) (Permit Compliance System and USEPA Region V 1986). Notices of Noncompliance were sent to encourage compliance with permit limits and compliance schedules.

Two recent reports have questioned what is actually known about compliance with discharge permits because of the dependence on self-monitoring, rare MDNR staff sampling of dischargers effluent and very little monitoring of minor discharges. A MDNR Audit Report noted that minor facilities could have a detrimental impact on surface water quality. The Areawide Water Quality Board/East Michigan Environmental Action Council report recommended "a comprehensive inspection and monitoring program should be put in place and funded to enable state agencies to bring hazardous materials handlers, waste handlers, and pollutant discharges into compliance with state environmental programs and permit requirements".

The Michigan United Conservation Club/National Wildlife Federation report recommended (1) development of a state plan for environmental monitoring of issuance of NPDES permits; (2) routine analysis of wastewater discharges where environmental monitoring indicates serious pollution problems, and WWTPs which accept industrial wastes analysis of their discharge for priority toxic pollutants; (3) routine DNR sampling and analysis of dischargers effluent for compliance monitoring funded by user fees.

7.1.7 Private and Nongovernmental Remedial Actions

A variety of stormwater treatment facilities have been incorporated in new developments, including but not limited to small grease/grit collection chambers at edges of commercial parking lots, stone/fabric filtering devices, and oil skimming and sediment settling in major detention basins.

DNR staff have estimated that for every one site of contamination that becomes listed under Act 307, there may be four cases of a spill incident where local governments and private owners have managed the cleanup.

Industries and businesses are becoming increasingly aware of the liability they incur in the event of accidental releases. Because of high insurance costs they are proceeding to institute better practices for the use, storage, and disposal of hazardous substances. For example, many service stations are not waiting for federal and state regulations to force them to replace old underground storage tanks. There are existing requirements for tank registration and removal of abandoned ones. Some local governments are now attempting to identify community tanks and monitor compliance with these regulations.

East Michigan Environmental Action Council and the Cooperative Extensive Service have compiled lists of oil recycling stations and provided the public with an information brochure. Oil discharges are considered major problems on the Clinton River. Often, heavy accumulations in the storm drains are flushed out by the early spring rains. Local government ordinances forbid disposal of waste oils in storm drains but it still occurs because enforcement is difficult.

Trout Unlimited has undertaken at least one stream habitat improvement project (on Paint Creek). That project addressed primarily bank erosion and siltation.

Since 1969, when there was a major Clinton River cleanup by volunteers organized by the Sterling Heights Rotary, there have been many volunteer cleanups of debris on various river segments. The most recent cleanup was held in August, 1988. The CRWC is supporting proposed legislation that would provide 50% matching grants with the expectation that local governments will agree to establishing on-going cleanup and bank stabilization work.

Developers are, with increasing frequency, featuring wet detention ponds and use of wetlands on development sites not only for aesthetic reasons but as the preferred means for nonpoint source runoff control.

7.1.8 Benefits Derived and Uses Restored

Although sediments in the lower Clinton River remain contaminated with oil, grease, conventional pollutants, heavy metals and organic compounds, the remarkable recovery of the river since the 1960s is a major success story of American pollution abatement programs (Peterson 1986; CRWC 1984; Mertz 1984; MNRC 1985; Natural Resources Register 1985; Richardson 1983). In the mid-1960s, the river was "dead" as far as fish were concerned from Pontiac to Lake St. Clair. The river emitted unpleasant odors and was covered and clogged with debris (Peggy Johnson as quoted in Mertz, 1984). However, by 1980, the U.S. Fish and Wildlife Service recorded 33 species of fish in the river. This improvement is the result of many of the efforts briefly described in the preceding sections of this RAP and the programs summarized in Chapter 9.

Improvements in Clinton River water quality between 1960 and 1973, mainly the elimination of sewage and reduction of uncontrolled point sources, allowed dissolved oxygen levels to rise to the point where fish could be restocked (CRWC, 1984). Since approximately 1974, 10-30 pound salmon have been found as far upriver as Yates Dam; some eggs and fingerlings have also been found, indicating spawning process. Fishing has had a resurgence at Sterling Heights, Rochester and Avon Township parks. These parks are the center of water-related recreation including fishing and canoeing that would have been unpleasant 20 years ago. Michigan DNR fishery managers requested steelhead for stocking in the lower river, where anglers already fish for smallmouth bass, northern pike, and walleye (CRWC 1984).

Dissolved oxygen and phosphorus levels are good indicators of water quality. In 1966, dissolved oxygen levels in the lower 15 miles of the river were below 5 mg/l (current state minimum standard). By 1973, mean levels had risen to over 7 mg/l upstream from Red Run, but still fell sharply at the confluence with Red Run to a low of 5 mg/l at the confluence with the North Branch (Richardson 1983). Likewise, phosphorus levels also declined during the 1970s and 1980 in large part due to control of point sources and the phosphorus ban in detergents.

Some local governments have placed restrictions on acquiring land in floodplains to prevent development encroachments, reduce flood damages, and improve recreational access to the river. All localities in the AOC currently participate in the National Flood Insurance Program, which requires them to take positive action (ordinances, zoning, etc.) to regulate any new development in the floodplain. Some local governments have local floodplain ordinances with more stringent requirements than the state and federal laws which allow floodplain development if elevated. The ordinances restrict filling and development to protect the ecological values of the floodplain including the water quality benefits.

Several communities on the Clinton River, including Sterling Heights and Mt. Clemens, have had strong programs to acquire floodplain property for use as parks and open space, providing greater opportunities for public access and recreation on the River and Lake St. Clair. The increasing demand for public access to the water front in the AOC for boating, fishing, walking and even swimming (in Lake St. Clair) in recent years is a strong indication of significant improvement in water quality.

7.2 ACTIONS IN PROGRESS

Many remedial activities directed at improving water or habitat quality and restoring impaired uses in the AOC are in progress or are being planned.

7.2.1 Mt. Clemens Wastewater Treatment Facility Construction

In 1978, Mt. Clemens submitted to MDNR an amendment to its 1974 facilities plan showing that building an interceptor to Detroit was no longer cost-effective, based in part on increased treatment fees by Detroit. In 1982, the US District Court rescinded the contract for regional treatment between Mt. Clemens and Detroit, and Mt. Clemens submitted a final facilities plan amendment which recommended that it build its own tertiary oxidation ditch plant with an average capacity of 6 mgd. This plant was expected to reduce dissolved oxygen and fecal coliform problems. The facilities plan also included provisions for reducing discharges from Mt. Clemens' combined sewer overflows, including the retention basin (which began operation in 1980) (Spalding, Dedecker & Associates, Inc. 1982). In 1978, the expected total project cost for the proposed plant was $6,302,000; by 1982, the estimated total project cost had risen to $15.2 million.

Mt. Clemens submitted plans and specifications to MDNR in 1983 and hoped to begin construction in 1984. The project was expected to include two oxidation ditches, final clarifiers, chlorination, and sludge management systems. In late 1985, USEPA disagreed with Mt. Clemens and MDNR that construction of a treatment plant in Mt. Clemens would be the most cost-effective alternative. (MDNR had agreed with the cost-effective proposal in the Mt. Clemens 1982 facilities plan amendment.) USEPA staff did not believe that the plant could be built for the estimated cost. However, in the summer of 1986, Mt. Clemens obtained bids for the work at less than the estimated cost and has let contracts for construction (R. Schrameck, MDNR, personal communication, 1986) which began in February 1987. The Mt. Clemens facility will be completed in December of 1988.

7.2.2 Dredging and Dredge Spoil Disposal

Two dredging projects which may constitute remedial actions for aquatic habitat restoration in the AOC are in their initial planning stages. The first would remove several thousand tons of sediment from the Clinton River just upstream of the spillway to improve flow down the natural channel. The first dredging was by the City of Mt. Clemens in 1961; a second was by the Clinton River Inter County Drainage Board in 1975. Dredging costs were estimated at $100,000 (G. Winn, Macomb County Department of Public Works, personal communication, 1987).

A disposal site has not been designated, but these sediments may be codisposed with sediments from other dredging projects, or in a new diked area adjacent to the one used for the mid-1970s disposal area across from Shady Side Park. This project would help alleviate low dissolved oxygen problems downstream of Mt. Clemens and would help restore acceptable bottom necessary for resident fisheries. Sediment removal would also help prevent flooding. A meeting of interested parties was convened by the Clinton River Watershed Council in November of 1987 to review dredging feasibility and reconstruction of a variable spillway weir.

The second proposed dredging project is considerably more extensive. The U.S. Army Corps of Engineers proposed to dredge the recreational navigation channel in the lower Clinton River and construct a Confined Disposal Facility (CDF) for dredged material on 30 acres of a 37-acre site located about 1.8 miles upstream from the mouth of the Clinton River, next to the Selfridge Air National Guard Base (USCOE 1985). In addition to allowing continued use of the lower Clinton River for recreational navigation, the project would remove sediments that contain high concentrations of oil, grease, metals, and organic contaminants. (USCOE 1987).

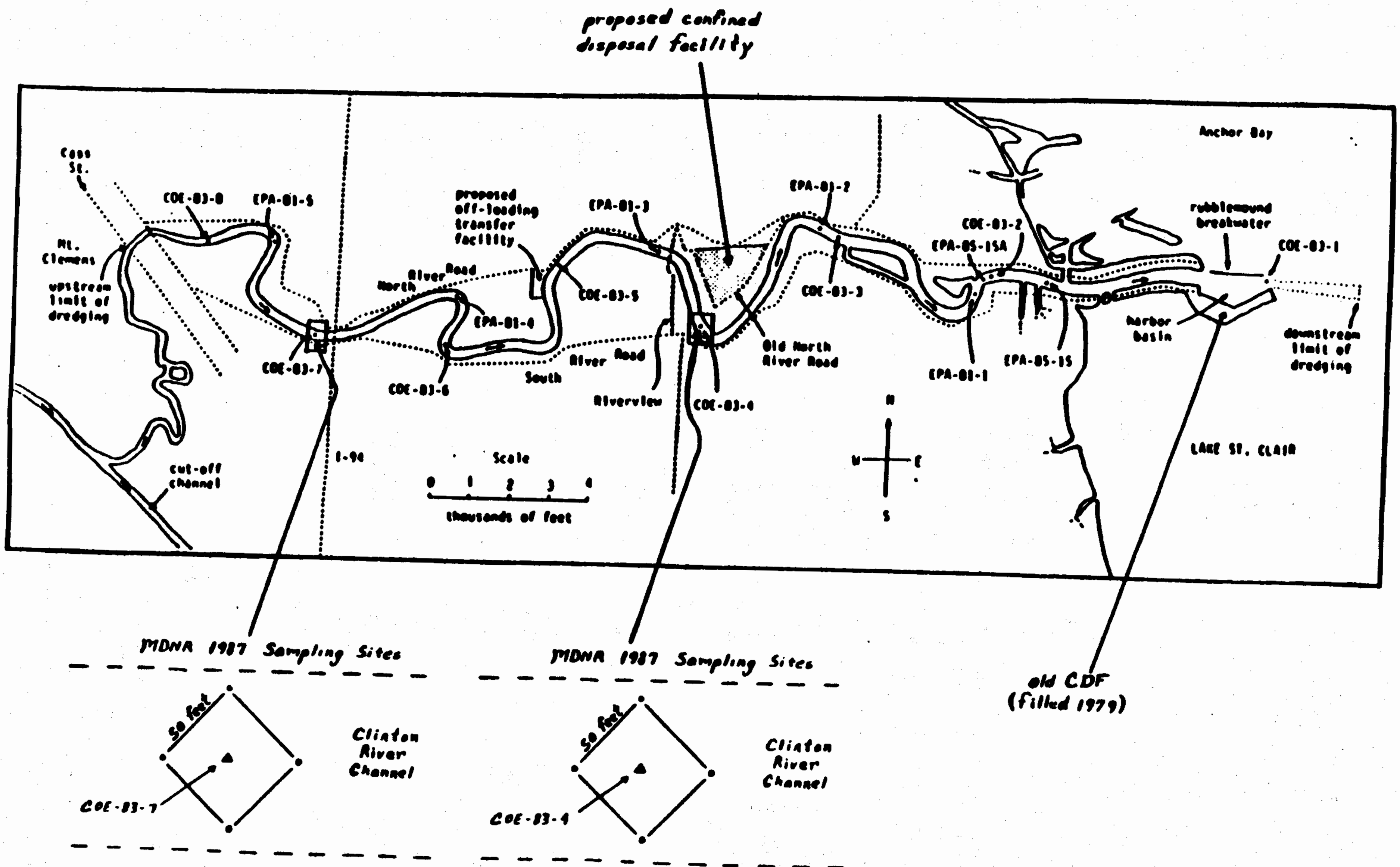
After the initial dredging, maintenance dredging would remove an additional 52,500 to 70,000 cubic yards of sediments every 3 to 4 years. The CDF would have a 10 year capacity if the present "backlog" of sediments is removed the first year (USCOE 1987).

Figure 7-1 shows the location of the proposed CDF. The river segment to be dredged is the authorized Federal navigation channel from the City of Mt. Clemens into Lake St. Clair or the lower 7.5 miles of the river.

The proposed CDF site is owned by the State of Michigan, the local sponsor for this project. The dredging and the CDF was reviewed by standard environmental review processes under several Federal initiatives. (These include the River and Harbor Act/Section 10; the Clean Water Act/ Section 404; Executive Order 11990 - Wetlands Protection; the Water Resources Development Act of 1976; the National Environmental Policy Act/NEPA; the Fish and Wildlife Act of 1956; the Fish and Wildlife Coordination Act of 1958; and several others.) In addition, the project was subject to State of Michigan review processes prior to any further action.

USEPA Region V and the U.S. Fish and Wildlife Service recommended close coordination with other planning activity in the lower Clinton River, and have highlighted potential groundwater contamination from the CDF and contamination of terrestrial biota. Detailed groundwater studies and appropriate sealing and capping are recommended to ensure that contaminated sediments are not leached into the groundwater (Best 1986). Since the proposed dredging would remove the contaminated sediments in the navigation channel, it would be a significant remedial action toward restoring aquatic habitat in the AOC.

Figure 7.1. **Sediment sampling locations, and the proposed and filled confined disposal facilities in and along the natural channel of the Clinton River, between Mt. Clemens and Lake St. Clair.**



Nearby residents have opposed the project since it is located adjacent to homes and would cause noise and inconvenience. Residents have also expressed concern over groundwater contamination and long-term integrity of the site. The CDF was completed in the fall of 1988.

7.2.3 Waste Site Cleanup

Remedial investigations and planning to clean up contamination that may affect water quality and the aquatic habitat in the Clinton River Watershed are proceeding at five areas including Selfridge Air National Guard Base, Red Run, Liquid Disposal, Inc., G&H Landfill and SMDA 9 and 9A. This section briefly describes steps that have been taken and current status of cleanup activities at each location.

7.2.3.1 Selfridge Air National Guard Base.

The U.S. Air Force has undertaken an Installation Restoration Program at Selfridge to address contaminants at seven locations on the base. The Air Force developed a draft report which recommended future study steps, the "Installation Restoration Program Phase II - Confirmation/ Quantification Stage I" report (R. Weston 1986). Work began on the Remedial Investigation Feasibility Study in December of 1987. See Section 5.6.2.4.

7.2.3.2 Red Run Landfills

In January, 1985, Red Run was listed on Michigan's Act 307 List of Environmental Contamination Sites requiring evaluation and interim response activities (MDNR 1986a). The site is in Macomb County, mostly in the City of Sterling Heights. It includes three distinct areas that contain one or two landfills each (Figure 5.2.7).

Background information indicates that property along Red Run and its tributaries was used for disposal of municipal, industrial, and household wastes in the 1950s and 1960s (E.C. Jordan 1986). In the three-mile long reach of Red Run, there are at least five and as many as seven landfills in five general locations along the drain, covering 200 to 250 acres. (Several hundred acres of landfill also line the banks of Red Run and its tributaries upstream from the designated site.)

MDNR collected leachate samples in 1983. The samples contained benzene, toluene, xylene, dioctylphthalate, dichlorobenzene, and dinitro-o-cresol, as well as lead, nickel, and chromium. Results of these tests led to the State 307 Act listing of the sites in 1985.

The Site Investigation's objectives are to evaluate threats to public health posed by leachate seepage and gas migration from the landfills and to identify alternatives to reduce or eliminate these threats (E.C. Jordan 1986). This will not include identifying and recommending remedial measures for impacts on water and sediment quality in Red Run and the Clinton River. A detailed study of Red Run is beyond the scope of the Site Investigation. According to MDNR's consultants (E.C. Jordan, 1986), the study will address ways to eliminate the direct discharge of leachate seeps to Red Run as a secondary benefit from the control of leachate seeps in general.

The Red Run Site Remedial Investigation now underway is expected to be completed in February of 1989.

7.2.3.3 Liquid Disposal, Inc.

Liquid Disposal, Inc. (LDI) was a liquid industrial waste incinerator and hazardous waste storage site. The facility was permanently closed in May 1982 after an industrial accident in which two workers died from toxic gas fumes.

The LDI site was submitted by Michigan DNR to USEPA as a remedial action candidate under Superfund (the Comprehensive Environmental Response, Compensation, and Liability Act) in May 1982 (Figure 7.2). It was placed on the National Interim Priority List in July 1982. CH_2M Hill, a consultant, completed a draft Remedial Action Master Plan for the site in January 1983. This report reviewed information then available on the site, identified data gaps, and proposed a plan, schedule, and cost estimate for remedial measures and a Remedial Investigation/Feasibility Study (RI/FS) (USEPA 1985b).

Since the site was closed, USEPA has spent over $4 million on emergency actions (MDNR, 1986c). In June 1982, USEPA and MDNR cleaned up a PCB-contaminated oil spill from the site. In 1983, USEPA took emergency action at the site, removing all liquids and sludges from a waste oil lagoon, piles of scrubber lagoon ash, and above ground drums and waste containers (USEPA, 1985b). A groundwater dewatering well and leachate collection sump were installed on the eastern boundary of the site, with their effluents discharged to the onsite incinerator pit.

Michigan DNR has spent $450,000 investigating LDI impacts on air, the Clinton River, groundwater, and soils. Private wells near the site have been sampled by the Macomb County Health Department (MDNR 1986c).

Michigan DNR was the lead agency in the RI/FS at the site, and contracted with GMC Associates, Inc. to perform the RI/FS. The remedial investigation began with a site visit in October 1983. Onsite work began in April 1984, including a geophysical investigation and a hydrogeologic investigation. Soil contamination and pollutant characterization studies were conducted in 1984 and early 1985. MDNR also undertook a surface water study in September of 1984 (Kenaga and Jones, 1986).

The surface water study concluded that leachate seeps may be contributing to surface water contamination, particularly along the storm water ditch east of the site (Kenaga and Jones 1986). The study also noted that groundwater contamination in offsite areas around LDI is apparently due to actual subsurface seepage into the upper aquifer through the fill beneath LDI. The lack of significant groundwater contamination around LDI may be due to leachate buildup onsite and little migration offsite. However, the east seep is heavily contaminated with compounds from the scrubber lagoon, which is still a significant contaminant source, and the north seeps contain PCB, probably rendered mobile by organic solvents in

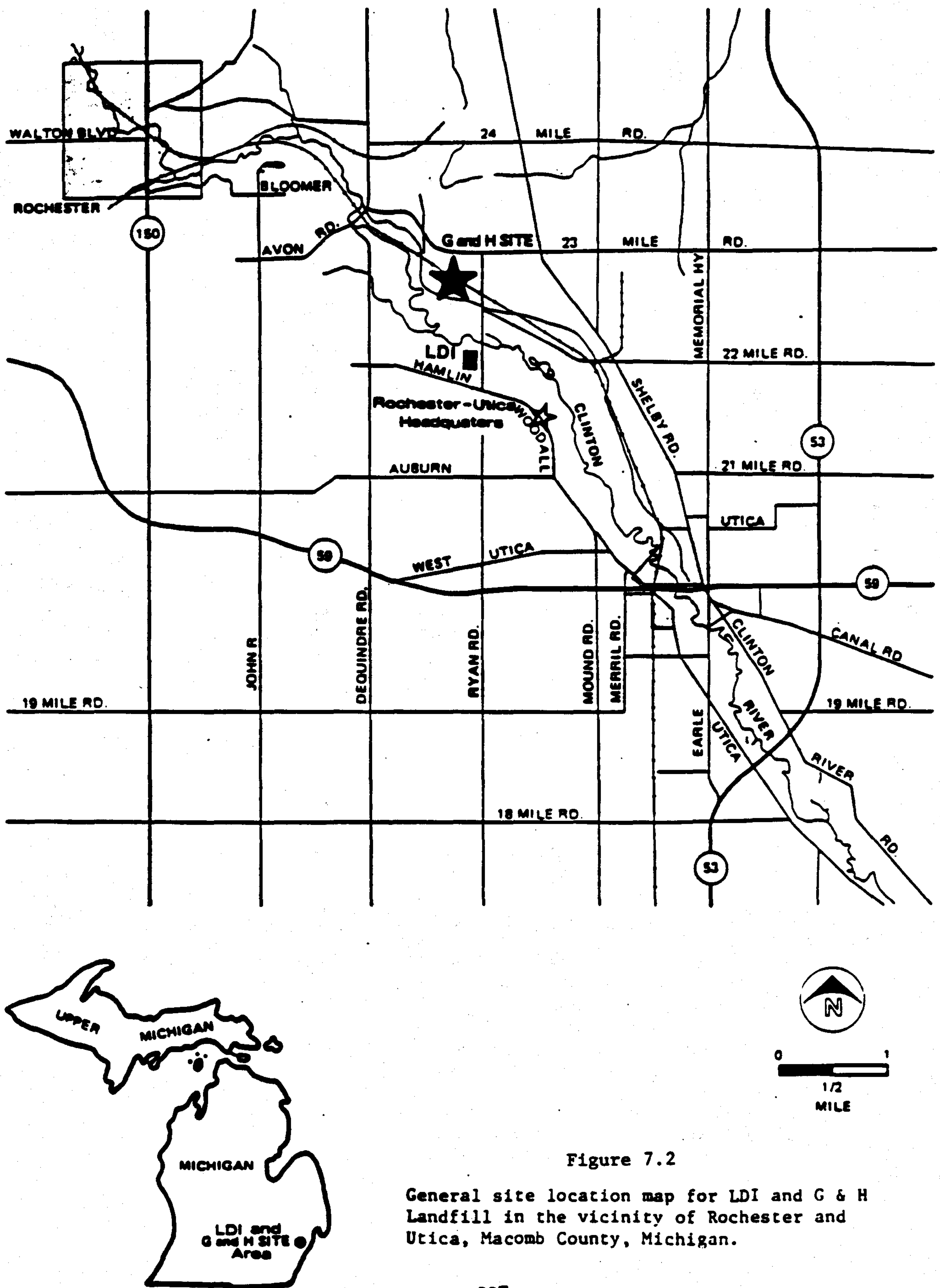


Figure 7.2

General site location map for LDI and G & H Landfill in the vicinity of Rochester and Utica, Macomb County, Michigan.

the landfill leachate. Removal of the final 40,000 gallons will take place through implementation of the Federal Superfund process.

The remedial investigation feasibility study was completed in August of 1987. The selected remedial action, including solidification of onsite soils, slurry wall around the site and capping the site. Offsite contaminated soils will be moved within site boundaries and solidified. The contaminated groundwater will be purged and treated off site. By late 1988 the cleanup agreement is expected to be signed and by mid-1989, the design work for the actual cleanup will begin.

7.2.3.4 G & H Landfill.

The G&H Landfill was used for disposal of municipal and industrial wastes from the mid-1950s until 1967, when the State of Michigan prohibited the landfill from accepting industrial waste (Figure 7.2). It continued to receive refuse until 1974, when it was permanently closed (MDNR 1986d).

USEPA took emergency action in 1982 and 1983 to contain PCB-contaminated oil seeps from the landfill, at a cost of $55,000, and to restrict public access to affected areas. From 1983 to March 1986, USEPA spent $566,000 investigating the impact of the landfill on air, wetlands, groundwater, soils, and the River. USEPA, Macomb County Health Department, and the Michigan Department of Public Health have sampled private wells in the area (MDNR 1986d). While investigations were going on, in 1983 MDNR formed a citizens information committee on the G&H Landfill and established a G&H telephone information answering service.

In September, 1983 and September, 1984, USEPA and MDNR conducted studies to help identify effects of the landfill on the Clinton River. Measurable impacts on the surface water quality of the Clinton River were not documented by these studies.

MDNR estimated in September 1988 that USEPA would need $1.3 million to complete an expanded RI/FS for the site. MDNR will need an additional $275,000 to complete a supplementary investigation. The remedial investigation report for the site will be complete in December 1989, and the feasibility study report will follow in early 1990.

7.2.3.5 South Macomb Disposal Authority Landfill 9 and 9A

The results of a 1983 survey of McBride Drain which runs adjacent to South Macomb Disposal Authority 9 and 9A, indicated no measurable impact on surface water quality or the aquatic macroinvertebrate community. There were resident young fish identified in the drain during the survey. The leachate collection system is apparently intercepting the majority of the landfill leachate moving was toward the south from 9A in the aquifer. The leachate tank must be pumped out on a regular basis to prevent overflow from this collection system. Studies are ongoing to determine the impact of leachate reaching McBride Drain during spring runoff from SMDA Landfill 9A. A leachate collection system and slurry wall is being installed along the north boundary of SMDA Landfill 9. In addition, this site has been placed on the Superfund list. An EPA contractor began a Remedial Investigation Feasibility Study in October 1988.

There are other 307 sites in the Clinton River basin that are not in the Area of Concern which are briefly discussed in Chapter 5. Sites that may possibly impact surface water sites are found in Appendix 5.

8. DEFINITION OF SPECIFIC GOALS, OBJECTIVES, AND MILESTONES FOR RESTORATION OF IMPAIRED USES

8.1 USES TO BE RESTORED OR MAINTAINED

The Michigan Water Resources Commission has designated water uses to be met in all Michigan waters in Part 4 of the General Rules of the Water Resources Commission, which covers water quality standards (Appendix 3.3). These rules were recently amended in November, 1987. All waters of the state, including the AOC, are protected for the following uses:

- Agriculture
- Navigation
- Industrial water supply
- Public water supply at the point of water intake
- Warmwater fish
- Other indigenous aquatic life and wildlife
- Partial body contact all year
- Total body contact recreation from May 1 to October 31.

The waters in the AOC have occasionally failed to support agriculture (irrigation) based on the total dissolved solids standard, other aquatic life in the form of a healthy warm water fishery and a healthy benthic macroinvertebrate community, and total body contact recreation due to the presence of fecal coliform bacteria. There are no impairments to navigation, industrial or public water supply or partial body contact recreation based on the minimum standards. Based on current Michigan regulations, all of these uses should continue to be supported or restored by any remedial actions undertaken pursuant to this RAP. All these uses are local impairments that do not result in any impairment of the Great Lakes.

8.2 DESIGNATED USES AND GOALS

8.2.1 Agriculture

The agricultural use impairment is due to Clinton River waters containing TDS in excess of 500 mg/l. This standard will not be met because high TDS are a natural product of the soil types in the Clinton River basin and there is no practical treatment for TDS at industrial or municipal treatment facilities.

GOAL: Minimize TDS from municipal and industrial facilities, reduce nonpoint sources of TDS through BMPs.

8.2.2 Navigation

There is no commercial navigation and recreational navigation is supported by the proposed USCOE dredging.

GOAL: Carry out proposed dredging to maintain recreational navigation in Section 1.

8.2.3 <u>Industrial Water Supply</u>

There are no limitations on industrial water supply.

GOAL: None.

8.2.4 <u>Public Water Supply</u>

There are no public water supply intakes in the AOC.

GOAL: Maintain existing water quality.

8.2.5 <u>Warmwater Fish</u>

There is a substantial resident warmwater fish community in the AOC, especially in the Clinton River SAOC upstream of the mouth of Red Run. There is a growing seasonal anadromous fishery in both spring and fall. several factors contribute to a degraded warmwater fishery in Section 1.

GOAL: Enhance the warmwater fishery in Section 1. Continued stocking of walleye is supported.

8.2.6 <u>Other Indigenous Aquatic Life</u>

Based on Michigan water quality standards, the AOC should support healthy populations of aquatic benthic macroinvertebrates and other aquatic life.

The benthic macroinvertebrate community in Section 1 of the AOC was impacted as of 1983 but the cause is uncertain. Meeting the D.O. standards in the AOC remains a major goal to support healthy aquatic communities.

GOALS:

A. Minimize effect of contaminated sediments on aquatic organisms.

B. Improve physical bottom habitat to support a healthy benthic macroinvertebrate community by:

   1. Reducing runoff in upstream watershed - good soil conservation practices
   2. Controlling instream erosion by controlling stormwater flows

C. Improve dissolved oxygen concentration in the water column so that D.O. standard is met by:

   1. Controlling point source discharges
   2. Minimizing stormwater loadings
   3. Being certain no industrial or sanitary systems are connected to the stormwater system

D. Improve dissolved oxygen in the natural channel by:

   1. Removal of sediments blocking flow to natural channel
   2. Weir modifications

E. To improve future sediment quality, reduce heavy metals and organic contaminants by:

   1. Adequate NPDES permit limitations
   2. Minimizing stormwater loadings
   3. Cleaning up sites of environmental contamination near surface waters.

F. Improve flow in the natural channel.

8.2.7 Partial Body Contact Recreation

Partial body contact is not impaired.

GOALS: None.

8.2.8 Total Body Contact Recreation

Total body contact recreation has apparently been restored since all CSOs will be treated prior to discharge.

GOALS: Maintain all WWTP and sewer systems in good working order to eliminate or minimize overflows; construct treatment systems to at least give all water primary treatment and disinfection; minimize stormwater loadings; maintain existing improved river quality.

8.3 WATER USE AND QUALITY OBJECTIVES

The goals of the Remedial Action Plan (RAP) are to adequately review existing information and to recommend remedial activities to restore designated uses in the Great Lakes. Most identified impaired uses are localized issues that will need to be dealt with by local corrective actions. PCB from the Clinton River system may result in Great Lakes impairment. PCB loading to and from the Clinton River remains unknown but is assumed to be small based on the data. Therefore, objectives for the Clinton River Area of Concern are the restoration of impaired uses in the Clinton River and the pursuit of data to determine the PCB sources to the Clinton River and PCB loading to the Great Lakes from the Clinton [illegible]

9. PROGRAMS AND PARTICIPANTS

9.1 REGULATORY AND ADMINISTRATIVE PROGRAMS

A variety of regulatory and administrative programs affect policy and implementation for water quality improvements in the AOC. These include programs carried out by state, local, and federal agencies under appropriate legislative, executive, or other mandates. This section briefly outlines several of the more significant programs and points out their importance for the Clinton River Area of Concern. Most of these programs are related, directly or indirectly, to Michigan's Water Quality Management program, administered by the Department of Natural Resources.

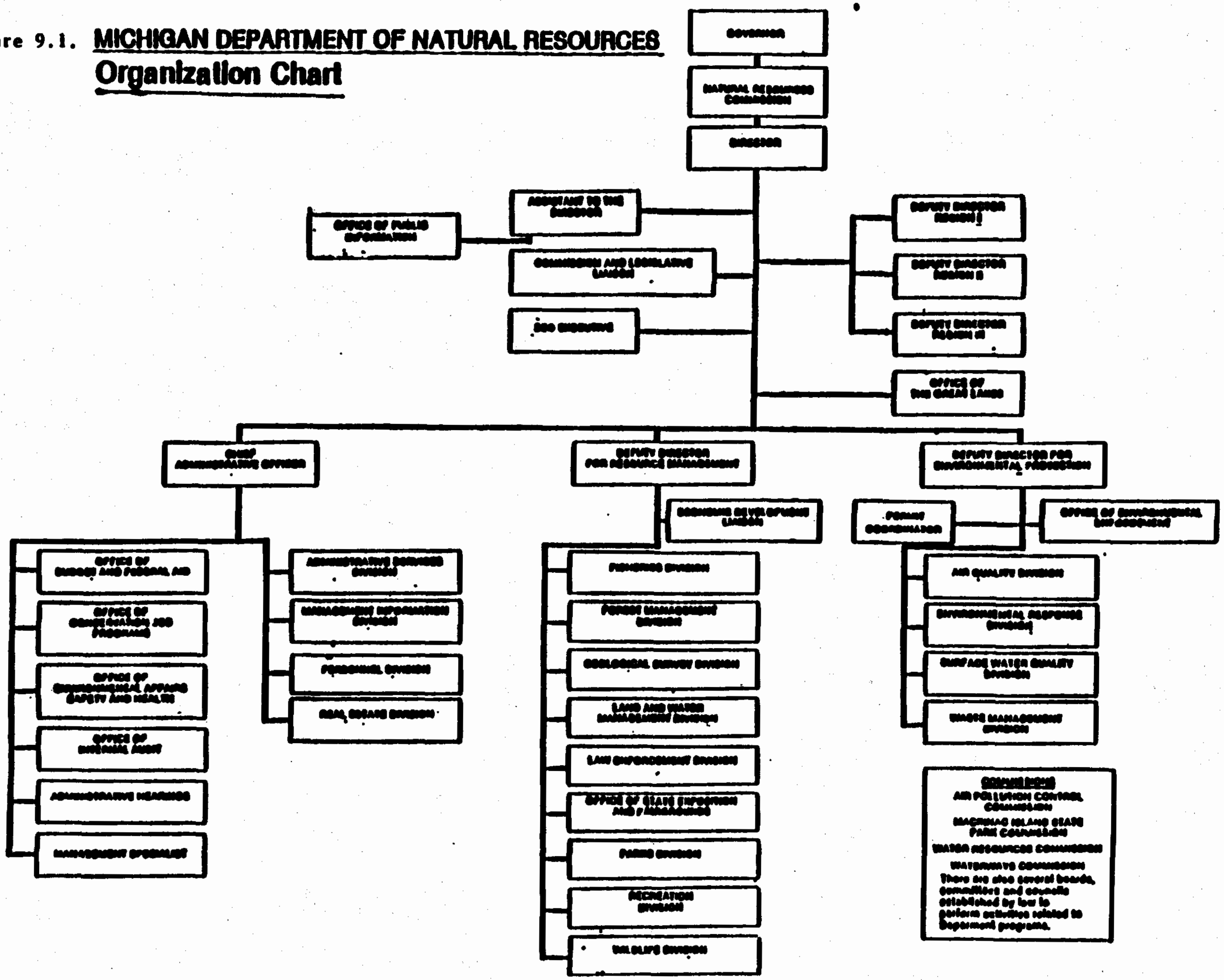
9.1.1 Water Quality Standards

Water Quality Standards. Water quality standards for all surface waters of the State of Michigan have been adopted pursuant to a mandate from the Michigan Water Resources Commission and the federal Clean Water Act. Michigan's Water Resources Commission General Rules state that the purpose of Michigan's water quality standards is "...to protect the public health and welfare, enhance and maintain the quality of water, protect the state's natural resources, and serve the purposes of P.L. 92-500 (the Federal Water Pollution Control and Clean Water Acts) as amended, Act No. 245 of the Public Acts of 1929 (the Michigan Water Resources Commission Act), as amended, being §323.1 et seq. of the Michigan Compiled Laws, and the Great Lakes Water Quality Agreement enacted November 22, 1978" (MWRC 1986).

The Water Resources Commission was created under Michigan Act 245 of 1929. Its powers and responsibilities were expanded in 1972 (based on Michigan Acts 3, 129, and 293) to bring it into compliance with the Federal Water Pollution Control Act. The administrative functions of the Commission are carried out through the Michigan Department of Natural Resources (Figure 9.1). The Commission is charged with protecting and conserving water resources of the state of Michigan, controlling pollution of any waters of the state and the Great Lakes, and controlling alteration of watercourses and floodplains of all rivers and streams in the state. It was also empowered to make rules, require registration of manufacturing products, materials, and waste products where certain wastes are discharged to state waters, and cover investigation, monitoring, and surveillance necessary to prevent and abate water pollution.

Current standards for the Clinton River are listed in Chapter 3. Appendix 3.3 contains the entire Part 4 Rules. Michigan's water quality standards were amended in November, 1986 to include more stringent minimum standards relative to plant nutrients, designated uses, microorganisms, dissolved oxygen, toxics, and anti-degradation. The new rules also designate certain waters as "protected waters" under state authority, to implement strong anti-degradation goals. Protected waters now include some designated streams in the Clinton River basin.

Figure 9.1. **MICHIGAN DEPARTMENT OF NATURAL RESOURCES**
Organization Chart



Technical work for the proposal of water use designations and water quality standards is carried out by MDNR's Surface Water Quality Division (Figure 9.2).

Additional long-term goals for the Clinton River were established in a 1979 Water Quality Management Plan for Southeast Michigan produced by the Southeast Michigan Council of Governments (SEMCOG). SEMCOG's 1981 River Basin Management Strategy Framework for the Clinton River Basin updates these goals, which include the following:

- Clinton River basin waters must be made drinkable, swimmable, and fishable
- Reduce point sources of water pollution
- Ensure that the effect of development does not result in degradation of water quality from previously existing levels
- Pollution from farm activities should be reduced
- Halt any degradation of groundwater through methods such as land use control and strict enforcement of regulatory programs.

The 1981 strategy provides detailed recommendations as to how these general goals should be achieved and which agencies are responsible to carry out necessary programs.

9.1.2 Compliance Status of Point Source Controls

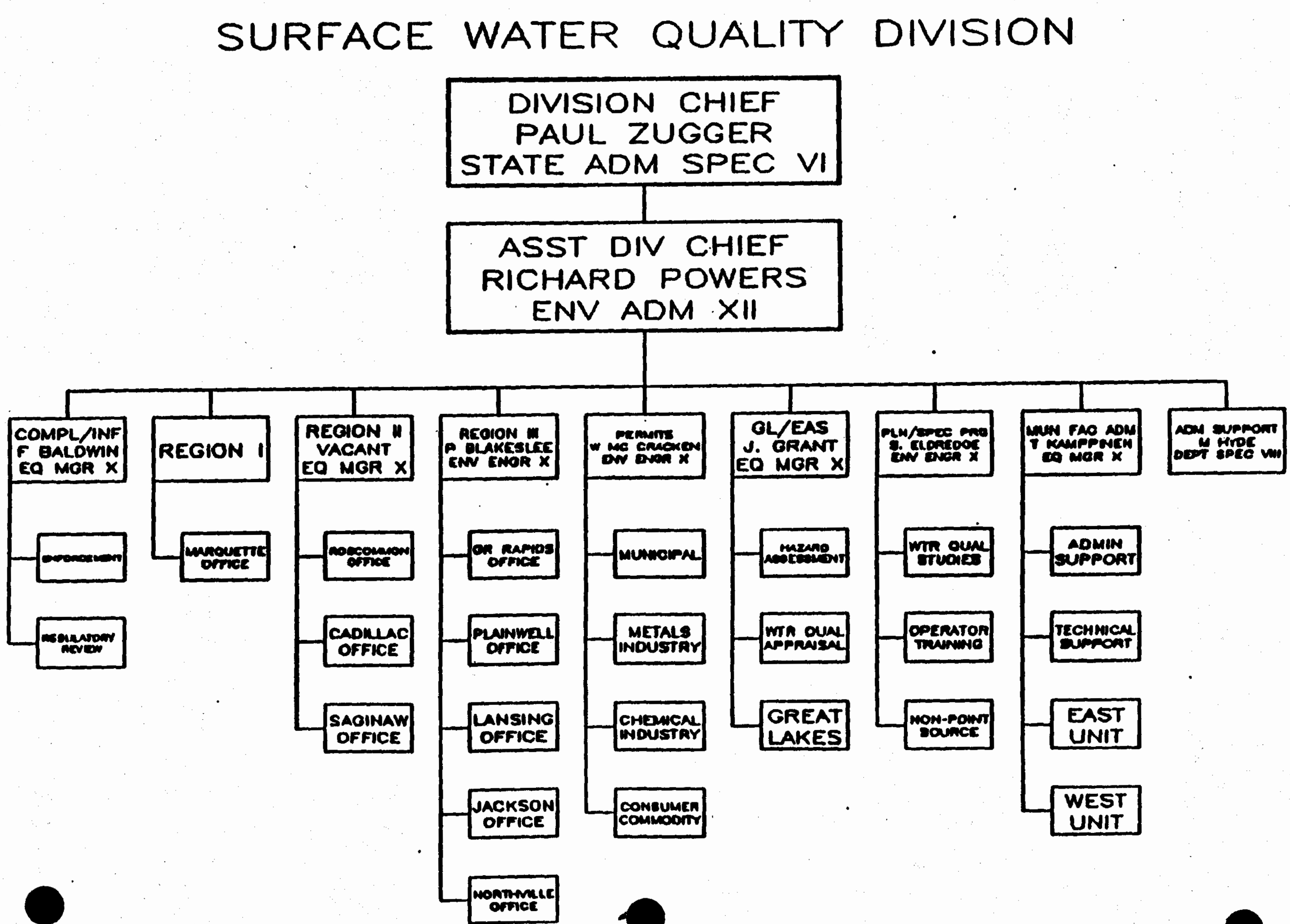
The Water Resources Commission was also empowered to require permits regulating the discharge or storage of any substance that could affect water quality and also to impose restrictions that would assure compliance with state standards, applicable federal laws, and regulations. The Commission is the authorized state agency to cooperate and negotiate with other governments and agencies in matters concerning state water resources and to provide penalties for violations of the Water Resources Commission Act.

Michigan's Water Resources Commission obtained federal approval to administer the NPDES program for Michigan in October 1973. The permit program for municipal and industrial dischargers is operated by the Michigan Department of Natural Resources' Surface Water Quality Division.

Because NPDES permits in Michigan are issued under the authority of the Water Resources Commission Act in addition to the federal Clean Water Act, permit violations are considered violations of the state Act and may be subject to civil or criminal penalties. Dischargers are notified of alleged violations by written notices of determination setting forth specific permit provisions that the Commission, through DNR, asserts have been violated.

NPDES permittees are obliged to comply with the terms and conditions of their discharge permits, normally reissued at 5-year intervals. Permits specify final effluent limits for applicable parameters (and interim

Figure 9.2. Surface Water Quality Division Organizational Chart.



limits, where applicable), monitoring requirements, test procedures and reporting. Records retention requirements, compliance schedules for completing system upgrading or studies necessary to ensure that dischargers are able to meet effluent limits and avoid causing violations of water quality criteria and standards are also in these permits. Permits may also specify the penalties for noncompliance, indications of need to modify permits, spill containment facility requirements, operator certification requirements, and noncompliance notification procedures. Procedures for spill notification and bypass notification are also included in current permits. Permits also contain industrial pretreatment program requirements.

Michigan's Water Resources Act also requires direct and indirect dischargers to file annual reports with the State describing the nature of the enterprise discharging wastewater; quantities of materials used in or incidental to manufacturing processes; quantities of any by-products and waste products on the Michigan register of critical materials; and volume of wastewater discharged to State waters or any sewer system, including cooling waters.

Table 5.1.1 shows dischargers currently holding NPDES permits for discharge of wastewater or storm water to the Clinton River.

Several dischargers are operating under compliance schedules incorporated into their NPDES permits. Others are subject to milestone dates for achieving various goals of industrial pretreatment programs. The following dischargers are subject to either compliance schedules or pretreatment program milestone dates that have been incorporated into their NPDES permits:

Permittee	Scheduled Item	Pretreatment Scheduled Item
Rochester		• Verify nondomestic user compliance with local limits
Armada	• Achieve operational level for new facilities • Complete construction	
Mt. Clemens	• Comply with final limits • Groundwater monitoring when new facilities are operational	• Verify nondomestic user compliance with categorical pretreatment standards
Almont	• Complete construction	

Several publicly owned treatment works (POTWs) in and tributary to the AOC have received construction grant funds for improving treatment and collection facilities. Facilities plans are reviewed by MDNR for compliance with state and federal regulations on planning for regional wastewater treatment facilities, based on state regulations and Section 201 of the federal Clean Water Act.

SEMCOG, as the regional water quality planning agency designated in accord with Clean Water Act Section 208, also reviews facilities plans for compliance with regional plans and promotes coordination with other water resource planning and management programs in southeast Michigan. SEMCOG is also the areawide clearinghouse for review of federal projects, including construction grants for wastewater systems, based on requirements of Office of Management and Budget Circular A-95.

The wastewater treatment authorities of Mt. Clemens, Pontiac, Romeo, Rochester, and Warren have undertaken programs to regulate discharges of their industrial users in order to prevent plant upsets, treatment interference, or pass-through of pollutants to receiving waters. Pretreatment programs operate under mandates from the federal Clean Water Act, state regulations, and local ordinances. See Chapter 5 for further pretreatment information.

9.1.3 Compliance Status of Hazardous Waste Control Regulations

Hazardous waste control regulations in Michigan are designed to protect surface waters, groundwater, and soils from contamination. These programs are especially significant in urban, industrial areas. Hazardous waste control programs are administered by the MDNR based on state mandates from the Water Resources Commission Act and the Solid Waste Management Act (Michigan Public Act 641 of 1978) as well as the federal Resource Conservation and Recovery Act (RCRA), and the Hazardous and Solid Waste Amendments of 1984. Michigan also has groundwater rules that prohibit discharges of substances to groundwater that may degrade groundwater quality, or usable aquifers (i.e., aquifers yielding sufficient quantities and qualities to be usable for water supply) (SEMCOG 1981a).

The MDNR licenses and supervises hazardous waste management in the Clinton River basin. Macomb, Oakland, St. Clair and Lapeer counties all have state-approved solid waste plans (Michigan Waste Report, 1986).

The MDNR has had an active hazardous waste program since 1979, when the Hazardous Waste Management Act (Act 64 of 1979) was adopted. The first administrative rules for this act were promulgated in 1981. In October of 1986 the MDNR received final authorization to conduct the RCRA hazardous waste management program from the U.S. EPA under the provision of 40 CFR Part 271. The hazardous waste program has evolved into a comprehensive hazardous waste regulatory program with activities in many areas including identifying and inspecting hazardous waste generators, transporters and treatment, storage or disposal (TSD) facilities, and computerized tracking of manifests and other data pertaining to regulated facilities. Additionally, the program involves permitting hazardous waste TSD facilities and transporters, taking enforcement actions for violations of state and federal hazardous waste rules and overseeing closures of facilities (L. AuBuchon, MDNR Detroit District HWD, personal communication 1987).

9.1.4 Status of Superfund and State Hazardous Waste Site Cleanup

Michigan's Environmental Response Act (MERA, Public Act 307) and Federal Superfund authority, based on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), provide for identifying sites, assessing risks, and evaluating priorities for cleaning up environmental contamination at specific sites. MERA and CERCLA both provide means for publicly financing remedial actions at sites where hazardous substances have polluted the environment, and prioritize sites to determine which are most in need of limited public funds. However, MERA provides Michigan with the ability to take action at sites not eligible for remedies through the Superfund program or at sites that do not rank high enough to receive Federal Superfund money. Michigan's priority ranking system ranks sites according to present conditions, while the federal system ranks sites according to the time they were at their worst (MDNR, 1986a).

The programs are administered through MDNR Enviromental Protection Bureau's Environmental Response Division and Waste Management Division (WMD). A chart showing the current organization of the WMD is shown in Figure 9-3. Figure 9-4 shows the current organization of the Environmental Response Division. An explanation of the relationship of hazardous site cleanup programs to water quality protection programs is provided in Table 9-1.

The hazardous site slated for cleanup at federal expense in the AOC is the Selfridge Air National Guard Base. Contamination at seven areas of Selfridge have been studied to determine how they should be classified relative to needs for further study and remedial action. In February 1986, the Air Force's Consultants "Phase II Stage I" Confirmation Study indicated that all seven sites at the base should be classified as Category II, meaning that additional work is required to quantify or further assess the extent of existing or future contamination (Roy F. Weston 1986). The study recommended expanded monitoring and sampling to evaluate the nature and extent of contamination and potential of contaminant pathways. Remedies for site contamination at Selfridge will be designed based on the findings of the next phase of studies.

9.1.5 Status of Urban Stormwater Pollution Control Efforts

Recent efforts to control urban stormwater pollution have focused on the need to coordinate water quality improvements with flood minimization. This is especially important since major water quality problems in the AOC occur during high runoff (USCOE 1979). To deal with these two issues it is crucial to differentiate between point and nonpoint sources. Any stormwater runoff reaching the surface water through a pipe, and any channelized runoff can be regulated as a point source under the Clean Water Act.

Michigan has no comprehensive mandate to directly regulate stormwater runoff unless it can be defined as a point source discharge. Several state programs including flood hazard management, water quality, soil erosion and sedimentation, and wetlands have overlapping mandates to address pollution carried to surface waters by urban stormwater.

All WWTPs with discharges, including stormwater discharges, that may affect the AOC have been involved in planning for adequate stormwater retention to avoid flooding and pollution of surface waters during high flows. During the 1980s, formal and informal relationships were developed

Figure 9.3. Waste Management Division Organizational Chart.

WASTE MANAGEMENT DIVISION

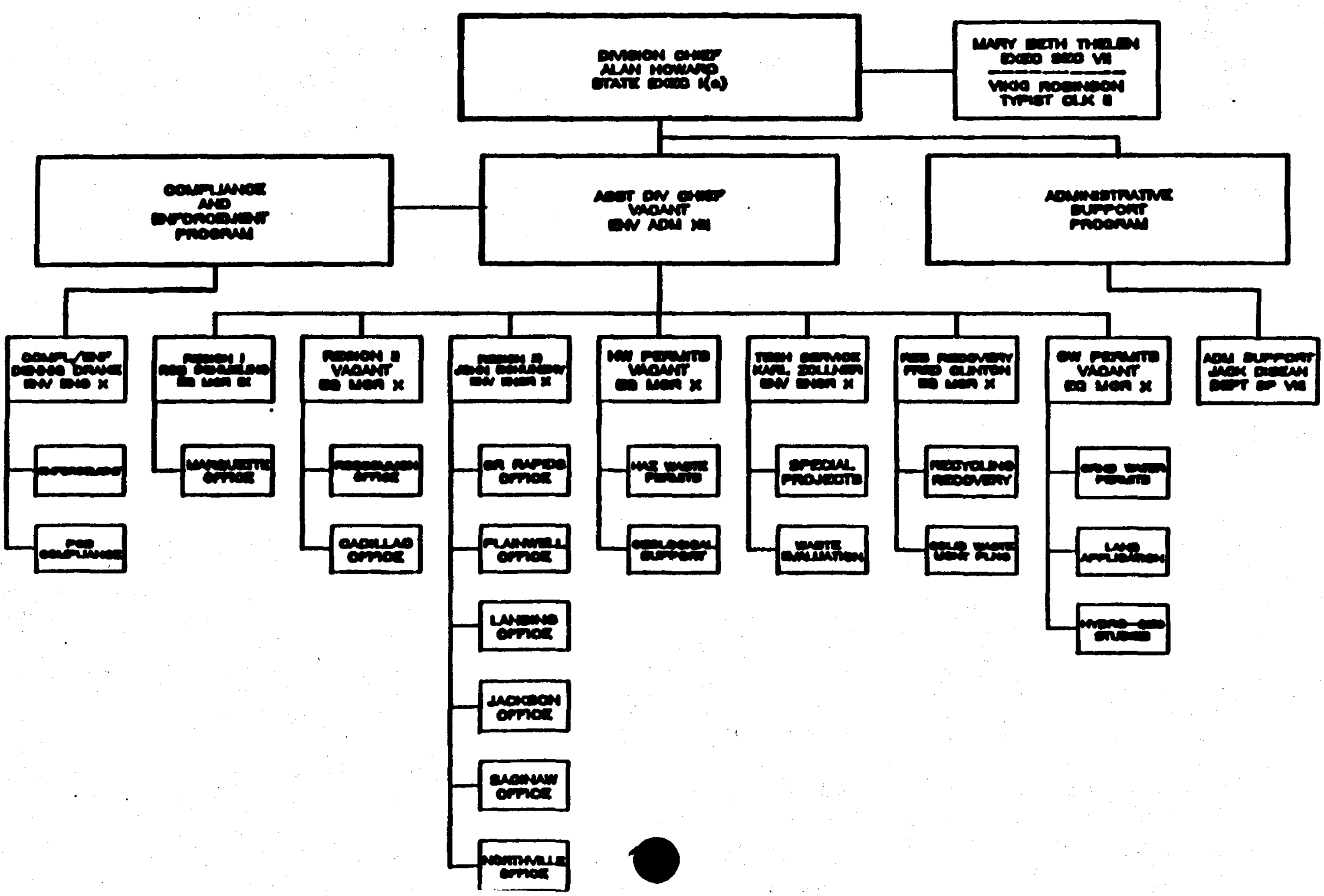


Figure 9.4. Environmental Response Division Organizational Chart.

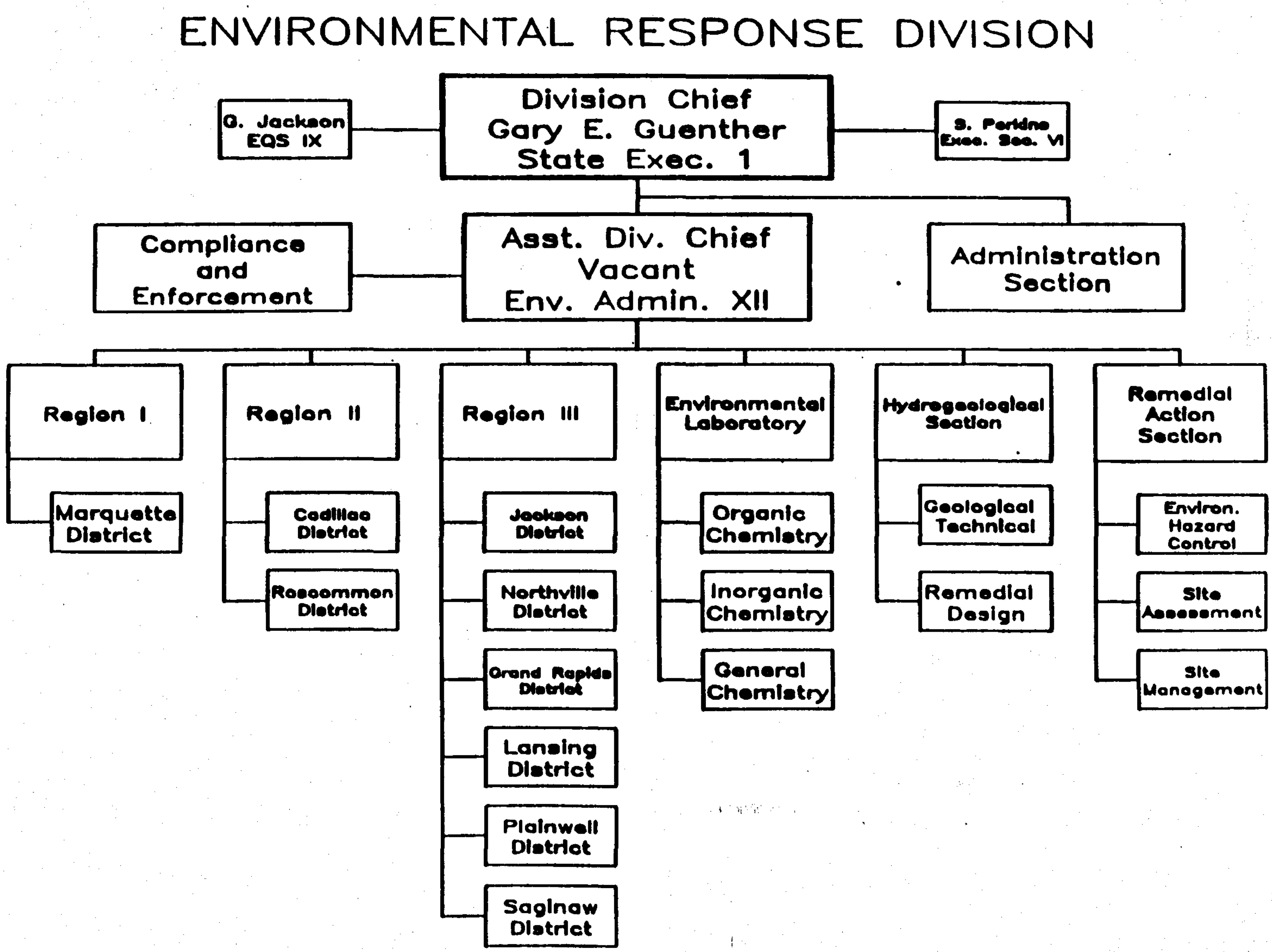


TABLE 9-1. DIVISION OF RESPONSIBILITY BETWEEN THE WASTE MANAGEMENT DIVISION (WMD) AND THE ENVIRONMENTAL RESPONSE DIVISION (ERD) FEBRUARY 9, 1987

This memorandum provides a detailed list of responsibilities for each of these new divisions. These decisions are based on the general responsibilities outlined with the reorganization announcement of January 7, 1987, recommendations made by a special committee of field staff and discussions with the Division Chiefs. We recognize that there may be extenuating circumstances that will lead us to make case-by-case exceptions to these decisions. We also recognize that this list is not all inconclusive, but should provide adequate guidance to determine reassignments of staff and to the start up of the new division.

Responsibility	Assigned To
1. Act 307 Listed Facilities without Operating Licenses or Permits	ERD, unless the facility is operating without a needed license. In that case the licensing division would pursue statutory violations.
2. Act 307 Listed Facilities holding an operating license that relates to the needed remedial action	WMD for facilities it permits. WMD checks compliance with the operating license. If remedial action is needed at the site, WMD requests a proposal and turns it over to ERD for review and comment. WMD maintains lead role for facility with input from ERD. For facilities by an NPDES permit, SWQD will function the same as WMD.
3. Comprehensive Environmental Response Compensation and Liability Act (CERCLA)	ERD
4. Underground storage tanks	WMD for compliance inspections. ERD for remedial actions.
5. PEAS and complaint response	ERD for managing the PEAS system and having general responsibility. PEAS calls and complaints will be referred to the division managing the affected resource as follows:

Surface water goes to SWQD.

Air complaints go to AQD.

TABLE 9-1. DIVISION OF RESPONSIBILITY BETWEEN THE WASTE MANAGEMENT DIVISION (WMD) AND THE ENVIRONMENTAL RESPONSE DIVISION (ERD) FEBRUARY 9, 1987 (Continued)

Responsibility	Assigned To
	Ground or soil contaminants to ERD. If the complaint involves Act 64, license, treatment, storage, or disposal facilities, or 641 licensed landfills, the complaints would go to WMD.
6. Act 641	WMD with one exception. Consistent with the assigned responsibility in No. 2. above, if normal compliance activities show a need for remedial action involving hydrogeological work and work plans, WMD will request the work plan and refer to the ERD for review and comment. WMD will maintain the lead and will obtain the remedial action by amending the operating license or other enforcement actions.
7. Act 64	Assigned to WMD with the ERD reviewing remedial action work plans or proposals.
8. Act 98 permits that depend upon a groundwater discharge	WMD. SWQD will assist WMD by providing engineering reviews of the typical sanitary engineering aspects of the facility, such as collection sewers, lift stations, and waste handling facilities up to the groundwater disposal facility.
9. Brine management activities	These activities will continue to be regulated by the Geological Survey Division under Act 61 pending further study.
10. Underground injection control program	WMD for class 1 wells. Other classes of wells will continue to reside with Geological Survey Division pending further study.
11. Act 136, Industrial Waste Haulers Act	WMD

TABLE 9-1. DIVISION OF RESPONSIBILITY BETWEEN THE WASTE MANAGEMENT DIVISION (WMD) AND THE ENVIRONMENTAL RESPONSE DIVISION (ERD) FEBRUARY 9, 1987 (Continued)

Responsibility	Assigned To
12. Act 245, Groundwater Discharge Permits	WMD
13. Nonroutine sampling of waste	ERD
14. [Illegible]	WMD
15. Responsibility Clean Michigan Fund	WMD for administration of the grants. Programs may involve other divisions.
16. Land application of sludge or wastewater	WMD
17. Act 181, Septage Haulers	WMD
18. Pollution Incident Prevention Plans (PIPPs)	WMD for managing the program and setting the standards. SWQD will review PIPPs at NPDES facilities.
19. Act 245 Storage Permits	WMD
20. Pump and haul permits	WMD
21. County health department grants	WMD, except for grants to county air pollution agencies that will remain with AQD.
22. Unlicensed dumps	WMD, if the facility is still operating in pursuit of Act 641 violations. ERD if the facility is closed. Some of these will need to be assigned a lead division on a case-by-case basis.

to facilitate coordination between local WWTPs and the agencies more traditionally responsible for regulating stormwater. Since 1981 a Technical Assistance Directory and Technical Assistance Guide, a public education booklet, and a model ordinance guidelines have been developed. In addition, the MDNR has provided technical assistance through stormwater modeling. Presently, the Clinton River Watershed Council is actively working with several townships to implement local stormwater management ordinances and policies.

SEMCOG and the Clinton River Watershed Council both provide guidance and technical assistance to local governments in reviewing development plans based on water quality guidelines (see SEMCOG 1980b). The City of Mt. Clemens has been particularly active in construction of additional stormwater retention capacity to prevent overflows and bypasses of untreated sewage from its wastewater system. The City of Mt. Clemens' planning and implementation of system upgrading since 1979 has taken place in accordance with regional facilities plans (a "201" study) and SEMCOG's "208" planning efforts.

Several recently issued municipal and industrial NPDES permits include some monitoring and control conditions for stormwater discharges conveyed to surface waters through pipes or channels. The City of Mt. Clemens is attempting to eliminate or reduce stormwater discharges and combined sewer overflows that contribute to flooding and degrade water quality in the AOC during high flows.

The MDNR's Land and Water Management Division and the Clinton River Watershed Council published the Clinton River Basin Stormwater Management Assessment in 1981 (MDNR, CRWC, and EA 1981). The assessment made several recommendations for institutional action that are now being pursued by area agencies to reduce flooding and runoff of pollutants to surface waters.

Recommendations focused on maintaining and providing technical assistance for local management of stormwater problems; local intergovernmental coordination within the watershed; and local government adoption of stormwater management policies and plans. The report indicated that state legislation on stormwater management may be inappropriate, based on lessons learned from local management experience.

The Clinton River Watershed Council was established, in part, to coordinate initiatives under all of these programs at the local level. The Council conducts water resources studies, prepares reports and recommendations, advises other governmental agencies, and cooperates with federal and state agencies to collect water resource data.

<u>Flood Issues</u>. Michigan's Flood Control Act of 1968 regulates activities in riverine floodplains of state waters. Encroachments into the floodway that may adversely affect the stage or discharge characteristics of the stream are prohibited. Michigan requires that any occupation, filling, or grading, except for agricultural activities, in floodplains receive a permit from the MDNR (MDNR, CRWC, and EA 1981).

All communities in the Clinton River AOC participate in the National Flood Insurance Program, which restricts new developments in floodplains. These restrictions provide for flood protection of structures and attendant sanitary sewage and other waste disposal systems. Over 503 communities statewide have had floodplain areas identified under this program with the heaviest concentration in Southeast Michigan. The Corps of Engineers' flood control project proposals for the lower Clinton River and Red Run Drain have addressed water quality issues through the EIS process, but these have not been closely tied to State flood hazard mitigation programs (MDNR, 1979).

Michigan's Subdivision Control Act of 1967 authorizes the MDNR to review and approve or disapprove preliminary plats for new subdivisions if they are to be located in or affected by State floodplains. The Flood Control Act of 1968 and the Subdivision Control Act of 1967 together minimize the potential that new urban development will aggravate flooding problems. The Subdivisions Control Act ensures each lot in the subdivision has an adequate building site and occurs above the floodplain and that the public interest in the waters of the state are protected. They may also be used to regulate the types of potentially polluting activities allowed to be located in floodplains, since the Water Resources Commission and MDNR may act to prevent incidents of water pollution prior to their occurrence.

Soil erosion and sedimentation. Michigan DNR oversees state, county and local public agencies who regulate earth moving within 500 feet of lakes or streams, or that may disturb one or more acres of land under the authority of the State's Soil Erosion and Sedimentation Act of 1972 (Act 347 as ammended). Earth change activities are based on State-approved procedures that describe erosion and sedimentation control measures to be employed as part of the project on a temporary and permanent basis.

County and local agencies administer and enforce permit restrictions authorized by the Soil Erosion and Sedimentation Control Act as well as local ordinances that address land cleaning, excavation, drainage, and earth moving activities. Local agencies inspect sites after earth moving permits are issued to monitor changes and enforce permit conditions. Designated enforcement agencies in the Clinton River basin are the Oakland County Drain Commission, the Macomb County Public Works Commission, the St. Clair County Department of Public Works, and the Lapeer County Drain Commission (MDNR, CRWC, and EA 1981).

Several public agencies "are authorized public agencies" under the Erosion and Sedimentation Control Act to enforce sedimentation and drainage rules for their own construction or maintenance activities, and the tentatively identified projects are shown in Table 9.2 (MDNR, CRWC, and EA, 1981; and SEMCOG, 1981a).

The Inland Lakes and Streams Act of 1972 (Act 346, as amended) allows MDNR to regulate construction, dredging, and filling activities below the ordinary high water mark on the shores of State waters, except the Great Lakes (including Lake St. Clair). Act 247 serves a similar function and applies to the Great Lakes. However, federal programs authorized by Sections 401 and 404 of the Clean Water Act regulate certain dredging and

Table 9.2 Responsible Agencies for Nonpoint Source Activities and a Tenative List of Best Management Practices for Construction Projects

The following governmental entities are serving under one or more of the approved classifications:

OAKLAND COUNTY

Oakland County Drain Commissioner
Oakland County Road Commission
Berkley
Birmingham
Lake Angelus
Lathrup
Madison Heights
Pontiac
Southfield
Troy

MACOMB COUNTY

Macomb County Department of Public Works
Macomb County Road Commision
Armada
Center Line
Fraser
Mt. Clemens
Roseville
Sterling Heights

LAPEER COUNTY

Lapeer County Planning Commision
Lapeer County Drain Commisioner
Lapeer County Road Commision

ST. CLAIR COUNTY

St. Clair County Drain Commisioner
St. Clair County Road Commision

The following practices have been tentatively identified as Best Management construction projects:

Staging	Construction Barriers	Riprapping
Scheduling	Diversions	Stream Relocation
Unified Keying System	Check Dams	Cofferdams
Hydrologic Modeling	Strip Planting	Stream Crossings
Maintenance	Special Grading Practices	Spoil Piles
Access Roads	Seawalls/Retaining Walls	Downdrains
Land Clearing	Slope Protection	Drop Control Structures
Wetland Protection	Dewatering	Mulching
Bonding	Terraces	Sprigging
Training and Education	Benches	pH Control
Noncompliance Procedures	Filters	Dormant Seeding
Soil Loss Estimating	Dust Control	Side Drains
Sediment Basins	Detention/Retention Basins	Grassed Waterways
Sodding	Soil Treatment	Filter Strips
Seeding	Buffer Strips	Subsurface Drainage
		Pumping Discharges

filling in any water or shoreline wetland, and fulfill many of the same functions as the state's Inland Lakes and Streams Act with regard to regulation of development that may affect stormwater discharges.

The U.S. Department of Agriculture (USDA) has recently established funding for farmers to convert certain lands to "water quality enhancement zones." The Agricultural Stabilization and Conservation Service administers this program. Filter strips of 66 to 99 feet along perennial and intermittent streams, lakes, and wetlands greater than five acres are eligible for annual payments for the next 10 years.

Building Codes and Engineering Standards. Prior to starting construction, builders intending to undertake projects above a specified value must apply to local governments for a building permit and submit a site plan to construct or significantly alter any structure. Building code reviews and site development reviews conducted locally require builders, developers, and public agencies to conform to minimum standards for provision of adequate storm sewers, retention basins, and structures to control pollution, erosion, and sedimentation. Many provisions in the Clinton River basin have been adopted under the authority of the state's Subdivision Control Act (MDNR, CRWC, and EA 1981). The relationship between administration of building code and engineering standards and administration of the provisions of state and local soil erosion and sedimentation controls varies between local governments and counties, depending on the local division of code review and enforcement responsibilities. The Clinton River Basin Stormwater Management Technical Assistance Directory provides information on the various functions of state and local agencies in the basin with regard to stormwater management issues (MDNR, CRWC, and EA 1982).

9.1.6 Status of Nonpoint Source Control Efforts

In addition to urban stormwater control efforts in the Clinton River basin, regional nonpoint source control programs are being pursued by state and local agencies. These efforts relate to rural nonpoint sources originating in the upper basin, including the North Branch.

SEMCOG is the regional agency designated to conduct areawide water quality planning activities in the Clinton River basin, under Section 208 of the Clean Water Act. SEMCOG published its Water Quality Management Plan For Southeast Michigan in 1978. This plan was incorporated into Michigan's 1981 Water Quality Management Plan. While funding for the 208 planning program has ended, SEMCOG continues its water quality planning and technical assistance efforts partly with the assistance of Federal "205(j)" grants that are passed through MDNR.

Many mechanisms briefly described for controlling pollution from urban stormwater are also used in more general nonpoint source pollution control in the Clinton River basin. In addition, a range of programs to control nonpoint source pollution and reduce sediment loads from agricultural runoff are being pursued by the County-level Soil Conservation Districts. Surface Water Quality Division district staff, in cooperation with the Cooperative Extension Service, assist farmers in adopting best management practices for soil conservation, gather information, and conduct studies of the success of agricultural soil conservation projects. District staff identify priority agricultural nonpoint source control areas in each county, based on SEMCOG's and the Districts' joint identification of designated critical areas. Conservation district staff then prepare programs for promoting best management practices in conjunction with county drain commissioners, the Agricultural Stabilization and Conservation Service, and the Cooperative Extension Service (SEMCOG 1981a).

While the Cooperative Extension Service promotes sound and profitable farm practices, soil conservation and farm waste containment are often major components of best management practices needed to reduce nonpoint sources of water pollution in the Clinton basin. Extension Service educational programs have recently been more explicit in explaining the need for conservation practices from a water quality standpoint as well as an agricultural standpoint. Drain commissioners in rural areas have also focused the implementation of best management practices in rural areas so that downstream water quality considerations are not ignored.

Michigan's Rural Nonpoint Source Pollution Subcommittee of the Governor's Cabinet Council on Environmental Protection, recently recommended a Strategy for the Reduction of Rural Nonpoint Source Pollution in Michigan (Rural Nonpoint Source Pollution Subcommittee, A Strategy for the Reduction of Rural Nonpoint Source Pollution in Michigan: A Report to the Governor's Cabinet Council on Environmental Protection, 1985). A subsequent report on urban nonpoint source pollution control strategy was prepared by MDNR and SEMCOG (1985). A MDNR staff report on nonpoint assesssment for small watersheds was also prepared (MDNR, 1985b).

9.1.7 Status of Corps of Engineers Projects

Historically, the Army Corps of Engineers has been active in the AOC reducing flooding and flood damages in the lower Clinton River area by dredging navigation channels and constructing the spillway in 1952. Additional plans to control flooding were investigated, but a final report in 1982 recommended against funding for projects in the Red Run-Lower Clinton River area, based on economic infeasibility (Richardson, 1983). The Water Resources Act of 1986, Section 1002 deauthorized a flood control project in this area authorized by the Flood Control Act of 1970.

The Corps has proposed dredging to facilitate recreational navigation if an appropriate CDF can be built. A 30-acre CDF has been built along the north bank of the Clinton River at about river mile 3.0. The facility has a capacity of 281,200 cubic meters (370,000 cubic yards), about half of which would be filled by a backlog of undredged material (USCOE, 1987). Dredging would fulfill some remedial action goals by removing some contaminated sediments in the Clinton River AOC. The Michigan Natural Resources Commission has confirmed the MDNR as the local sponsor for this project.

9.1.8 Spill Control Measures

Michigan's Water Resources Commission is authorized to take action to reduce damage to water quality resulting from spilled materials that may enter state waters. The Michigan Legislature authorized the Water Resources Commission to develop a Register of Critical Materials which are or may be used or discharged in Michigan (Act 293 of 1972). Every business in the state using critical materials and discharging process or sanitary waste to a sewer system or the surface waters must file an annual report on critical materials use and discharge. This information is used for protection of the environment and human health through water pollution control programs (MDNR 1980).

While the list was originally developed to help the state control toxic materials entering the public sewage treatment systems, it has also been used to identify dischargers at risk of accidentally spilling toxic materials into surface waters. Some of this information was used to require direct dischargers to provide sufficient facilities to contain spills of potentially toxic materials in accordance with Water Resources Commission Rules, Part 5 (see general management requirements in Part II of current Michigan NPDES permits).

Michigan regulations on oil spills and polluting materials (Water Resources Commission Rules, Part 5, Rules 151 to 169) cover requirements for oil loading and unloading, oil storage facilities, surveillance of storage and loading, and emergency containment structures. They also include regulations for salt storage areas and for storage, use, and emergency containment structures for other polluting materials (for liquids, 150 percent of storage capacity is generally required for emergency containment). Oil storage facility owners must submit to the Water Resources Commission a plan for prevention of spills and set forth emergency cleanup procedures and inventory monitoring methods to be used. The rules also authorize companies to form oil spill cooperatives. Provisions of Michigan's spill control rules are enforced by the Water Resources Commission.

Michigan DNR also operates a Pollution Emergency Alert System. A telephone line is maintained on a 24-hour, toll-free basis for callers to report suspected pollution incidents (1-800-292-4706). DNR staff who respond to calls and complaints are designated as Pollution Emergency Communications Coordinators. Coordinators contact appropriate field staff to investigate and respond to emergency situations. Coordinators also administer Water Cleaning Emergency Funds and serve as field staff contacts with regard to Michigan's Hazardous Waste Service funds for emergency situations (memorandum from Gary Guenther, MDNR, to all Environmental Protection Bureau Staff, February 24, 1986).

9.1.9 Land Application

Michigan laws regulating land application of septage have been recently amended to become more in line with laws regulating application of municipal sludges. Sludges from hazardous waste generators are also regulated by stringent State and Federal land application laws.

9.1.10 Chemical Use

Bans have been established on the use of particular chemicals such as DDT, PCB, and Chlordane.

A state pesticides strategy was adopted in 1986.

There are state and federal requirements for Pollution Incident Prevention Plans (PIPP) and Spill Prevention, Control and Counter Measures (SPCC) at specified businesses regulating above ground storage of chemicals and petroleum based products.

Registration of existing underground storage tanks is required. These same regulations require the removal of abandoned tanks. EPA regulations for underground storage tanks are expected to be promulgated in 1988 and a Michigan Underground Storage Tank program is under development. Federal funds were first available in 1987 for states to finance petroleum related cleanups, a complement to the "Superfund" monies for sites contaminated by other hazardous substances.

In 1987, the Macomb County Health Department inaugurated an on-going collection and disposal service for household hazardous wastes.

9.1.11 Management and Planning Activities

Urban and Industrial Storm Drains

In the February, 1987 amendments to the Clean Water Act, Section 405 specifies that EPA regulations regarding storm drains for industries and large municipalities be completed by February, 1989, and that permit applications be submitted by February, 1990. Permit issuance should be completed by February, 1991 and these facilities should be in compliance by February, 1994. For smaller municipalities, the scheduled steps are two years later. The DNR will need to identify the industrial and municipal storm drains subject to permits, determine the nature and extent of pollution through monitoring and modeling, and establish methods of control.

Michigan Nonpoint Source Control Program

The February, 1987 amendments to the Clean Water Act provide for state assessments of nonpoint problems and development of a state Nonpoint Source Management Plan. The plan must be submitted for EPA approval by August of 1988 if the state is to be eligible for federal grants.

The DNR Nonpoint Source Section is expanding its nonpoint problems survey, which will be compiled and assessed by the DNR.

Groundwater Protection

In 1986-87, the CRWC and pilot communities received Groundwater Compliance grants to explore appropriate groundwater protection activities for local government, and opportunities for state/county/local coordination. The focus was on small business activities to prevent leaks/spills/dumping.

Secondary containment requirements were established through local ordinances and inspection programs. The actions will be also protective of surface water quality.

<u>Continued Technical Assistance to Local Governments for Stormwater Management and Groundwater Protection</u>

Local governments in the river basin are requesting assistance from the CRWC for analysis of local problems, development of performance standards, and ordinance amendments. Emphasis is on runoff and erosion control on new development sites, use and protection of wetlands, prevention of leaks/spills/dumping at small businesses, and septic management. Analysis of the Michigan 307 sites list suggests small businesses are a predominant source of contamination.

9.2 PUBLIC INVOLVEMENT

The importance of public involvement in the RAP planning process cannot be overstated. It is the local governments that manage the local community, make laws, establish ordinances, pass edicts as well as enforce "the laws of the land" that are promulgated by the state and federal government. It is the local people who elect local leaders to manage the local government which manages local issues. Since this remedial action plan will be implemented largely at the local level, it is essential that local people, "the public" be involved in the planning and the implementation process.

On June 18, 1986 a technical advisory committee meeting was held consisting of 15 representatives of state, local, federal, and private interests with knowledge or data about the Clinton River. Compiled reports from all MDNR divisions and outside agencies were gathered by the site coordinator and sent to SAIC, a consultant provided to the MDNR by the USEPA.

The MDNR held a public meeting to give and gather information concerning the Clinton River AOC in July 17, 1986, in Mt. Clemens. MDNR personnel offered an overview of problems and positive activities which have occurred recently in the Clinton River basin. The public asked questions and received answers and a promise to respond to all questions. The meeting was well attended and much information was exchanged. The issues discussed and the responses to those issues are seen throughout the RAP and are specifically answered in Appendix 9.1.

Several months later, the Clinton River RAP Status Report was mailed to meeting attendees. In addition, the MDNR kept in continuous contact with the CRWC, SEMCOG, and the Lake St. Clair Advisory Committee in an attempt to keep a finger on the pulse of the Clinton River watershed public interests.

A public meeting was held on February 26, 1987, concerning the proposed Clinton River dredging and confined disposal facility project. The topic of discussion was primarily the CDF location and its impact on the resources and property owners. The meeting was primarily an information sharing meeting. Over 250 people were present.

A copy of the final draft RAP was distributed to all Technical Advisory Committee members and interested public. A public meeting was held on January 27, 1988. Comments from the public and Technical Advisory Committee were consolidated into this RAP.

9.3 INTERAGENCY AGREEMENTS

9.3.1 Great Lakes Water Quality Agreement of 1978

The Great Lakes WQA established water quality planning and regulatory guidelines for the Great Lakes to be followed by the United States and Canada, the two agreement signatories. The International Joint Commission and its Water Quality Board are the principle organizations charged with carrying out the provisions of the agreement through federal agencies, states and provinces in the United States and Canada. Designation of Areas of Concern and drafting of Remedial Action Plans are results of this agreement.

10. RECOMMENDED ACTIONS

10.1 Use Impairments, and Their Historical and Present Causes

The use impairments in the Clinton River AOC are: restricted agricultural water use (for irrigation) because of water quality standard exceedences of total dissolved solids, and locally degraded aquatic macroinvertebrate and fish communities. These impairments are local problems and none of which contribute to impairment in the Great Lakes.

The historical causes of the identified impaired uses include municipal and industrial point source discharges, urban an rural nonpoint sources, combined sewer overflows and sediment contaminants. Urbanization, stream channelization, and natural flow regime also have played a significant role in contributing to use impairments.

Present causes of use impairments are: (1) naturally occurring high total dissolved solids and (2) naturally occurring geographical, hydrological, and manmade conditions resulting in slow-moving or stagnant water compounded by the addition of oxygen demanding substances from municipal and industrial wastewater and extreme hydrologic variations contributed by urban and rural runoff.

10.2 Proposed Actions

Proposed actions for the Clinton River include specific cleanup activities, regulatory restrictions, integrated watershed management planning activities, special studies, and evaluations. Suggested actions presented on the following pages are proposed in light of the fact that all pertinent information is not available. There are many areas where data are ambiguous or outdated. The proposed actions are aimed at filling information gaps, as well as correcting the immediate problems and the long-term causes.

Recommended actions are grouped to reflect the fact that most impairments were local versus Great Lakes impairments. Local or Great Lakes recommended actions are further grouped by the impaired uses they are designed to correct.

10.3 Recommended Actions to Address Local Impairments

Warmwater Fish

1. Design and conduct a fish community study in the Clinton River.

    The fish community in the Clinton River in the 1960s was considered "dead." In the 1970s the fish community was poor. To determine if improvements in water treatment since then have created favorable conditions and restored fish communities, 22 representative stations in Section 1(3), the North Branch (2), the spillway (2), Red Run (5), and Section 5(10) should be surveyed to determine the present fish community. Fisheries Division would conduct the study during low flow and spawning runs in the spring and fall. These surveys would take 0.5 years to complete including the shocking, netting, and reporting. Approximate costs were estimated at $30,000. This action could be wholly funded by the MDNR.

2. Design caged fish studies to determine river quality.

   Certain sections of the fish community between Pontiac and the mouth are degraded. The cause of the degradation is unknown but may be due to poor water conditions (low dissolved oxygen).

   To determine if fish can survive in the Clinton River, caged fish studies could be designed to determine river quality conditions during low flow at 12 stations, including the spillway (1), Section 1(3), Section 3(2), Red Run in Section 4(2), the North Branch in Section 6(2), and the Main Branch in Section 5 of the Clinton River (2) downstream of Pontiac. Estimated costs were $20,000 for the fish studies and $1,200 for the water sample analysis. Work could be done by the SWQD, MDNR or a contract laboratory over a period of three to four months. Data interpretation and report writing would be approximately $6,000.

<u>Benthic Macroinvertebrate Community Degradation</u>

1. Conduct a series of sediment bioassays to determine if contaminated sediments are impairing the aquatic macroinvertebrate communities in the AOC, the North Branch, and Red Run.

   The macroinvertebrate communities in some portions of the Clinton River watershed were degraded when last surveyed. Several factors may contribute to the degradation of the macroinvertebrate community, including low dissolved oxygen, poor overlying water quality, extreme hydrologic fluctuations, sediment particle size, or contaminated sediments.

   To determine the impact of sediment contaminants on the health of the aquatic macroinvertebrate community, a suite of sediment bioassays should be conducted at 30 stations. Sediment chemical analyses need to be paired with the sediment bioassays. Parameters should include heavy metals (including mercury), PCB and other organics, and selected conventional parameters (TOC, BOD, COD, percent solids). Sediment bioassays would be conducted by a suitable contractual laboratory. Samples could be collected by MDNR staff with approximately 12 days required. Project cost is estimated at approximately $70,000. Total time to complete this action would be approximately seven months.

2. Support the USCOE dredging of the recreational navigation channel in the Clinton River downstream of Mt. Clemens.

   Accumulated sediments have partially filled the recreational navigation channel in the lower Clinton River. If the Great Lakes levels decrease, the river will be too shallow for boat passage. These sediments are classified as moderately to heavily polluted, and represent a potential source of PCB, metals, and oil and grease to aquatic life in the Clinton River and the Great Lakes. Removal from the aquatic system would remove or substantially reduce this potential source. The MDNR is the local sponsor for the confined disposal facility (CDF). For these reasons, the MDNR should continue to support the USCOE's proposed dredging of the recreational navigational channel from river mile 7.5 into Lake St. Clair and continue to act as the local sponsor for the CDF site on North River Road.

All work would be done and paid for by the USCOE at a cost of approximately $3 million for the construction of the CDF and off-loading site. The actual cost of dredging is unknown but would be done with federal funds. The CDF would be completed by 1989 and dredging could commence at that time. Periodic dredging could occur for 10 years after the CDF is completed.

3. Conduct an intensive macroinvertebrate survey of river Sections 1 through 3 (AOC) of the Clinton River, Red Run, and the North Branch.

   The benthic macroinvertebrate community in the lower Clinton River was degraded and dominated by pollution tolerant forms during the last survey. Improvements in point source discharges may now have yielded improved water quality, but not necessarily improved sediment quality. The information is old and very sparse. The current condition of the Clinton River benthic macroinvertebrate community should be determined since they are primary indicators of stream quality and the true measure of water pollution control activities to date.

   To accomplish this task, select 30-35 stations above and below suspected contaminant sources using ponar grabs, and qualitative methods to determine the benthic community structure. MDNR staff biologists could conduct the surveys if staffing levels were adequate or it could be contracted out. One and half years ($65,000) would be required to complete the survey including macroinvertebrate collections, processing, identification, interpretation of data, and report writing. A funding source for this action has not been identified if completed by a contractor.

Local Fish and Benthic Macroinvertebrate Community Degradation

1. Conduct intensive 24-hour water chemistry surveys in the AOC to document pollution sources and the extent of dissolved oxygen problems in the lower Clinton River below Red Run.

   The lower Clinton River and Red Run experiences dissolved oxygen concentrations which do not meet Michigan's water quality standards. The dissolved oxygen data are relatively recent, but are available from only one sampling point and only during the oxygen producing rather than the oxygen consuming time of the day. Therefore, they do not represent the critical conditions to which the aquatic community is subject to. To determine the temporal and spatial extent of water quality standards exceedence for dissolved oxygen, eight or 10 stations should be selected in areas having suspected dissolved oxygen problems. Sampling should include diurnal analyses at each station several times during the year. Samples should be analyzed for D.O., TOC, BOD, total phosphorus, ammonia, fecal coliforms, and other possible constituents of local interest. Analyses of these ambient samples would cost between $20,000-$25,000. Point source sampling should be paired with this river survey. Point source studies are estimated to cost $2,000-$4,000 for each study. Depending on resources, the data could be evaluated and reported by MDNR staff at a cost of approximately $20,000. Further remedial measures, including NPDES effluent limits as part of the waste load allocation, could be recommended based on the conclusions of the report. This action would take approximately one year to complete.

2. Conduct a waste load allocation for all industrial and municipal dischargers in the Clinton River Basin.

   The Clinton River is experiencing dissolved oxygen problems that result in part from municipal and industrial point source dischargers. The Clinton River is an effluent dominated stream below Pontiac. The impact of these discharges upon river Sections 1, 2, and 3 should be determined so that appropriate effluent limits are assured when permits are reissued in 1990.

   To determine the magnitude that each NPDES discharger contributes to this problem, conduct a coordinated waste load allocation for all industrial and municipal dischargers in the basin based on ambient D.O. determined in the proposed River D.O. studies. This activity should be an MDNR Surface Water Quality Division (SWQD) responsibility performed as part of the Division's strategy. Extensive sampling would be required to determine the Clinton River's assimilative capacity and still meet water quality standards for D.O. The studies could take several months to complete, interpret, and write. Each discharger would be surveyed during the river survey. Costs for this portion are described in 10.4.6.b. The actual waste load allocation should be federally funded as part of the NPDES permit program since it will determine the impact these dischargers have upon the Clinton River. Estimated cost of $25,000.

3. Upgrade the Mt. Clemens and Armada WWTPs.

   The Mt. Clemens and Armada WWTPs have historically discharged effluent that caused their respective receiving waters to violate Michigan's water quality standards. In addition, they also have had combined sewer overflows.

   To meet water quality standards in the Clinton River, complete the upgrading of the Mt. Clemens and Armada wastewater treatment plants so they meet their final effluent limits and comply with required industrial pretreatment programs. At Mt. Clemens in Section 1 this includes upgrading the retention basin facility to reduce frequency and magnitude of overflows to the Clinton River. At Armada in Section 6 this includes a separation of storm and sanitary sewers. Funding would continue to be incurred by the individual communities or state and federal grants. Both projects are underway and should be completed in 1988. Estimated cost of $20,900,000.

4. The Southeast Oakland County Sewage Disposal/Pollution Control facility discharges chlorinated combined sewer overflow to Red Run approximately 12 times per year.

   Studies to determine the impact of this facility's discharge on aquatic life and the cost to reduce the frequency or eliminate this periodic overflow need to be determined. This would probably be best handled by a consultant. The estimated cost is $150,000.

5. Conduct dye or smoke testing to identify illegal connections to the storm or sanitary sewer system.

   It is suspected that a significant amount of pollutant loadings enter the Clinton River via illegal connections to the storm sewer system. Loading reductions could be accomplished if illegal connections could be corrected. This action could be completed by conducting a dye or smoke testing program to identify all illegal connections to the storm or sanitary sewer system in the AOC and Red Run. This could be accomplished through a contractual agent. Costs are unknown and would be determined by contractor bids. The time to complete this remedial action is also unknown and dependent on contractor availability and the scope of work. Funding would come from local communities. Estimated cost of $150,000.

6. Implement Michigan's urban and rural nonpoint strategies.

   Nonpoint sources contribute a very large portion of the conventional pollutant loadings to the Clinton River.

   To improve the river quality, Michigan urban and rural nonpoint strategies should be implemented. This would involve a coordinated effort between the local, county, and state governmental agencies and private land owners, farmers, and businesses. The MDNR should conduct a periodic review of all soil erosion and sedimentation control agencies performing specific responsibilities under the Sediment Act including county enforcing agencies, local enforcing agencies, authorized public agencies, and Soil Conservation Districts. A review for each agency should be completed at least once in each five years as a minimum, or once in three years as the need arises. Costs are estimated at $15,000,000. Several years would be required to complete this remedial action. Funding sources have not been identified for this action.

7. Enforce Best Management Practices (BMPs) for erosion control and soil conservation at agricultural and construction sites. BMPs are measures that may be employed to help ensure against nonpoint source pollution caused by sediment transport. These practices may be identified in one or more functional groups including planning, administration, enforcement, and construction. The state's Nonpoint Source Control Unit, MDNR is presently formulating information on these practices as a part of the requirements under the U.S. 1972 Clean Water Act.

8. Determine the impact that weir modifications might have on the river quality of the natural channel and the spillway between Mt. Clemens and Lake St. Clair.

River quality in the natural channel between the Clinton River spillway weir and Lake St. Clair has been poor over the past 25 years. The weir installation achieved its purpose of providing flood relief, but has altered the river quality in the natural channel. Low volumes and low velocities down the natural channel are thought to contribute to increased shoaling and low dissolved oxygen in the river reach. This portion of the Clinton River has rather complex hydrology and, therefore, has not been extensively studied. Because the City of Mt. Clemens WWTP NPDES permit limits are based on a design stream flow and a large existing pleasure boating industry also requires certain river flow, it is necessary to maintain a given volume of water down this natural channel. Weir modifications have been suggested, but no one has recently attempted to determine the impact that weir modifications could have upon the natural channel and the spillway downstream of the weir.

To determine what river quality improvements could occur, alternatives for weir modification and their effects should be evaluated by a consultant hired by the Intra County Drainage Board. MDNR's SWQD and Land and Water Management Division staff could work with the consultant to ensure that if weir adjustments are made, they would improve the stream quality of the Clinton River. Land and Water Management Division would be requested to project consultant costs and provide consultant supervision. Funding sources have not been identified and the length of time to complete this action is unknown, but estimated at two years. Estimated cost is $200,000.

9. Encourage state and federal air quality personnel to monitor airborne chemical (nutrients, metals, and organics) contaminants.

There is presently a very limited air quality monitoring program in the Clinton River watershed which measures only a few constituents. Atmospheric deposition of organic and metal contaminants should be monitored to determine if air is a significant contaminant source to the AOC.

This could be accomplished by encouraging state and fedral air quality personnel to monitor airborne metals, organics, and conventional pollutants. The cost is unknown, but should be funded by the state or federal government since clean air is a major responsibility of the government. Time to complete this action is undetermined. First year cost is estimated at $105,000.

10. Continue existing remedial actions presently occurring at Act 307 and Superfund landfills in the Clinton River watershed.

Superfund and Act 307 sites are potentially sources of surface water contamination and should be cleaned up. Site cleanup at identified 307 and Superfund landfill sites has proceeded with MDNR assistance resulting in reduced potential for surface water contamination at some sites. Additional site cleanup would protect groundwater which could eventually discharge to the surface water.

Remedial actions should include encouraging cleanup activities to include determining the impact these facilities have on aquatic life and stream quality. Actions and monitoring at these facilities are conducted by MDNR's Environmental Response Division (ERD) through Public Act 307 and the U.S. EPA through Superfund processes. Costs vary by site, and time to complete remedial actions will also vary by site, but many years would be required to remediate all 307 sites. Funding sources have been the State of Michigan and the federal government. Estimated cost is $9,000,000.

Potential Local and Great Lakes PCB Contamination of Fish

1. Collect sediment samples in areas where PCB was previously reported.

   PCB contaminated sediments may contribute to fish flesh PCB body burdens. Some elevated PCB levels in carp have been reported in the Clinton River, but PCB sources are unknown. The areal extent and concentrations of PCB contaminated sediments in localized areas are also unknown.

   To determine the concentration and extent of PCB contaminated sediments, design and conduct a sediment survey of Amy Drain, Murphy Creek, and the Main Branch of the Clinton River downstream of the confluence of Murphy Creek. Sediments from Greiner Drain, and downstream of the confluence of Greiner Drain in the North Branch of the Clinton River, and in Red Run should also be collected. The number of samples required is presently unknown, but costs of sediment analysis for PCB is $200 per sample. Time to complete this phase, including study design, sampling, and chemical analysis is approximately four months. The work could be performed by the MDNR's Surface Water Quality Division or a contractor. The source of funding is unknown. Estimated cost of $20,000.

2. Expand the Fixed Station Ambient Water Monitoring Program on the Clinton River to include sampling for organic contaminants.

   Clinton River water analyses for organic contaminants are very sparse, especially for persistent organics with bioaccumulative qualities. It is these organic contaminants (i.e., PCB) that result in fish consumption advisories in local systems and fishing bans in the Great Lakes and their connecting channels. If these contaminants were found in the water, upstream sources could be sought out and remediated.

   To achieve this task, fixed station monitoring on the Clinton River could be expanded to include sampling for organic contaminants (especially persistent organics with bioaccumulative qualities) to determine each river section's loadings. Current station samples are analyzed for conventional and metal parameters. Additional samples could be collected at current monitoring stations for organics analysis. An additional $400-$600 per sample would be necessary. Estimated cost is $22,000/year.

3. Collect fish from Clinton River and nearshore Lake St. Clair for chemical analysis.

In the past, certain Clinton River fish tissue have exceeded U.S. FDA guidelines for PCB, DDT, and/or mercury. To monitor the trends, collect fish for chemical analysis in the Clinton River at nine (9) stations. Stations should include Lake St. Clair (vicinity of the Clinton River mouth and spillway), Clinton River mouth (Section 1), the Spillway (Section 2), Section 3, Red Run (Section 4), above and below Yates Dam (Section 5) and in the North Branch of the Clinton River (Section 6).

Ten (10) carp and ten (10) bass and/or walleye should be analyzed for mercury (Hg) and PCB. Two or three different size ranges of these fish may be required to address possible fish consumption advisories. These collections include carp and bass/walleye since these species are major sport fish or have contained elevated levels of PCB, DDT, and/or Hg in the past. Collections would be conducted as part of Michigan's Fish Contaminant Monitoring Program with assistance from Fisheries Division or contracted out over the next three years. Collections may need to be seasonal since anadromous fish may not be in the river year round. Approximately 15 days would be required for the collections which were estimated to cost $4,000-$5,000, including salary, travel, and equipment. Tissue analysis could be performed by the Michigan Department of Public Health or a suitable contractor. Processing and analysis of the fish would be approximately $72,000. If several sizes are required, the cost will increase accordingly. Data interpretation and reporting would be an additional $20,000. Planning, implementation, and report writing for this project would take approximately four (4) years to complete in the normal course of work.

<u>Sediments Block River Flow</u>

1. Define sediment transport and loading of suspended material in the Clinton River.

Suspended sediments settle out in the depositional zones in river Sections 1 and 3. Sources and transport mechanisms should be defined to locate where action could be taken to reduce sediment souces.

To determine suspended solids loadings, sources, and transport mechanisms should be defined. A sediment transport study showing sediment sources should be conducted. The cost is unknown and dependent on proposals submitted by consultants. Time to complete the remedial action and funding sources are also unknown. Estimated cost of $400,000.

2. Perform maintenance dredging in the natural channel of the Clinton River at Shadyside Park to enhance flow.

Sediments deposited at the spillway/natural channel divergence upstream of Mt. Clemens form shoals which partially block water flow down the natural channel resulting in low water volume, and velocity and low dissolved oxygen.

Dredge the natural channel near Shadyside Park to enhance the flow in the natural channel. In the 1970s approximately 13,000 cubic yards of sediment were removed from this location by Macomb County at a cost of $78,000. The spoils were placed along the floodplain of the river. New regulations would require sediment chemical analysis prior to removal and disposal. If the spoils require confined disposal, costs would be significantly greater than the last dredging. Dredging should be performed by a contractor funded by the Clinton River Intra-County Drainage Board. Time to complete the dredging is estimated at two months. Estimated cost of $200,000.

3. Sedimentation and sediment deposition in the Clinton River have been a problem in the lower Clinton River in Sections 1, 2, and 3. Since sediments usually come from upstream sources, these sources should be controlled.

   County and federal soil conservation service personnel should strictly enforce the BMPs for erosion control. In addition, local building inspectors or drain commissioners should strictly enforce these laws at construction sites throughout the basin. Costs for these actions should be developed within a basin framework under the auspices of the Clinton River Watershed Council, the Intra-County Drainage Board, and the County Soil Conservation Service offices. Costs, funding sources, and length of time to complete this action is unknown. Costs are included in 10.4.5a.

Clinton River Ecosystem Coordination

Develop a watershed-wide, multi-jurisdictional river basin organization with modest long term assured funding under the control of a watershed board to be a "Center for Clinton River Watershed Actions." This organization would be a vital force in implementation of all watershed actions and issues, including construction site runoff, urban storm drainage, education, public involvement, floodplain issues, agricultural runoff, and other watershed/water quality related activities that the board would determine. Funding should come from the whole watershed since all watershed users contribute to the problems to some extent.

10.4 Recommended Actions to Address Great Lakes Impairments

Impairments

1. Design a caged fish contaminant uptake study.

   Some fish species downstream of Yates Dam contain elevated levels of DDT, PCB, or mercury. Contaminant sources are unknown. We are also uncertain if these fish are resident or Lake St. Clair fish. A caged fish study could determine contaminant presence in and rate of uptake from Clinton River water.

Caged fish could be analyzed for mercury (Hg), DDT, and PCB, the parameters of concern in Lake St. Clair, to determine presence and/or the rate of uptake. Additional water chemical analysis and D.O. may be necessary at these sampling locations. Five locations, one each in Sections 1, 2, 4, and 6 and two in Section 5 (one upstream and one downstream of Yates Dam) should be selected. Studies would take one month to complete at a cost of approximately $20,000 for fish cage placement, servicing and fish flesh analysis. Work would be done by the SWQD, MDNR or a contractor. Funding sources are uncertain.

2. See items 1, 2 and 3 under Potential Local and Great Lakes PCB Concentrations in Fish.

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Appendices

Appendix 3.1 Clinton River Drainage Basin
Stream Orders and Lakes Within the Drainage Basin

SECTION 1 - Main Branch of Clinton River Downstream of Spillway

Main Branch Clinton River - 5th order

SECTION 2 - Clinton River Spillway

Spillway - 5th order (manmade)

SECTION 3 - Main Br. Clinton R. and Tribs. Between Red Run & Spillway

Main Br. of Clinton R. between Red Run & the North Branch- 4th order

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Main Br. of Clinton R. downstream of North Branch - 5th order

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1st order stream
 Harrington Drain

SECTION 4 - Red Run and Tributaries

Red Run - 3rd order

1st order streams
 Bear Creek
 Plum Brook
 2 unnamed streams

2nd order stream
 Big Beaver Creek

SECTION 5 - Main Br. Clinton R. & Tributaries Upstream of Red Run

Main Branch Clinton River upstream of Red Run - 4th order

Stony Creek - 3rd order
 1st order streams
  West Branch Stony River
  9 unnamed streams

 2nd order streams
  2 unnamed streans

 Lakes
  Green Lake
  Lakeville Lake
  Cranberry Lake
  Twin Lakes
  Dollar Lake
  Irwood Lake
  Thorington lake
  Stony Creek Lake
  1 unnamed Lake

Appendix 3.1 continued
Section 5 continued (Stream Orders and Lakes Within Clinton R. Basin)

Paint Creek - 2nd order
- 1st order streams
  - Trout Creek
  - Sargent Creek
  - 18 unnamed streams

- 2nd order streams
  - 3 unnamed streams

- Lakes
  - Howland Lake
  - Fish Lake
  - Pine Lake
  - Indianwood Lake
  - Clear Lake
  - Long Lake
  - Tan Lake
  - Davis Lake
  - Marl Lake
  - Lake Orion
  - Pungs Lake
  - 14 unnamed lakes

Main Branch (upstream of Paint Creek)
- 1st order streams
  - 30 unnamed streams

- 2nd Order streams
  - Galloway Creek
  - 4 unnamed streams

- Lakes
  - Upper Bushman Lake
  - Whipple Lake
  - Crooked Lake
  - Parke Lake
  - Knox Lake
  - Deer Lake
  - Dixie Lake
  - Greens Lake
  - Lotus Lake
  - Mill Pond
  - Woodhull Lake
  - Eagle Lake
  - Lake Oakland
  - Morgon Lake
  - Mill Lake
  - Voorheis Lake
  - Lake Sixteen
  - Deer Park Lake
  - Tommys Lake
  - Elkhorn Lake
  - Square Lake
  - Judah Lake
  - Mud Lake
  - Carpender Lake
  - Lake Angelus
  - Loon Lake
  - Willian Lake
  - Pleasant Lake
  - Cass Lake
  - Sylvan Lake
  - Crystal Lake
  - Galloway Lake
  - 8 unnamed lakes

Stream Orders and Lakes Within the Clinton R. Basin

SECTION 6 - North & Middle Branch of Clinton R. & Their Tributaries

North Branch Clinton River - 4th order

1st order streams
- Newland Drain
- Mahatty Creek
- Camp Brook
- McBride Drain
- Deer Creek
- Highbank Creek
- Tupper Brook
- Healy Drain
- 12 unnamed streams

2nd order Streams
- Able Drain
- East Branch Coon Creek
- East Pond Creek
- 2 unnamed streams

3nd order streams
- Coon Creek
- Middle Branch Clinton River

Lakes
- Streeter Lake
- Secord Lake
- East Mill Lake
- Hidden Lake
- Nowland Lake
- Fisher Lake

Appendix 3.2. Slope Values for the Clinton River Basin

Section	Name of Tributary	Location	Slope* (ft/mile)
#1	Main Br. Clinton R.	From the mouth of Clinton R. to Spillway mouth	0.1
#2	Spillway	From mouth at L. St. Clair to mouth at weir at Clinton R.	0.1
#3	Main Br. Clinton R.	From the Spillway mouth to the mouth of the North branch of Clinton R.	<0.1
	Main Br. Clinton R.	From North branch mouth to mouth of Red Run	1.8
	Harrington Drn.	From the mouth to Schroeder Drn.	4.4
#4	Red Run	From mouth of Red Run to mouth of Big Beaver Cr.	1.2
	Red Run	From mouth of Big Beaver Cr. to Lane Ditch(Headwaters)	8.3
	Plum Brook	From mouth of Plum Brk. to Gibson Dr.	5.8
	Plum Brook	From Gibson Dr. to source of Plum Brook	26.9
#5	Middle Br. Clinton R.	From the mouth of Middle Br. to mouth of Healy Dr.	3.8
	Middle Br. Clinton R.	From mouth of Healy Drain to Shelby Road (4.4 miles from source)	12.0
	Healy Drain	From the mouth of Healy drain to Jewell Road (1.9 miles below source)	21.0
	Main Br. Clinton R.	From mouth of Red Run to mouth of Stony Cr.	6.6
	Stony Creek	From the mouth of Stony Cr. to mouth of West Branch Stony Cr.	24.3
	Stony Creek	From mouth of West Br. Stony Cr. to Lakeville Lake	10.9
	West Branch Stony Cr.	From mouth of West Br. Stony Cr. to Harmon Rd. (3.0 miles from Source)	14.4
	Main Br. Clinton R.	From the mouth of Stony Cr. to mouth of Paint Cr.	15.3
	Paint Creek	From mouth of Paint Cr. to Highway 24 (at Orion Lake)	19.9
	Paint Creek	From Highway 24 to Howland Lake (headwaters of Paint Cr.)	5.7
	Main Br. Clinton R.	From mouth of Paint Cr. to mouth of Galloway Cr.	16.0
	Galloway Creek	From mouth of Galloway Cr. to Walton Boulevard (2.4 miles from source)	19.5
	Main Br. Clinton R.	From mouth of Galloway Cr. to Cass Lake outlet	0.8
	Main Br. Clinton R.	From Cass L. outlet to Walton Blvd. (Between Loon L. and L. Angelus)	1.9
	Sashabow Creek	From the mouth of Sashabow Cr. to Voorheis Lake	4.9
	Main Br. Clinton R.	From Walton Blvd. to Deer Lake outlet	2.3
#6	North Br. Clinton R.	From the mouth of the North Branch to mouth of McBride Dr.	1.3
	McBride Drain	From the mouth of McBride Dr. to West Branch	6.3
	North Br. Clinton R.	From mouth of McBride Dr. to Coon Creek	2.1
	Coon Creek	From the mouth of Coon Creek to Armada Center	10.9
	East Coon Creek	From the mouth of East Coon Cr. to mouth of Highbank Creek	2.1
	East Coon Creek	From the mouth of Highbank Creek to within 2 miles of source	10.8
	Deer Creek	From mouth of Deer Creek to mouth of Morton Drain	6.7
	North Br. Clinton R.	From mouth of Coon Cr. to mouth of Camp Brook Dr.	4.2
	Camp Brook Drain	From mouth of Camp Brook Dr. to source	17.8
	North Br. Clinton R.	From mouth of Camp Brook Dr. to mouth of East Pond Cr.	12.1
	East Pond Creek	From mouth of East Pond Cr. to Secord Lake	10.1
	North Br. Clinton R.	From mouth of East Pond Cr. to Mouth of Newland Drain	9.0
	Newland Drain	From the mouth of Newland Dr. to 4.8 miles upstream	7.7
	North Br. Clinton R.	From mouth of Newland Dr. to Boardman Rd. (4.4 miles from source)	9.4

*his represents gross slope although short dist. [illegible]s were used to obtain a more average slope valu

Appendix 3.3 Michigan's Water Quality Standards

DEPARTMENT OF NATURAL RESOURCES

WATER RESOURCES COMMISSION

GENERAL RULES

Filed with the Secretary of State on November 14, 1986
These rules take effect 15 days after filing with the Secretary of State

(By authority conferred on the water resources commission by sections 2 and 5 of Act No. 245 of the Public Acts of 1929, as amended, being §§323.2 and 323.5 of the Michigan Compiled Laws)

R 323.1041 to R 323.1050, R 323.1053, R 323.1055, R 323.1058 to R 323.1065, R 323.1070, R 323.1075, R 323.1082, R 323.1092 to R 323.1098, R 323.1100, and R 323.1116 of the Michigan Administrative Code, appearing on pages 1630 and 1632 to 1639 of the 1979 Administrative Code and pages 162 to 164, 166, and 167 of the 1984 Annual Supplement to the Code, are amended, and R 323.1099 is added, to read as hereinafter set forth.

R 323.1074, R 323.1080, R 323.1091, R 323.1110, and R 323.1115 of the Michigan Administrative Code, appearing on pages 1636 to 1644 of the 1979 Michigan Administrative Code, are rescinded.

PART 4. WATER QUALITY STANDARDS

R 323.1041 Purpose.

Rule 41. The purpose of the water quality standards as prescribed by these rules is to establish water quality requirements applicable to the Great Lakes, the connecting waters, and all other surface waters of the state, to protect the public health and welfare, to enhance and maintain the quality of water, to protect the state's natural resources, and serve the purposes of Public Law 92-500, as amended, 33 U.S.C. §466 et seq., Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws, and the Great Lakes water quality agreement enacted November 22, 1978. These standards may not reflect current water quality in all cases, but are minimum water quality requirements for which the waters of the state are to be managed.

R 323.1043 Definitions; A to N.

Rule 43. As used in this part:

(a) "Agricultural use" means a use of water for agricultural purposes, including livestock watering, irrigation, and crop spraying.

(b) "Anadromous salmonids" means those trout and salmon which ascend streams to spawn.

(c) "Carcinogen" means a substance which causes an increased incidence of benign or malignant neoplasms or a substantial decrease in the latency period between exposure and onset of neoplasms through oral or dermal exposure or through inhalation exposure when the cancer occurs at nonrespiratory sites, in at least 1 mammalian species, or man through epidemiological or clinical studies, unless the commission, on the basis of credible scientific evidence, determines that there is significant uncertainty regarding the credibility, validity, or significance of such study or studies, in which case it shall refer the question of carcinogenicity to experts on carcinogenesis and shall consider the recommendations of those experts in making its final determination.

(d) "Coldwater fish" means those fish species whose populations thrive in relatively cold water, including trout, salmon, whitefish, and cisco.

(e) "Commission" means the Michigan water resources commission established pursuant to Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws.

(f) "Connecting waters" means any of the following:

(i) The St. Marys river.

(ii) The Keweenaw waterway.

(iii) The Detroit river.

(iv) The St. Clair river.

(v) Lake St. Clair.

(g) "Designated use" means a use of the waters of the state as established by these rules, including use for any of the following:

(i) Industrial, agricultural, and public water supply.

(ii) Recreation.

(iii) Fish, other aquatic life, and wildlife.

(iv) Navigation.

(h) "Dissolved oxygen" means the amount of oxygen dissolved in water and is commonly expressed as a concentration in terms of milligrams per liter.

(i) "Dissolved solids" means the amount of materials dissolved in water and is commonly expressed as a concentration in terms of milligrams per liter.

(j) "Effluent" means a wastewater discharged from a point source to the waters of the state.

(k) "Fecal coliform" means a type of coliform bacteria found in the intestinal tract of humans and other warm-blooded animals.

(l) "Final acute value" means the level of a chemical or mixture of chemicals that does not allow the mortality of important fish or fish food organisms to exceed 50% when exposed for 96 hours, except where a shorter time period is appropriate for certain species.

(m) "Fish, other aquatic life, and wildlife use" means the use of the waters of the state by fish, other aquatic life, and wildlife for any life history stage or activity.

(n) "Industrial water supply" means a water source intended for use in commercial or industrial applications or for noncontact food processing.

(o) "Inland lake" means an inland body of standing water of the state situated in a topographic depression other than an artificial agricultural pond less than one acre, unless it is otherwise determined by the commission. The commission may designate a dammed river channel or an impoundment as an inland lake based on aquatic resources to be protected.

(p) "Keweenaw waterway" means the entire Keweenaw waterway, including Portage lake, Houghton county.

(q) "MATC" means the maximum acceptable toxicant concentration obtained by calculating the geometric mean of the lower and upper chronic limits from a chronic test. A lower chronic limit is the highest tested concentration which did not cause the occurrence of a specified adverse effect. An upper chronic limit is the lowest tested concentration which did cause the occurrence of a specified adverse effect and above which all tested concentrations caused such an occurrence.

(r) "Mixing zone" means that portion of a water body wherein a point source discharge is mixed with the receiving water.

(s) "Natural water temperature" means the temperature of a body of water without an influence from an artificial source or a temperature as otherwise determined by the commission.

(t) "NOAEL" means the highest level of toxicant which results in no observable adverse effects to exposed test organisms.

(u) "Non-point source" means a source of material other than a source defined as a point source.

R 323.1044 Definitions; P to W.

Rule 44. As used in this part:

(a) "Palatable" means the state of being agreeable or acceptable to the sense of sight, taste, or smell.

(b) "Plant nutrients" means those chemicals, including nitrogen and phosphorus, necessary for the growth and reproduction of aquatic rooted, attached, and floating plants, fungi, or bacteria.

(c) "Point source" means a discernible, confined, and discrete conveyance from which wastewater is or may be discharged to the waters of the state, including the following:

(i) A pipe.
(ii) A ditch.
(iii) A channel.
(iv) A tunnel.
(v) A conduit.
(vi) A well.
(vii) A discrete fissure.
(viii) A container.
(ix) A concentrated animal feeding operation.
(x) A boat or other watercraft.

(d) "Public water supply sources" means a surface raw water source which, after conventional treatment, provides a source of safe water for various uses, including human consumption, food processing, cooking, and as a liquid ingredient in foods and beverages.

(e) "Raw water" means the waters of the state before any treatment.

(f) "Receiving waters" means the waters of the state into which an effluent is or may be discharged.

(g) "Sanitary sewage" means treated or untreated wastewaters which contain human metabolic and domestic wastes.

(h) "Standard" means a definite numerical value or narrative statement promulgated by the commission to maintain or restore water quality to provide for, and fully protect, a designated use of the waters of the state.

(i) "Suspended solids" means the amount of materials suspended in water and is commonly expressed as a concentration in terms of milligrams per liter.

(j) "Total body contact recreation" means any activity where the human body may come into direct contact with water to the point of complete submergence, including swimming, waterskiing, and skin diving.

(k) "Toxic substance" means a substance, except heat, when present in sufficient concentrations or quantities which are or may become harmful to plant life, animal life, or designated uses.

(l) "Warmwater fish" means those fish species whose populations thrive in relatively warm water, including any of the following:

(i) Bass.

(ii) Pike.

(iii) Walleye.

(iv) Panfish.

(m) "Wastewater" means storm water runoff which could result in injury to a use designated in R 323.1100; liquid waste resulting from commercial, institutional, domestic, industrial, and agricultural activities, including cooling and condensing waters; sanitary sewage; and industrial waste.

(n) "Waters of the state" means all of the following, but does not include drainage ways and ponds used solely for wastewater conveyance, treatment, or control:

(i) The Great Lakes and their connecting waters.

(ii) All inland lakes.

(iii) Rivers.

(iv) Streams.

(v) Impoundments.

(vi) Open drains.

(vii) Other surface waterbodies within the confines of the state.

R 323.1050 Physical characteristics.

Rule 50. The waters of the state shall not have any of the following unnatural physical properties in quantities which are or may become injurious to any designated use:

(a) Turbidity.

(b) Color.

(c) Oil films.

(d) Floating solids.

(e) Foams.

(f) Settleable solids.

(g) Suspended solids.

(h) Deposits.

R 323.1051 Dissolved solids.

Rule 51. (1) The addition of any dissolved solids shall not exceed concentrations which are or may become injurious to any designated use. Point sources containing dissolved solids shall be considered by the commission on a case-by-case basis and increases of dissolved solids in the waters of the state shall be limited through the application of best practicable control technology currently available as prescribed by the administrator of the United States environmental protection agency pursuant to section 304(b) of Public Law 92-500, as amended, 33 U.S.C. §466 et seq., except that in no instance shall total dissolved solids in the waters of the state exceed a concentration of 500 milligrams per liter as a monthly average nor more than 750 milligrams per liter at any time, as a result of controllable point sources.

(2) The waters of the state designated as a public water supply source shall not exceed 125 milligrams per liter of chlorides as a monthly average, except for the Great Lakes and connecting waters, where chlorides shall not exceed 50 milligrams per liter as a monthly average.

R 323.1053 Hydrogen ion concentration.

Rule 53. The hydrogen ion concentration expressed as pH shall be maintained within the range of 6.5 to 9.0 in all waters of the state. Any artificially induced variation in the natural pH shall remain within this range and shall not exceed 0.5 units of pH.

R 323.1055 Taste- or odor-producing substances.

Rule 55. The waters of the state shall contain no taste-producing or odor-producing substances in concentrations which impair or may impair their use for a public, industrial, or agricultural water supply source which impair the palatability of fish as measured by test procedures approved by the commission.

R 323.1057. Toxic substances.

Rule 57. (1) Toxic substances shall not be present in the waters of the state at levels which are or may become injurious to the public health, safety, or welfare; plant and animal life; or the designated uses of those waters. Allowable levels of toxic substances shall be determined by the commission using appropriate scientific data.

(2) All of the following provisions apply for purposes of developing allowable levels of toxic substances in the surface waters of the state applicable to point source discharge permits issued pursuant to Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws:

(a) Water quality-based effluent limits developed pursuant to this subrule shall be used only when they are more restrictive than technology-based limitations required pursuant to R 323.2137 and R 323.2140.

(b) The toxic substances to which this subrule shall apply are those on the 1984 Michigan critical materials register established pursuant to Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws; the priority pollutants and hazardous chemicals in 40 C.F.R. §122.21, appendix D (1983); and any other toxic substances as the commission may determine are of concern at a specific site.

(c) Allowable levels of toxic substances in the surface water after a discharge is mixed with the receiving stream volume specified in R 323.1082 shall be determined by applying an adequate margin of safety to the MATC, NOAEL, or other appropriate effect end points, based on knowledge of the behavior of the toxic substance, characteristics of the receiving water, and the organisms to be protected.

(d) In addition to restrictions pursuant to subdivision (c) of this subrule, a discharge of carcinogens, not determined to cause cancer by a threshold mechanism, shall not create a level of risk to the public health greater than 1 in 100,000 in the surface water after mixing with the allowable receiving stream volume specified in R 323.1082. The commission may require a greater degree of protection pursuant to R 323.1098 where achievable through utilization of control measures already in place or where otherwise determined necessary.

(e) Guidelines shall be adopted pursuant to Act No. 306 of the Public Acts of 1969, as amended, being §24.201 et seq. of the Michigan Compiled Laws, setting forth procedures to be used by staff in the development of recommendations to the commission on allowable levels of toxic substances and the minimum data necessary to derive such recommendations. The commission may require the applicant to provide the minimum data when otherwise not available for derivation of allowable levels of toxic substances.

(f) For existing discharges, the commission may issue a scheduled abatement permit pursuant to R 323.2145 upon a determination by the commission that the applicant has demonstrated that each of the following conditions is met:

(i) Immediate attainment of the allowable level of a toxic substance is not economically or technically feasible.

(ii) No prudent alternative exists.

(iii) During the period of scheduled abatement, the permitted discharge will be consistent with the protection of the public health, safety, and welfare.

(iv) Reasonable progress will be made toward compliance with this rule over the term of the permit, as provided for in a schedule in the permit.

R 323.1058 Radioactive substances.

Rule 58. The control and regulation of radioactive substances discharged to the waters of the state shall be pursuant to the criteria, standards, or requirements prescribed by the United States nuclear regulatory commission in 10 C.F.R. §20.1 et seq. and by the United States environmental protection agency.

R 323.1060 Plant nutrients.

Rule 60. (1) Consistent with Great Lakes protection, phosphorus which is or may readily become available as a plant nutrient shall be controlled from point source discharges to achieve 1 milligram per liter of total phosphorus as a maximum monthly average effluent concentration unless other limits, either higher or lower, are deemed necessary and appropriate by the commission.

(2) In addition to the protection provided under subrule (1) of this rule, nutrients shall be limited to the extent necessary to prevent stimulation of growths of aquatic rooted, attached, suspended, and floating plants, fungi or bacteria which are or may become injurious to the designated uses of the waters of the state.

R 323.1062 Microorganisms.

Rule 62. (1) All waters of the state shall contain not more than 200 fecal coliform per 100 milliliters. This concentration may be exceeded if such concentration is due to uncontrollable non-point sources. The commission may suspend this rule from November 1 through April 30 upon determining that designated uses will be protected.

(2) Compliance with the fecal coliform standards prescribed by subrule (1) of this rule shall be determined on the basis of the geometric average of any series of 5 or more consecutive samples taken over not more than a 30-day period.

(3) Protection of the waters of the state designated for total body contact recreation and public water supply source by the water quality standards prescribed by this rule may be subject to temporary interruption during or following flood conditions, accidents, or emergencies which affect a sewer or wastewater treatment system. In the event of such occurrences, notice shall be served to those affected in accordance with procedures established by the commission. Prompt corrective action shall be taken by the discharger to restore the designated use.

R 323.1064 Dissolved oxygen in Great Lakes, connecting waters, and inland streams.

Rule 64. (1) A minimum of 7 milligrams per liter of dissolved oxygen in all Great Lakes and connecting waterways shall be maintained, and, except for inland lakes as prescribed in R 323.1065, a minimum of 7 milligrams per liter of dissolved oxygen shall be maintained at all times in all inland waters designated by these rules to be protected for coldwater fish. In all other waters, except for inland lakes as prescribed by R 323.1065, a minimum of 5 milligrams per liter of dissolved oxygen shall be maintained. These standards do not apply for a limited warmwater fishery use subcategory or limited coldwater fishery use subcategory established pursuant to R 323.1100(10) or during those periods when the standards specified in subrule (2) of this rule apply.

(2) Waters of the state which do not meet the standards set forth in subrule (1) of this rule shall be upgraded to meet those standards. For existing point source discharges to these waters, the commission may issue permits pursuant to R 323.2145 which establish schedules to achieve the standards set forth in subrule (1) of this rule. If existing point source dischargers demonstrate to the commission that the dissolved oxygen standards specified in subrule (1) of this rule are not attainable through further feasible and prudent reductions in their discharges or that the diurnal variation between the daily average and daily minimum dissolved oxygen concentrations in those waters exceeds 1 milligram per liter, further reductions in oxygen-consuming substances from such discharges will not be required, except as necessary to meet the interim standards specified in this subrule, until comprehensive plans to upgrade these waters to the standards specified in subrule (1) of this rule have been approved by the commission and orders, permits, or other actions necessary to implement the approved plans have been issued by the commission. In the interim, all of the following standards apply:

(a) For waters of the state designated for use for coldwater fish, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 6 milligrams per liter at the design flow during the warm weather season in accordance with R.323.1090(3) and (4). At the design flows during other seasonal periods, as provided in R 323.1090(4), a minimum of 7 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision.

(b) For waters of the state designated for use for warmwater fish and other aquatic life, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 4 milligrams per liter, or below 5 milligrams per liter as a daily average, at the design flow during the warm weather season in accordance with R 323.1090(3) and (4). At the design flows during other seasonal periods as provided in R 323.1090(4), a minimum of 5 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision.

(c) For waters of the state designated for use for warmwater fish and other aquatic life, but also designated as principal migratory routes for anadromous salmonids, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below 5 milligrams per liter as a minimum during periods of migration.

(3) The commission may cause a comprehensive plan to be prepared to upgrade waters to the standards specified in subrule (1) of this rule taking into consideration all factors affecting dissolved oxygen in these waters and the cost effectiveness of control measures to upgrade these waters and, after notice and hearing, approve the plan. After notice and hearing, the commission may amend a comprehensive plan for cause. In undertaking the comprehensive planning effort the commission shall provide for and encourage participation by interested and impacted persons in the affected area. Persons directly or indirectly discharging substances which contribute towards these waters not meeting the standards specified in subrule (1) of this rule may be required after notice and order to provide necessary information to assist in the development or amendment of the comprehensive plan. Upon notice and order, permit, or other action of the commission, persons directly or indirectly discharging substances which contribute toward these waters not meeting the standards specified in subrule (1) of this rule shall take the necessary actions consistent with the approved comprehensive plan to control these discharges to upgrade these waters to the standards specified in subrule (1) of this rule.

R 323.1065 Dissolved oxygen; inland lakes.

Rule 65. (1) The following standards for dissolved oxygen shall apply to lakes designated as trout lakes by the natural resources commission or lakes listed in the publication entitled "Coldwater Lakes of Michigan":

(a) In stratified coldwater lakes which have dissolved oxygen concentrations less than 7 milligrams per liter in the upper half of the hypolimnion, a minimum of 7 milligrams per liter dissolved oxygen shall be maintained throughout the epilimnion and upper 1/3 of the thermocline during stratification. Lakes capable of sustaining oxygen throughout the hypolimnion shall maintain oxygen throughout the hypolimnion. At all other times, dissolved oxygen concentrations greater than 7 milligrams per liter shall be maintained.

(b) Except for lakes described in subdivision (c) of this subrule, in stratified coldwater lakes which have dissolved oxygen concentrations greater than 7 milligrams per liter in the upper half of the hypolimnion, a minimum of 7 milligrams per liter of dissolved oxygen shall be maintained in the epilimnion, thermocline, and upper half of the hypolimnion. Lakes capable of sustaining oxygen throughout the hypolimnion shall maintain oxygen throughout the hypolimnion. At all other times, dissolved oxygen concentrations greater than 7 milligrams per liter shall be maintained.

(c) In stratified coldwater lakes which have dissolved oxygen concentrations greater than 7 milligrams per liter throughout the hypolimnion, a minimum of 7 milligrams per liter shall be maintained throughout the lake.

(d) In unstratified coldwater lakes, a minimum of 7 milligrams per liter of dissolved oxygen shall be maintained throughout the lake.

(2) For all other inland lakes not specified in subrule (1) of this rule, during stratification, a minimum dissolved oxygen concentration of 5 milligrams per liter shall be maintained throughout the epilimnion. At all other times, dissolved oxygen concentrations greater than 5 milligrams per liter shall be maintained.

R 323.1069. Temperature; general considerations.

Rule 69. (1) In all waters of the state, the points of temperature measurement normally shall be in the surface 1 meter; however, where turbulence, sinking plumes, discharge inertia or other phenomena upset the natural thermal distribution patterns of receiving waters, temperature measurements shall be required to identify the spatial characteristics of the thermal profile.

(2) Monthly maximum temperatures, based on the ninetieth percentile occurrence of natural water temperatures plus the increase allowed at the edge of the mixing zone and in part on long-term physiological needs of fish, may be exceeded for short periods when natural water temperatures exceed the ninetieth percentile occurrence. Temperature increases during these periods may be permitted by the commission, but in all cases shall not be greater than the natural water temperature plus the increase allowed at the edge of the mixing zone.

(3) Natural daily and seasonal temperature fluctuations of the receiving waters shall be preserved.

R 323.1070 Temperature of Great Lakes and connecting waters.

Rule 70. (1) The Great Lakes and connecting waters shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 3 degrees Fahrenheit above the existing natural water temperature.

(2) The Great Lakes and connecting waters shall not receive a heat load which would warm the receiving water at the edge of the mixing zone to temperatures in degrees Fahrenheit higher than the following monthly maximum temperature:

(a) Lake Michigan north of a line due west from the city of Pentwater.

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	50	55	70	75	75	75	65	60	45

(b) Lake Michigan south of a line due west from the city of Pentwater.

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	55	60	70	80	80	80	65	60	50

(c) Lake Superior and the St. Marys river:

J	F	M	A	M	J	J	A	S	O	N	D
38	36	39	46	53	61	71	74	71	61	49	42

(d) Lake Huron north of a line due east from Tawas point:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	50	60	70	75	80	75	65	55	45

(e) Lake Huron south of a line due east from Tawas point, except Saginaw bay.

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	55	60	75	80	80	80	65	55	45

(f) Lake Huron, Saginaw bay:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	60	70	75	80	85	78	65	55	45

(g) St. Clair river:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	50	60	70	75	80	75	65	55	50

(h) Lake St. Clair:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	45	55	70	75	80	83	80	70	55	45

(i) Detroit river:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	45	60	70	75	80	83	80	70	55	45

(j) Lake Erie:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	60	70	75	80	85	80	70	60	50

R 323.1075 Temperature of rivers, streams, and impoundments.

Rule 75. (1) Rivers, streams, and impoundments naturally capable of supporting coldwater fish shall not receive a heat load which would do either of the following:

(a) Increase the temperature of the receiving waters at the edge of the mixing zone more than 2 degrees Fahrenheit above the existing natural water temperature.

(b) Increase the temperature of the receiving waters at the edge of the mixing zone to temperatures greater than the following monthly maximum temperatures:

J	F	M	A	M	J	J	A	S	O	N	D
38	38	43	54	65	68	68	68	63	56	48	40

(2) Rivers, streams, and impoundments naturally capable of supporting warmwater fish shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature.

(3) Rivers, streams, and impoundments naturally capable of supporting warmwater fish shall not receive a heat load which would warm the receiving water at the edge of the mixing zone to temperatures greater than the following monthly maximum temperatures:

(a) For rivers, streams, and impoundments north of a line between Bay City, Midland, Alma and North Muskegon:

J	F	M	A	M	J	J	A	S	O	N	D
38	38	41	56	70	80	83	81	74	64	49	39

(b) For rivers, streams, and impoundments south of a line between Bay City, Midland, Alma, and North Muskegon, except the St. Joseph river:

J	F	M	A	M	J	J	A	S	O	N	D
41	40	50	63	76	84	85	85	79	68	55	43

(c) St. Joseph river:

J	F	M	A	M	J	J	A	S	O	N	D
50	50	55	65	75	85	85	85	85	70	60	50

(4) Non-trout rivers and streams that serve as principal migratory routes for anadromous salmonids shall not receive a heat load during periods of migration at such locations and in a manner which may adversely affect salmonid migration or raise the receiving water temperature at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature.

R 323.1082 Mixing zones.

Rule 82. (1) A mixing zone to achieve a mixture of a point source discharge with the receiving waters shall be considered a region in which the response of organisms to water quality characteristics is time dependent. Exposure in mixing zones shall not cause an irreversible response which results in deleterious effects to populations of aquatic life or wildlife. As a minimum restriction, the final acute value for aquatic life shall not be exceeded in the mixing zone at any point inhabitable by these organisms, unless it can be demonstrated to the commission that a higher level is acceptable. The mixing zone shall not prevent the passage of fish or fish food organisms in a manner which would result in adverse impacts on their immediate or future populations. Watercourses or portions thereof which, without 1 or more point source discharge, would have no flow except during periods of surface runoff may be considered as a mixing zone for a point source discharge. The area of mixing zones should be minimized. To this end, devices for rapid mixing, dilution, and dispersion are encouraged where practicable.

(2) For toxic substances, not more than 25% of the receiving water design flow, as stated in R 323.1090, shall be utilized when determining effluent limitations for surface water discharges, unless it can be demonstrated to the commission that the use of a larger volume is acceptable. The commission shall not base a decision to grant more than 25% of the receiving water design flow for purposes of developing effluent limitations for discharges of toxic substances solely on the use of rapid mixing, dilution, or dispersion devices. However, where such a device is or may be employed, the commission may authorize the use of a design flow greater than 25% if the effluent limitations which correspond to such a design flow are shown, based upon a site-specific demonstration, to be consistent with Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws, and other applicable law.

(3) For substances not included in subrule (2) of this rule, the design flow, as stated in R 323.1090, shall be utilized when determining effluent limitations for surface water discharges if the provisions in subrule (1) of this rule are met, unless the commission determines that a more restrictive volume is necessary.

(4) For all substances, defined mixing zone boundaries may be established and shall be determined on a case-by-case basis.

(5) Mixing zones in the Great Lakes, their connecting waters, and inland lakes shall be determined on a case-by-case basis.

R 323.1090. Applicability of water quality standards.

Rule 90. (1) The water quality standards prescribed by these rules shall not apply within mixing zones, except for those standards prescribed in R 323.1082(1) and R 323.1050.

(2) Water quality standards prescribed by these rules are minimally acceptable water quality conditions. Water quality shall be equal to or better than such minimal water quality conditions not less than 95% of the time.

(3) Water quality standards shall apply at all flows equal to or exceeding the design flow. The design flow is equal to the most restrictive of the 12 monthly 95% exceedance flows, except where the commission determines that a more restrictive design flow is necessary or where the commission determines that seasonal design flows may be granted pursuant to R 323.1090(4). The 95% exceedance flow is the flow equal to or exceeded 95% of the time for the specified month.

(4) A maximum of 4 seasonal design flows may be granted when determining effluent limitations for a surface water discharge if it is determined by the commission that the use of such design flows will protect water quality and be consistent with the protection of the public health, safety, and welfare. The seasonal design flows shall be the most restrictive of the monthly 95% exceedance flow for the months in each season. Seasonal design flows shall not be granted for toxic substances which, on the basis of credible scientific evidence, may bioaccumulate in biota inhabiting or using the waters of the state unless, taking into account the receiving water characteristics the persistence and environmental fate characteristics of the substance or substances and the presence of other discharges of bioaccumulative toxic substances into the same receiving waters, the commission determines that the increased mass loading of the substance or substances resulting from granting seasonal design flows is consistent with Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws, and other applicable law.

R 323.1092 Applicability of water quality standards to dredging or construction activities.

Rule 92. Unless the commission determines, after consideration of dilution and dispersion, that such activities result in unacceptable adverse impacts on designated uses, the water quality standards prescribed by these rules shall not apply to dredging or construction activities within the waters of the state where such activities occur or during the periods of time when the aftereffects of dredging or construction activities degrade water quality within such waters of the state, if the dredging operations or construction activities have been authorized by the United States army corps of engineers or the department of natural resources. The water quality standards shall apply, however, in nonconfined waters of the state utilized for the disposal of spoil from dredging operations, except within spoil disposal sites specifically defined by the United States army corps of engineers or the department of natural resources.

R 323.1096 Determinations of compliance with water quality standards.
Rule 96. Analysis of the waters of the state to determine compliance with the water quality standards prescribed by these rules shall be made pursuant to procedures outlined in 40 C.F.R. §136, as amended by F.R. pp. 43234 to 43442 October 26, 1984, and F.R. pp. 690 to 697 January 4, 1985, or pursuant to other methods prescribed or approved by the commission and the United States environmental protection agency.

R 323.1097 Materials applications not subject to standards.
Rule 97. The application of materials for water resource management projects pursuant to state statutory provisions is not subject to the standards prescribed by these rules, but all projects shall be reviewed and approved by the commission before application.

R 323.1098 Antidegradation.
Rule 98. (1) This rule applies to waters of the state in which the existing water quality is better than the water quality standards prescribed by these rules or than needed to protect existing uses.

(2) These waters shall not be lowered in quality by action of the commission unless it is determined by the commission that such lowering will not do any of the following:

(a) Become injurious to the public health, safety, or welfare.

(b) Become injurious to domestic, commercial, industrial, agricultural, recreational, or other uses which are or may be made of such waters.

(c) Become injurious to the value or utility of riparian lands.

(d) Become injurious to livestock, wild animals, including birds, fish, and other aquatic animals, or plants, or their growth or propagation.

(e) Destroy or impair the value of game, fish, and wildlife.

(f) Be unreasonable and against the public interest in view of the existing conditions.

(3) All of the following waters are designated as protected waters:

(a) All Michigan waters of the Great Lakes, except as these waters may be affected by discharges to the connecting waters and tributaries.

(b) Trout streams south of a line between Bay City, Midland, Alma, and North Muskegon.

(c) Inland lakes.

(d) Reaches of country-scenic and wild-scenic rivers designated under Act No. 231 of the Public Acts of 1970, being §281.761 et seq. of the Michigan Compiled Laws.

(e) Scenic and recreational rivers designated under the wild and scenic rivers act of 1968, 16 U.S.C. §1721 et seq.

(4) In addition to the requirements of subrule (2) of this rule, the waters specified in subrule (3) of this rule shall not be lowered in quality unless, after opportunity for public hearing, it has been demonstrated by the applicant to the commission that a lowering in quality will not be unreasonable, is in the public interest in view of existing conditions, is necessary to accommodate important social or economic

development, and that there are no prudent and feasible alternatives to lowering water quality.

(5) Reaches of the following rivers have been designated pursuant to Act No. 231 of the Public Acts of 1970, being §281.761 et seq. of the Michigan Compiled Laws:

(a) Jordan river - October, 1972, natural river plan.
(b) Betsie river - July, 1973, natural river plan.
(c) Rogue river - July, 1973, natural river plan.
(d) White river - May, 1975, natural river plan.
(e) Boardman river - December, 1975, natural river plan.
(f) Huron river - May, 1977, natural river plan.
(g) Pere Marquette river - July, 1978, natural river plan
(h) Flat river - October, 1979, natural river plan.
(i) Rifle river - May, 1980, natural river plan.
(j) Kalamazoo river - June, 1981, natural river plan.
(k) Pigeon river - June, 1982, natural river plan.

Designated reaches of these rivers are provided in the department of natural resources natural river plan for each respective river.

(6) Reaches of the AuSable river - November, 1984, have been designated pursuant to the wild and scenic rivers act of 1968, 16 U.S.C. §1721 et seq.

(7) Michigan's waters of the Great Lakes are of special significance and are designated as outstanding state resource waters. In addition to the protection specified under subrules (2), (3) and (4) of this rule, mixing zones shall not be used for new or increased discharges to the Great Lakes of toxic substances, as defined by R 323.1057(2)(b), which would result in a lowering of water quality. However, the commission may grant a mixing zone for certain toxic substances on a case-by-case basis, taking into account credible scientific evidence, including persistence and environmental fate characteristics of the substances. Mixing zones for existing discharges of these toxic substances to the Great Lakes and for all discharges of these toxic substances to the connecting waters shall be minimized.

(8) Before authorizing a new or increased discharge of wastewater directly to the Great Lakes or connecting waters, the commission shall provide, in addition to the public notice required by commission rules, supplemental notice of its intent to authorize such discharge, of its proposed determination with respect to the applicable factors set forth in subrule (4) of this rule, and the proposed national pollutant discharge elimination system permit terms and conditions, to the administrator of the United States environmental protection agency, the director of the state or provincial water pollution control agency for all states or provinces which border the lake or connecting waters which receive the new or increased discharge, the United States fish and wildlife service, and the international joint commission. The commission shall allow not less than 30 days for comments from the recipients of the supplemental notice and shall carefully consider all comments received in making its determination.

(9) Wild rivers designated under the wild and scenic rivers act of 1968, 16 U.S.C. §1721 et seq., rivers flowing into, through, or out of national parks or national lakeshores, and wilderness rivers designated under Act No. 231 of the Public Acts of 1970, being §281.761 et seq. of the Michigan Compiled Laws, shall not be lowered in quality. Reaches of

the Two Hearted river - December, 1973, natural river plan - are designated under Act No. 231 of the Public Acts of 1970 as a wilderness river.

R 323.1099 Waters which do not meet standards.

Rule 99. Waters of the state which do not meet the water quality standards prescribed by these rules shall be improved to meet those standards. Where the water quality of certain waters of the state does not meet the water quality standards as a result of natural causes or conditions, further reduction of water quality is prohibited.

R 323.1100 Designated uses.

Rule 100. (1) As a minimum, all waters of the state are designated for, and shall be protected for, all of the following uses:

(a) Agriculture.
(b) Navigation.
(c) Industrial water supply.
(d) Public water supply at the point of water intake.
(e) Warmwater fish.
(f) Other indigenous aquatic life and wildlife.
(g) Partial body contact recreation.

(2) All waters of the state are designated for, and shall be protected for, total body contact recreation from May 1 to October 31 in accordance with R 323.1062. The commission will annually publish a list of those waters of the state located immediately downstream of municipal sewage system discharges where total or partial body contact recreation is contrary to prudent public health practices.

(3) All inland lakes identified in the publication entitled "Coldwater Lakes of Michigan," as published in 1976 by the department of natural resources, are designated for, and shall be protected for, coldwater fish.

(4) All Great Lakes and their connecting waters, except the entire Keweenaw waterway, including Portage lake, Houghton county, and Lake St. Clair, are designated for, and shall be protected for, coldwater fish.

(5) All lakes designated as trout lakes by the natural resources commission under the authority of Act No. 165 of the Public Acts of 1929, as amended, being §301.1 et seq. of the Michigan Compiled Laws, are designated for, and shall be protected for, coldwater fish.

(6) All waters of the state designated as trout streams by the director of the department pursuant to section 8 of Act No. 165 of the Public Acts of 1929, as amended, being §301.8 et seq. of the Michigan Compiled Laws, shall be protected for coldwater fish.

(7) All waters of the state which are designated by the Michigan department of public health as existing or proposed for use as public water supply sources are protected for such use at the point of water intake and in such contiguous areas as the commission may determine necessary for assured protection.

(8) Water quality of all waters of the state serving as migratory routes for anadromous salmonids shall be protected as necessary to assure that migration is not adversely affected.

(9) Discharges to wetlands, as defined by Act No. 203 of the Public Acts of 1979, being §281.701 of the Michigan Compiled Laws, that result in quality less than that prescribed by these rules may be permitted after a use attainability analysis shows that designated uses are not and cannot be attained and shows that attainable uses will be protected.

(10) After completion of a comprehensive plan developed pursuant to R 323.1064(3), upon petition by a municipality or other person, and in conformance with the requirements of 40 C.F.R. §131.10 (1983), the commission may determine that attainment of the dissolved oxygen standards of R 323.1064(1) is not feasible and designate, by amendment to this rule, a limited warmwater fishery use subcategory of the warmwater fishery use or a limited cold water fishery use subcategory of the cold water fishery use. For waters so designated, the dissolved oxygen standards specified in R 323.1064(2) and all other applicable standards of these rules apply. For waters so designated, the dissolved oxygen standards specified in R 323.1064(1) do not apply. Not less than sixty days before filing a petition under this subrule by a municipality or other person, a petitioner shall provide written notice to the executive secretary of the water resources commission and the clerk of the municipalities in which the affected waters are located of its intent to file such petition.

R 323.1105. Multiple designated uses.

Rule 105. When a particular portion of the waters of the state is designated for more than 1 use, the most restrictive water quality standards for one or more of those designated uses shall apply to that portion.

R 323.1116 Availability of documents.

Rule 116. Documents referenced in R 323.1057, R 323.1058, R 323.1065, R 323.1096, and R 323.1100 may be obtained at current costs as follows:

(a) "EPA Priority Pollutants and Hazardous Substances," 40 C.F.R. §122.21, appendix D (1983); copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost, or from the Office of Water Enforcement, United States Environmental Protection Agency, Washington, D.C. 20460, at no cost.

(b) "1984 Michigan Critical Materials Register;" copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

(c) "Guidelines Establishing Test Procedures for Analysis of Pollutants," 40 C.F.R. §136 as amended by F.R. pp 43234 to 43442, October 26, 1984, and F.R. pp. 690 to 697, January 4, 1985; copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

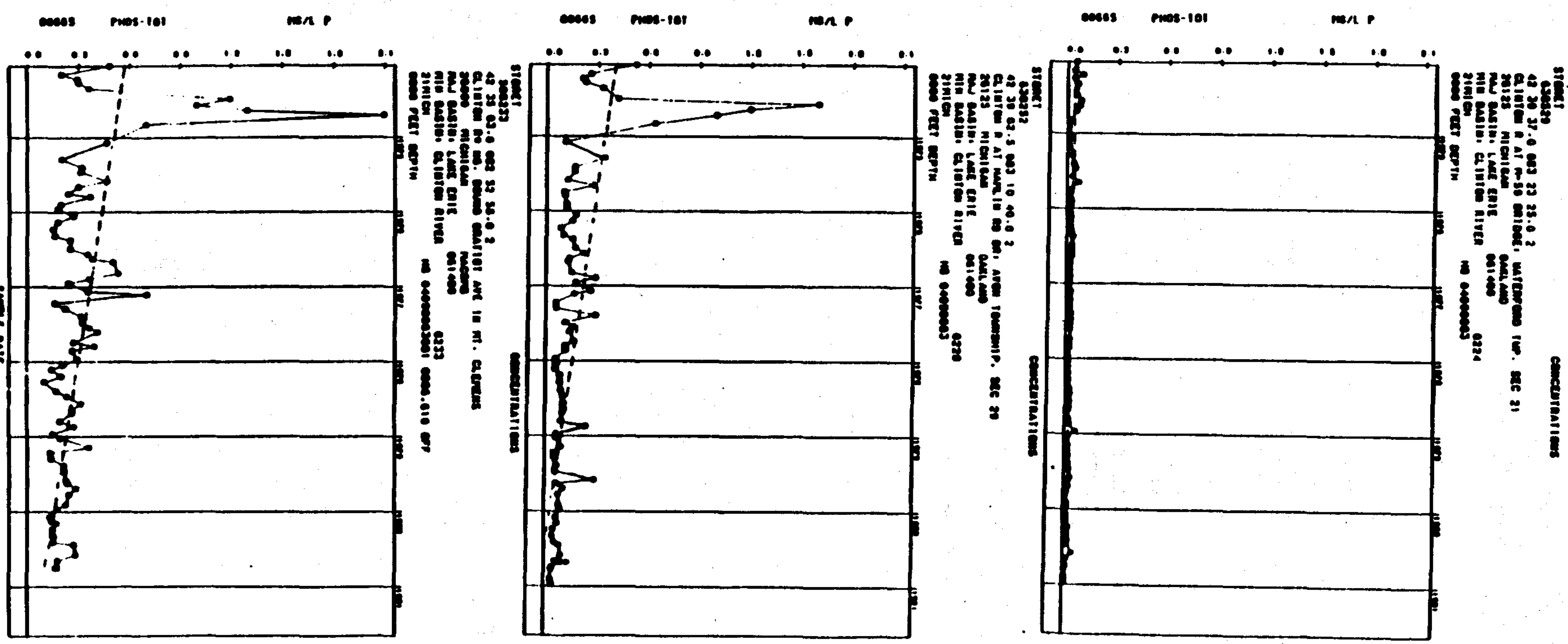
(d) "Designated Trout Lakes," a publication of the department of natural resources; copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

(e) "Coldwater Lakes of Michigan," August, 1976, a publication of the department of natural resources, fisheries division, copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

(f) "Designated Trout Streams for the State of Michigan," April, 1975, a publication of the department of natural resources; copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

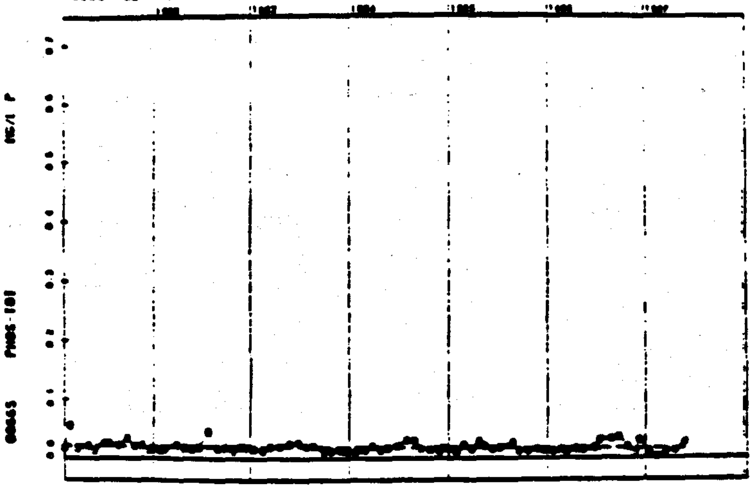
(g) "Standards for Protection Against Radiation," 10 C.F.R. §20, January 1, 1985. Copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

(h) "Designation of uses," 40 C.F.R. §131.10, as published in November 8, 1983 F.R. pp. 51406 and 51407; copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

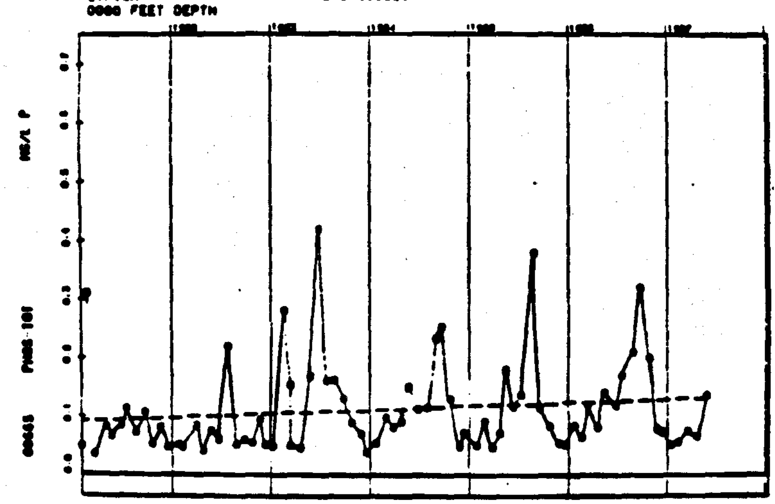


Appendix 4.1 Total phosphorus concentrations(mg/l) and loadings(lbs/day) at M-59 bridge in Waterford(502), Hamlin Rd Bridge(518), and Gratiot Avenue(310), 1974-1986.

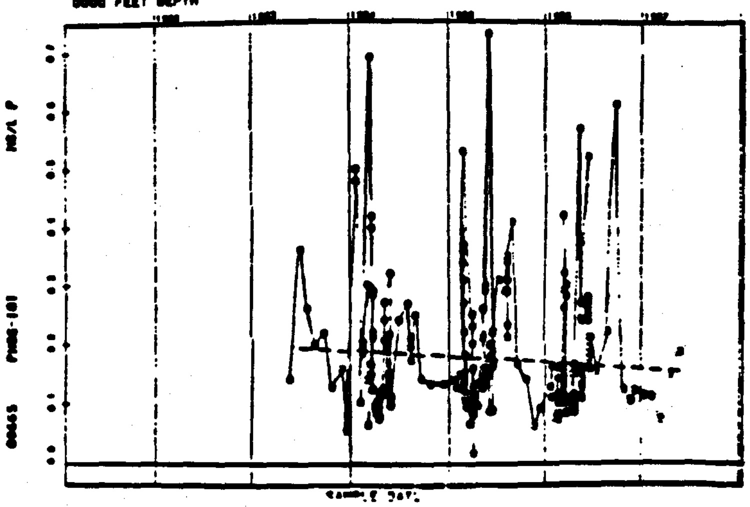
STORET CONCENTRATIONS
630529
42 39 37.0 083 23 25.0 2
CLINTON R AT M-59 BRIDGE; WATERFORD TWP. SEC 21
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 3224
21MICH MQ 04090003
0000 FEET DEPTH



STORET CONCENTRATIONS
630252
42 39 02.9 083 10 46.0 2
CLINTON R AT HAMLIN RD BR; AVON TOWNSHIP. SEC 29
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0228
21MICH MQ 04090003
0000 FEET DEPTH



STORET CONCENTRATIONS
500233
42 35 03.0 082 52 38.0 2
CLINTON R0 N0. BOUND GRATIOT AVE IN MT. CLEMENS
26099 MICHIGAN MACOMB
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0233
21MICH MQ 04090003001 0006.610 OFF
0000 FEET DEPTH



Appendix 4.1 continued

STORET LOADINGS
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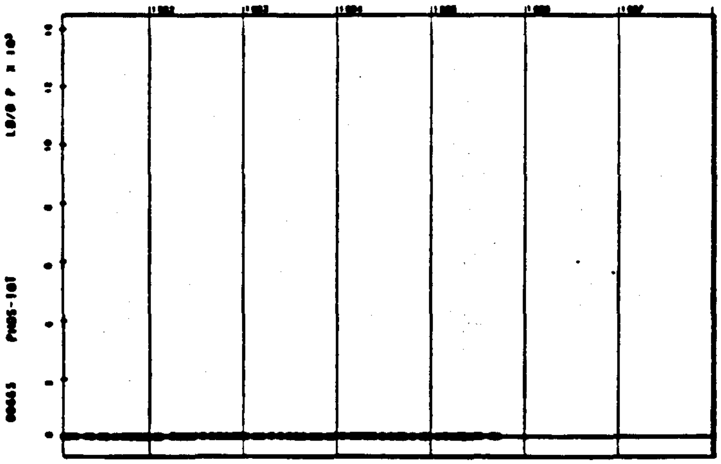
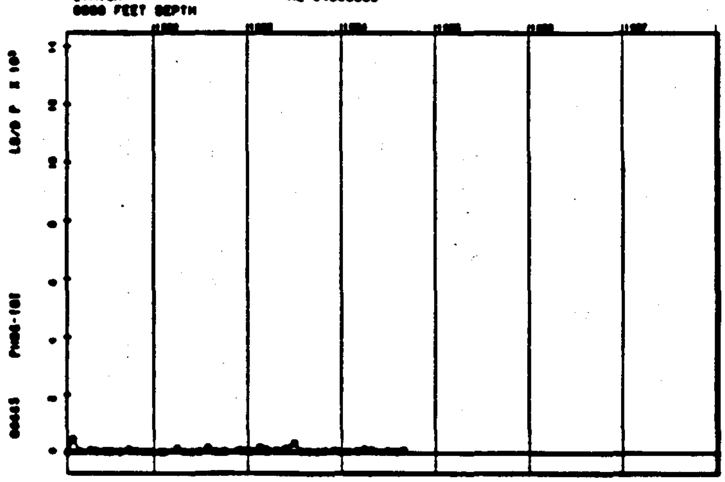
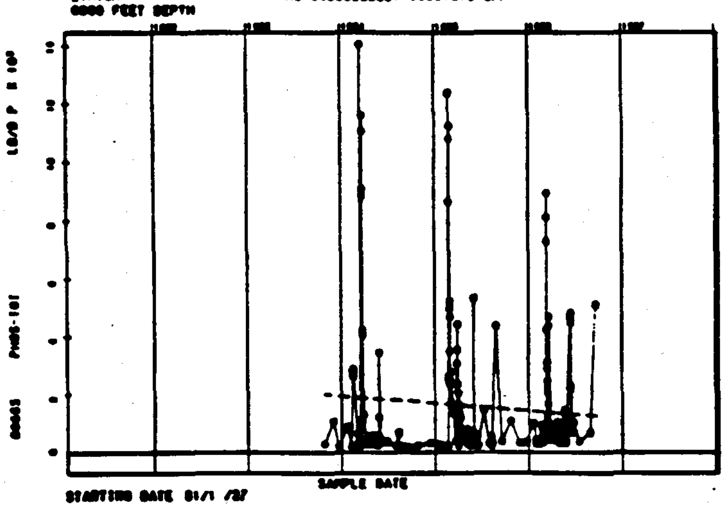
42 30 37.0 083 23 25.0 2
CLINTON R AT M-59 BRIDGE, WATERFORD TWP. SEC 21
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0224
21MICH MG 04000003
0000 FEET DEPTH



STORET LOADINGS
630292
42 39 02.3 083 10 40.0 2
CLINTON R AT HAMLIN RD BR: AVON TOWNSHIP. SEC 29
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0228
21MICH MG 04000003
0000 FEET DEPTH



STORET LOADINGS
500233
42 35 03.0 082 52 30.0 2
CLINTON R0 NO. BOUND GRATIOT AVE IN MT. CLEMENS
26099 MICHIGAN MACOMB
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0233
21MICH MG 04000003001 0006.010 OFF
0000 FEET DEPTH



STARTING DATE 01/1 /87 SAMPLE DATE

Appendix 4.1 continued

STORET LOADINGS
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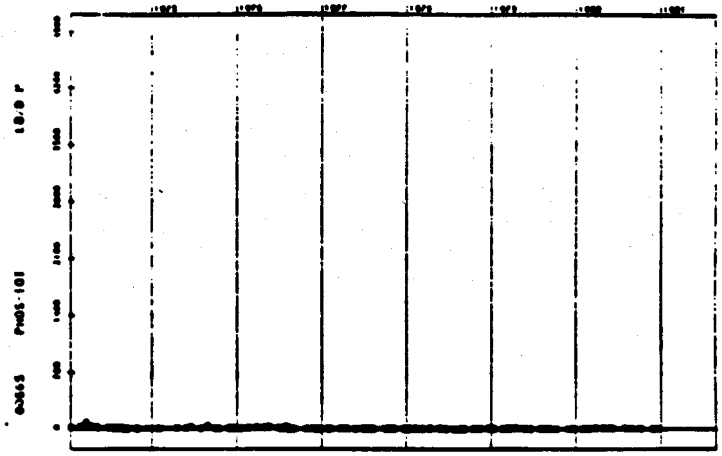
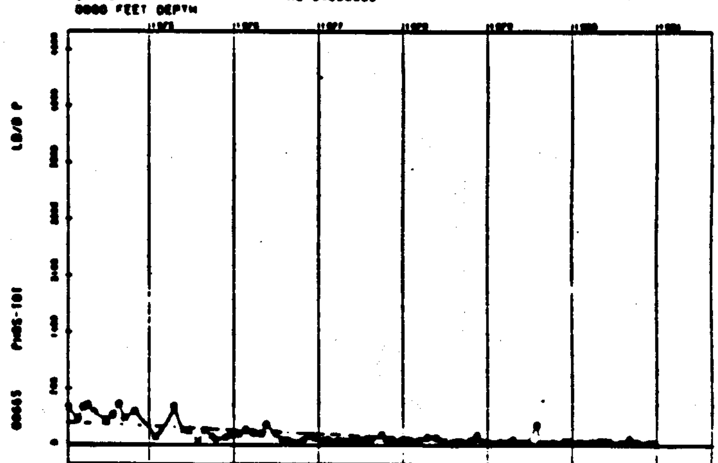
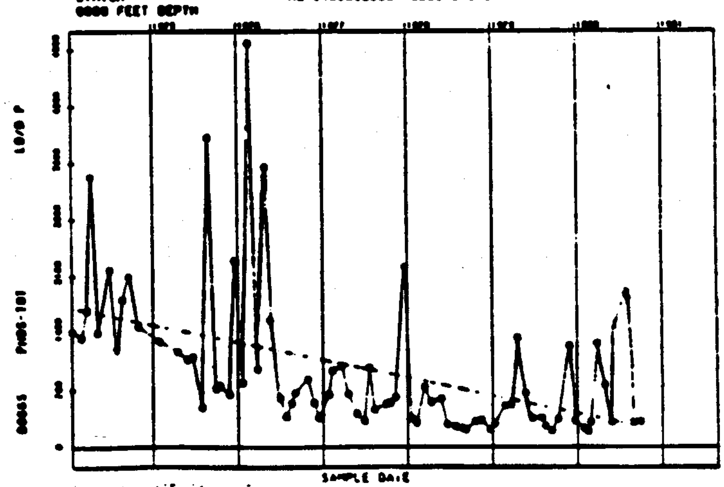
CLINTON R AT M-59 BRIDGE, WATERFORD TWP. SEC 21
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0224
21MICH HQ 04090003
0000 FEET DEPTH



STORET LOADINGS
630252
42 39 02.5 083 10 40.0 2
CLINTON R AT HAMLIN RD BR, AVON TOWNSHIP, SEC 28
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0228
21MICH HQ 04090003
0000 FEET DEPTH

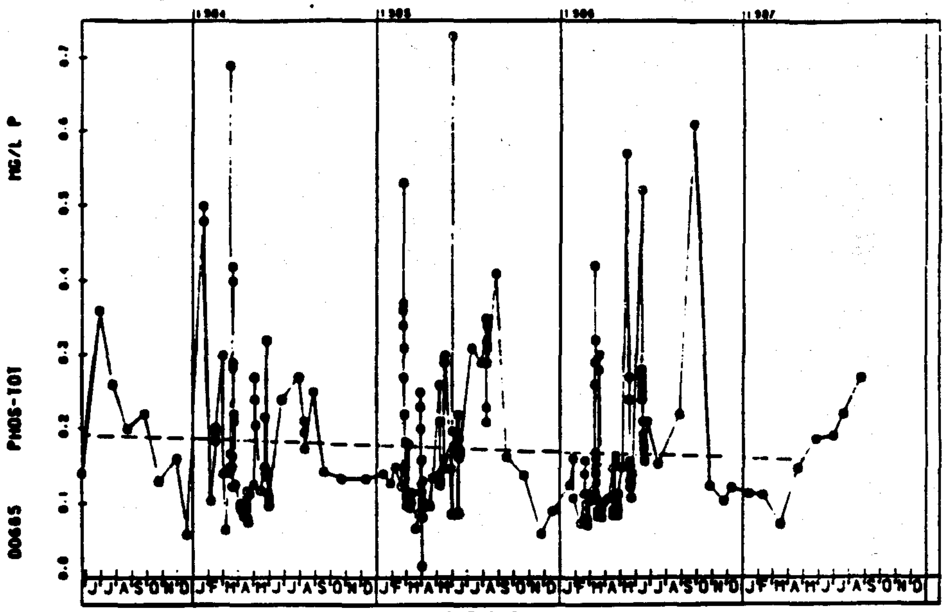


STORET LOADINGS
500233
42 35 03.0 082 52 50.0 2
CLINTON RV NO. BOUND GRATIOT AVE IN MT. CLEMENS
26099 MICHIGAN MACOMB
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0233
21MICH HQ 04090003001 0000.010 OFF
0000 FEET DEPTH



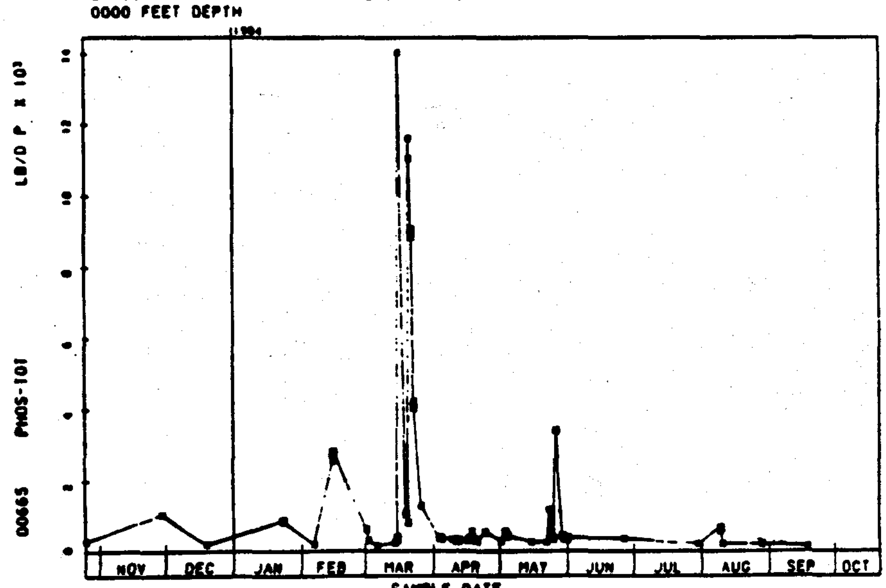
Appendix 4.1 continued

STORET CONCENTRATIONS
500233
42 35 03.0 082 52 58.0 2
CLINTON R* NO. BOUND GRATIOT AVE IN MT. CLEMENS
26099 MICHIGAN MACOMB
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0233
21MICH HQ 04090003001 0006.610 OFF
0000 FEET DEPTH



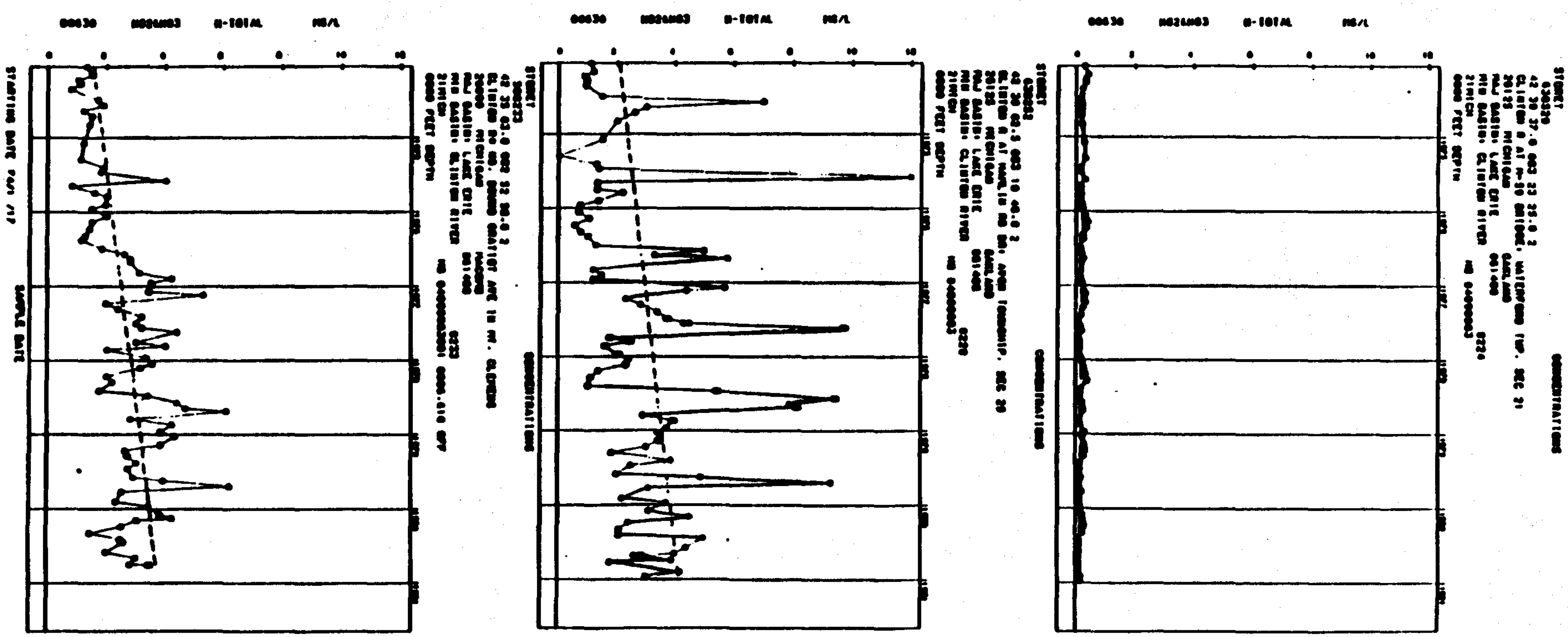
STARTING DATE 83/5 /25

STORET LOADINGS
500233
42 35 03.0 082 52 58.0 2
CLINTON R* NO. BOUND GRATIOT AVE IN MT. CLEMENS
26099 MICHIGAN MACOMB
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0233
21MICH HQ 04090003
0000 FEET DEPTH



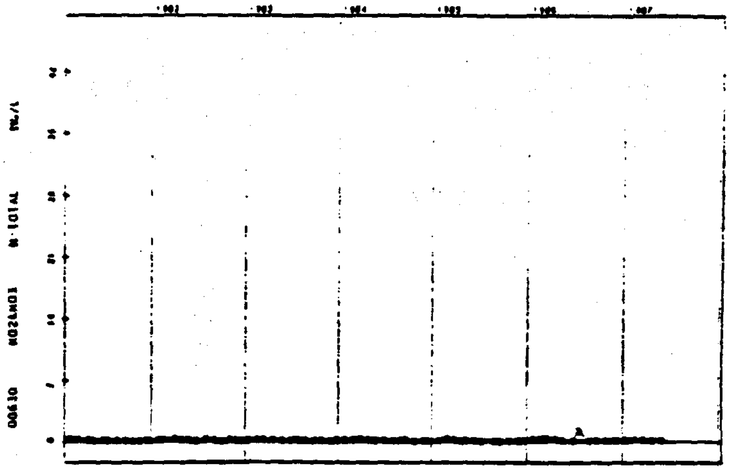
STARTING DATE 83/10/25

Appendix 4.1 continued

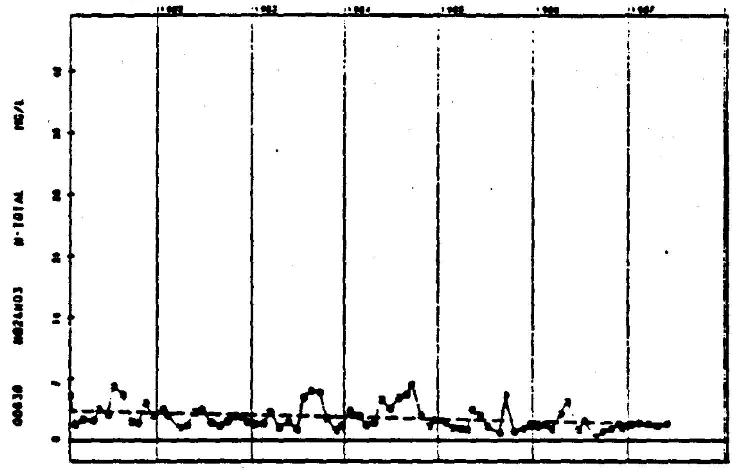


Appendix 4.2 Concentrations of Total Nitrite plus Nitrate(mg/l) in the Clinton River at M-59 Bridge in Waterford(502), Hamlin Road Bridge(518), and Gratiot Avenue in Mt. Clemens(310), 1974 to 1987.

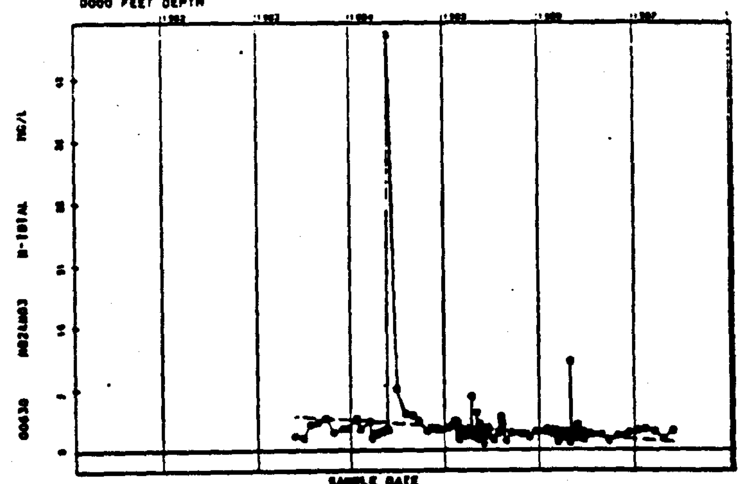
STORET CONCENTRATIONS
530329
42 38 37.0 083 23 25.0 2
CLINTON R AT M-59 BRIDGE, WATERFORD TWP. SEC 21
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0224
21MICH HQ 04090003
0000 FEET DEPTH



STORET CONCENTRATIONS
630252
42 39 02.5 083 10 40.0 2
CLINTON R AT HAMLIN RD BR, AVON TOWNSHIP, SEC 29
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0228
21MICH HQ 04090003
0000 FEET DEPTH

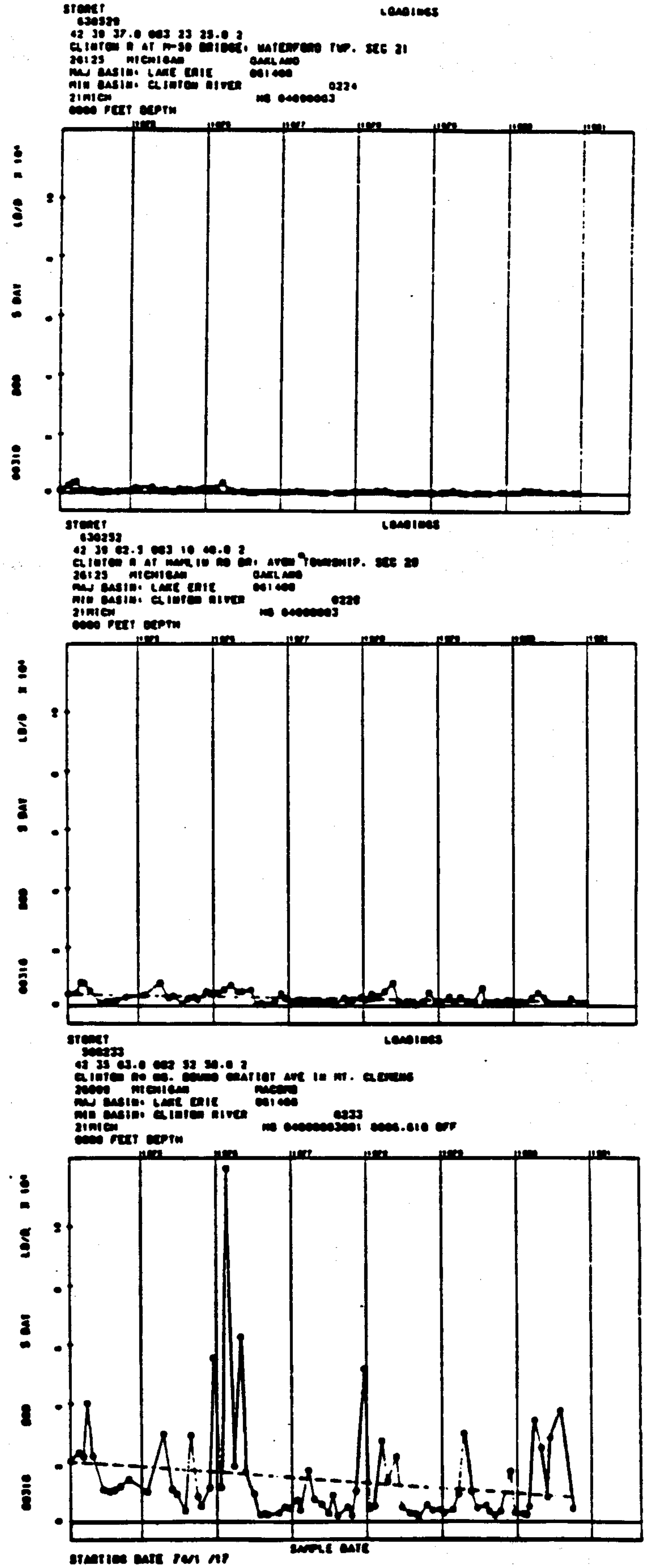


STORET CONCENTRATIONS
500233
42 35 03.0 082 52 38.0 2
CLINTON R. NO. BOUND GRATIOT AVE IN MT. CLEMENS
26099 MICHIGAN MACOMB
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0233
21MICH HQ 04090003001 0006.610 OFF
0000 FEET DEPTH



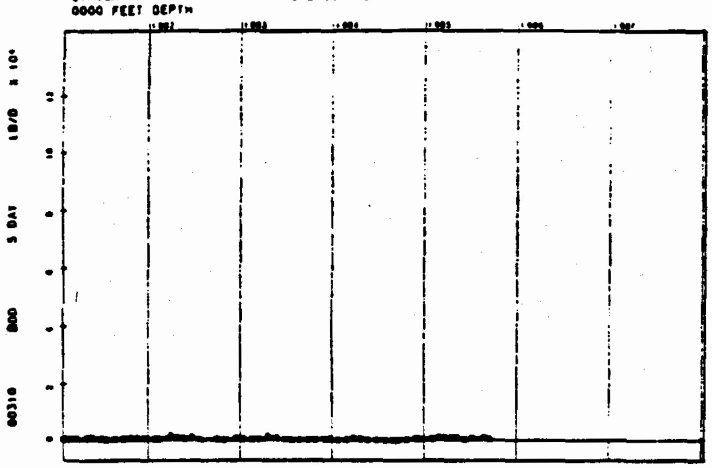
STARTING DATE

Appendix 4.2 continued

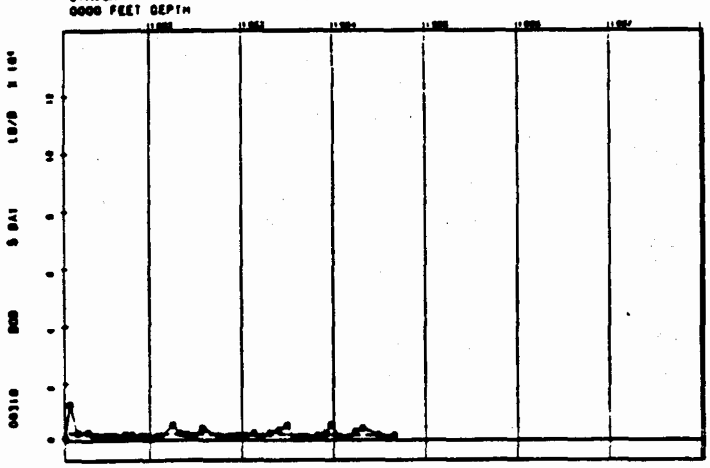


Appendix 4.3 BOD loadings in the Clinton River at M-59 Bridge in Waterford(502), Hamlin Road Bridge(518), and Gratiot Avenue at Mt Clemens(310), in lbs/day, 1974 - 1986.

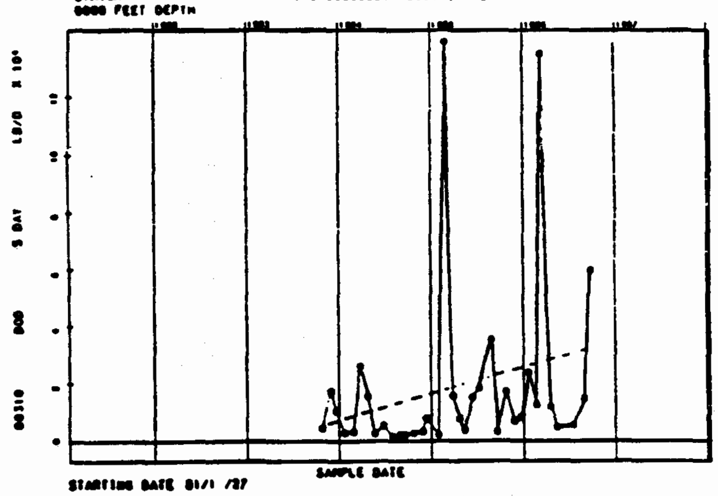
STORET LOADINGS
630329
42 39 37.0 083 23 25.0 2
CLINTON R AT M-59 BRIDGE, WATERFORD TWP. SEC 21
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0224
21MICH HG 04080003
0000 FEET DEPTH



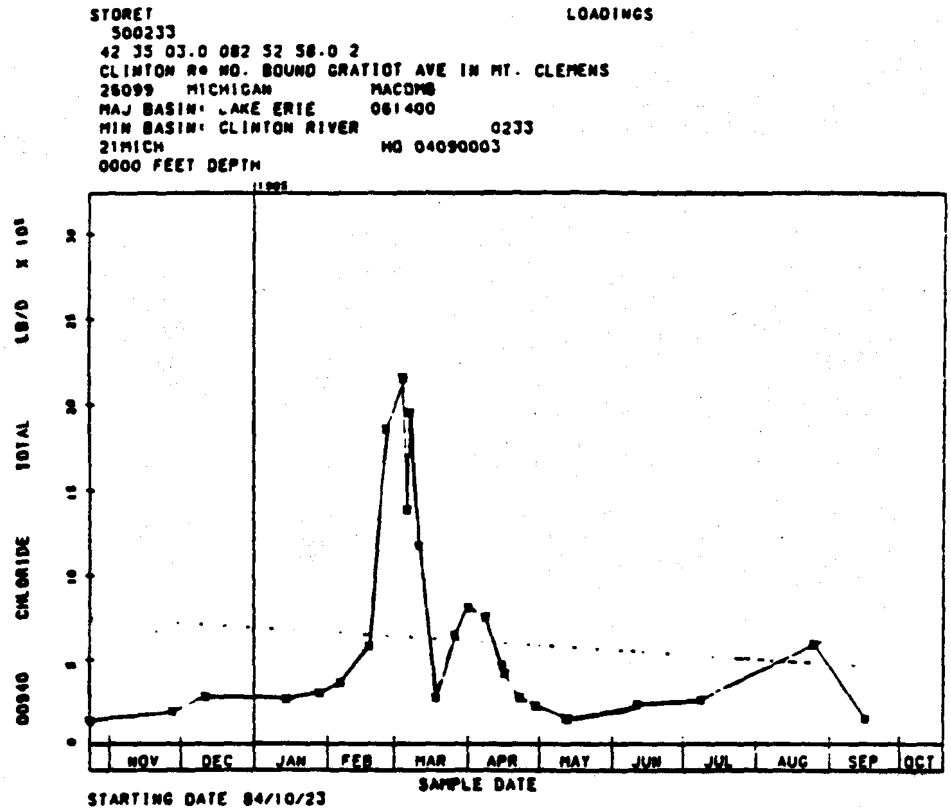
STORET LOADINGS
630252
42 39 02.5 083 10 40.0 2
CLINTON R AT HAMLIN RD BR, AVON TOWNSHIP. SEC 29
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0228
21MICH HG 04080003
0000 FEET DEPTH

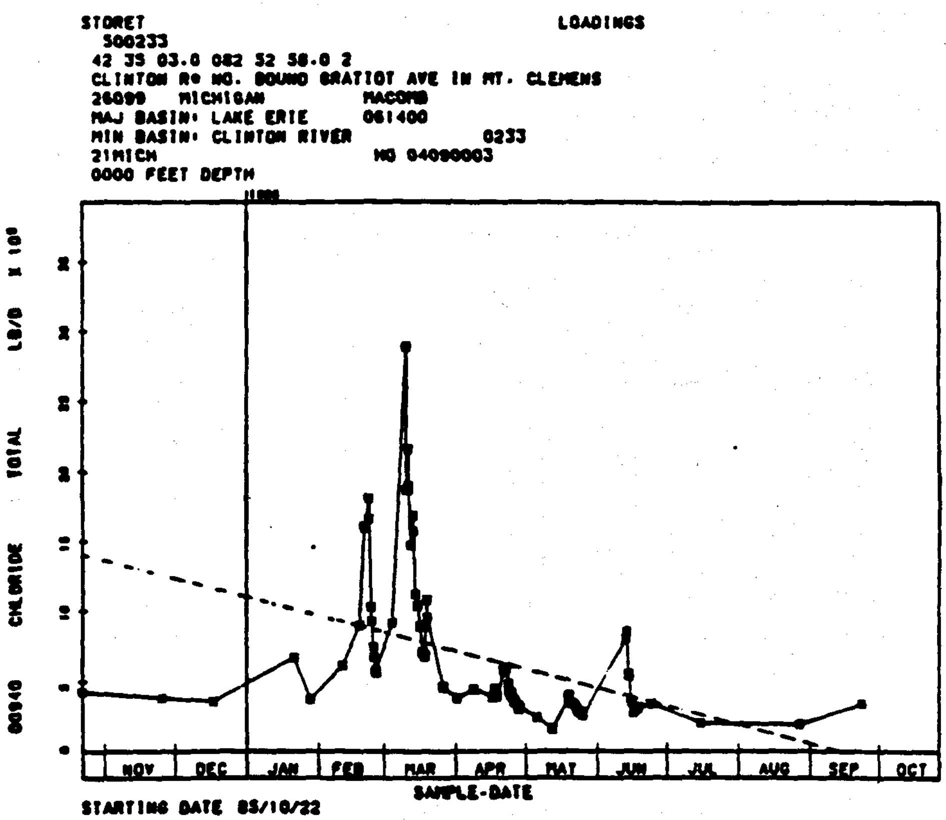


STORET LOADINGS
500233
42 35 03.0 082 52 56.0 2
CLINTON RV NO. BOUND GRATIOT AVE IN MT. CLEMENS
26099 MICHIGAN MACOMB
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0233
21MICH HG 04090003001 0006.610 OFF
0000 FEET DEPTH

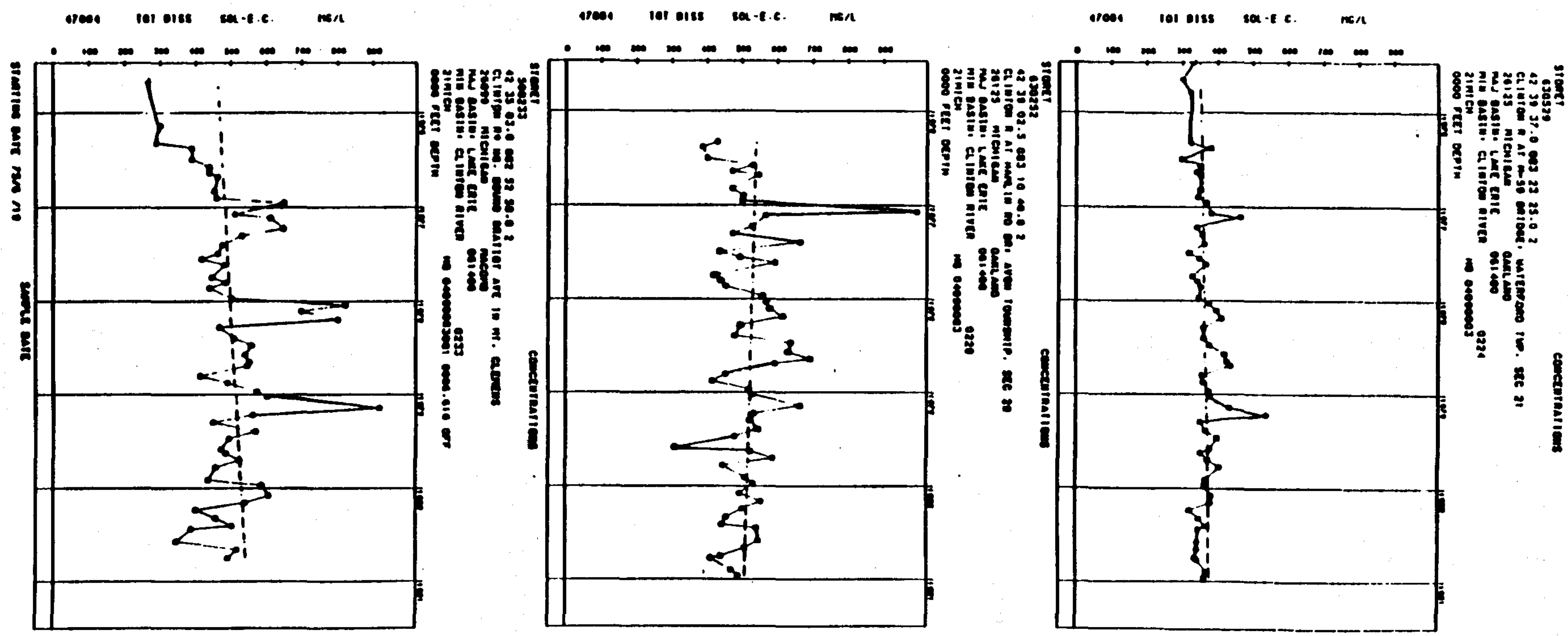


Appendix 4.3 continued

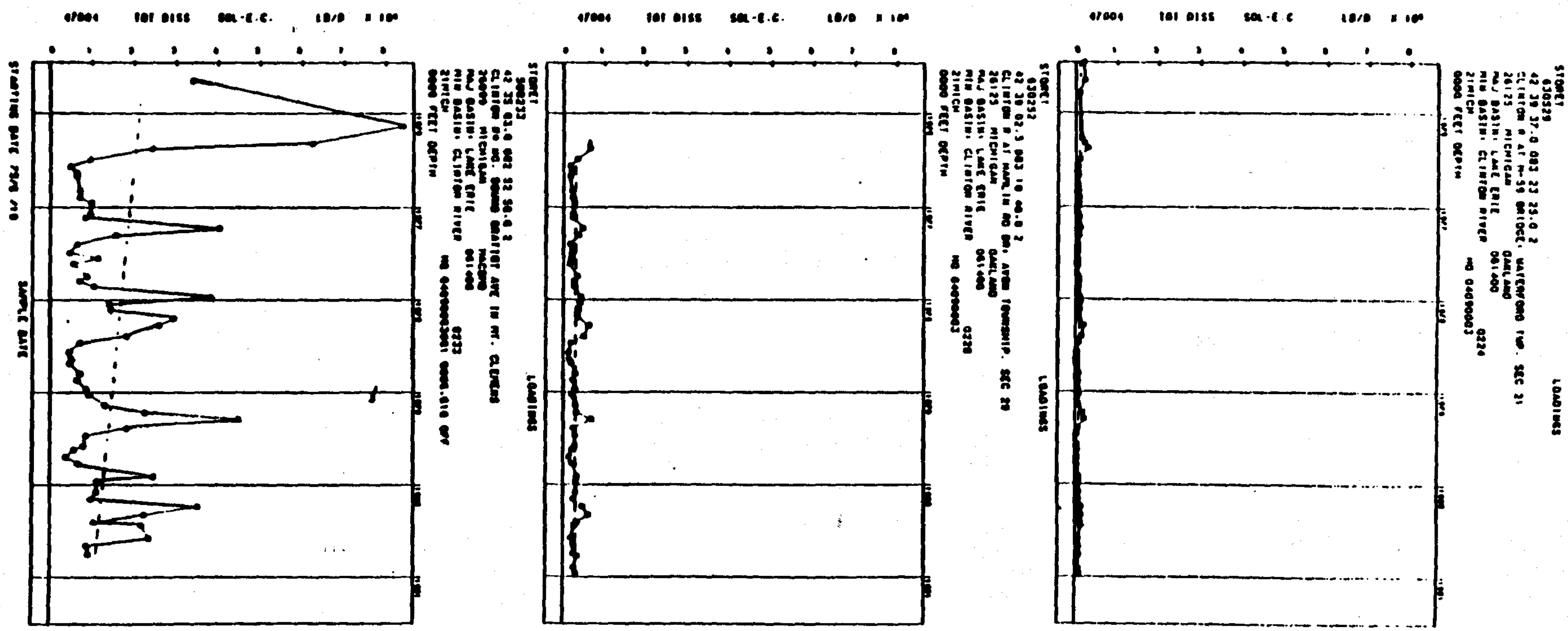




Appendix 4.4 Chloride loadings(lbs/day) in the Clinton River at Gratiot Avenue in Mt. Clemens(310), 1984-1986.

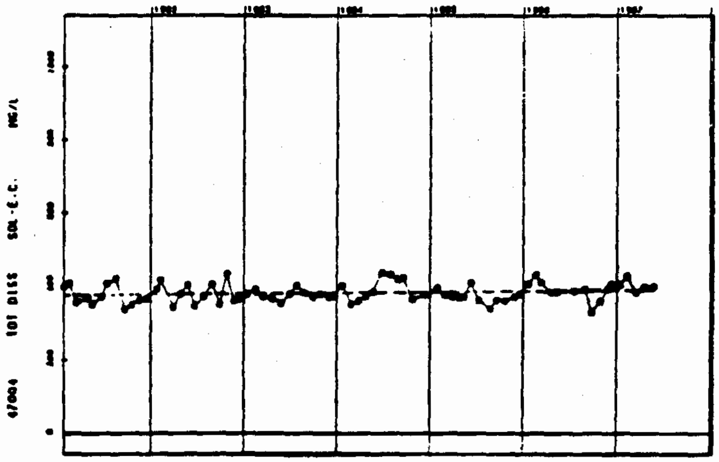


Appendix 4.5 Total dissolved solids concentrations(mg/l) and loadings(lbs/day) in the Clinton River at M-59 Bridge in Waterford(502), Hamlin Road Bridge(518), and Gratiot Avenue in Mt. Clemens(310), 1975 to 1986.

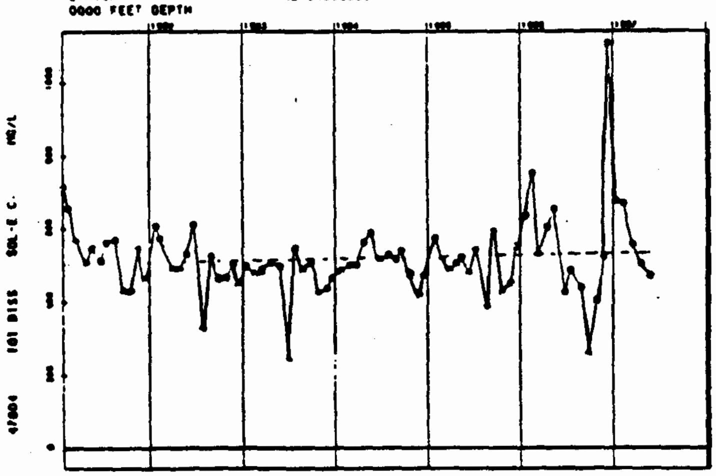


Appendix 4.5 continued

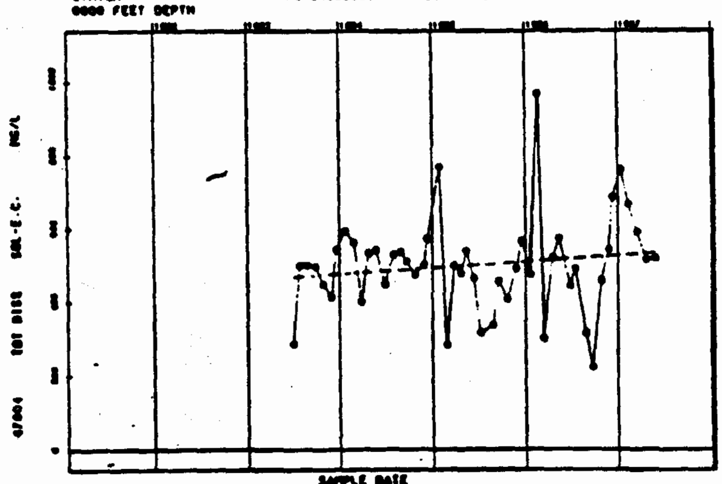
STORET CONCENTRATIONS
630329
42 39 37.0 083 23 25.0 2
CLINTON R AT M-59 BRIDGE; WATERFORD TWP. SEC 21
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0224
21MICH HQ 04090003
0000 FEET DEPTH



STORET CONCENTRATIONS
630252
42 39 02.5 083 10 40.0 2
CLINTON R AT MARLIN RD BR; AVON TOWNSHIP. SEC 29
26125 MICHIGAN OAKLAND
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0228
21MICH HQ 04090003
0000 FEET DEPTH

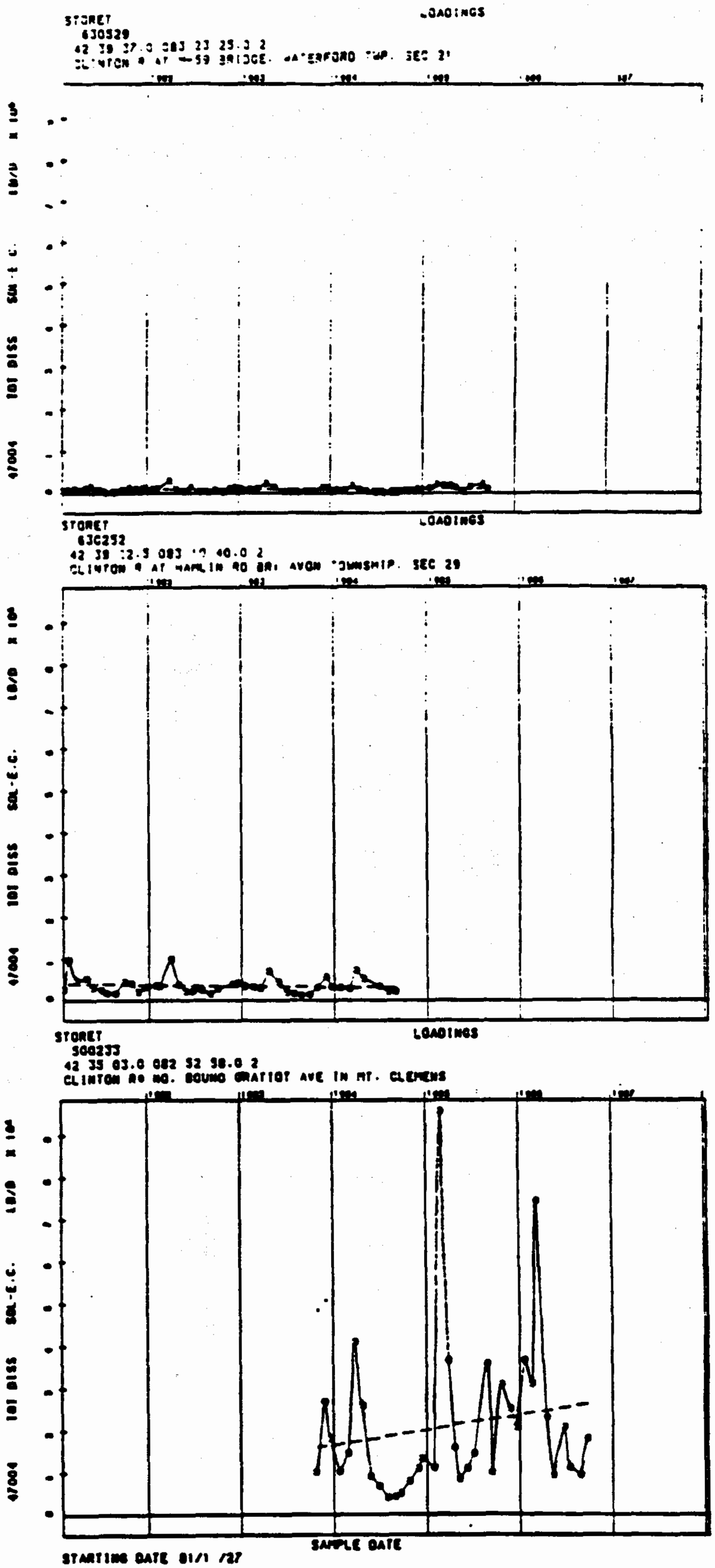


STORET CONCENTRATIONS
500233
42 35 03.0 082 52 30.0 2
CLINTON R@ NO. BOUND GRATIOT AVE IN MT. CLEMENS
26099 MICHIGAN MACOMB
MAJ BASIN: LAKE ERIE 061400
MIN BASIN: CLINTON RIVER 0233
21MICH HQ 04090003001 0006.610 OFF
0000 FEET DEPTH



STARTING DATE 01/1 /27

Appendix 4.5 continued



Appendix 4.5 continued

APPENDIX 4.6. HEAVY METAL CRITERIA FOR CLINTON RIVER WATER ANALYSIS.
Based on rule " 57 " Mi. WQS, 1987.

HARDNESS	CADMIUM	CHROMIUM	COPPER	NICKEL	LEAD	ZINC
Long term safe criteria (No chronic effect) * ug/l *						
@ 300 mg/l	0.9	130.0	58.0	214.0	17.0	249.0
@ 250 mg/l	0.8	111.0	49.0	181.0	13.0	213.0
@ 200 mg/l	0.6	93.0	40.0	148.0	9.0	177.0
@ 150 mg/l	0.5	73.0	30.0	113.0	6.0	138.0
@ 100 mg/l	0.4	52.0	21.0	78.0	3.0	98.0
Acute toxic criteria (96 Hour LC 50) * ug/l *						
@ 300 mg/l	161.0	9083.0	408.0	6684.0	1270.0	2364.0
@ 250 mg/l	129.0	7807.0	344.0	5652.0	961.0	2025.0
@ 200 mg/l	99.0	6487.0	279.0	4603.0	683.0	1675.0
@ 150 mg/l	70.0	5109.0	213.0	3533.0	440.0	1312.0
@ 100 mg/l	43.0	3649.0	145.0	2433.0	236.0	929.0

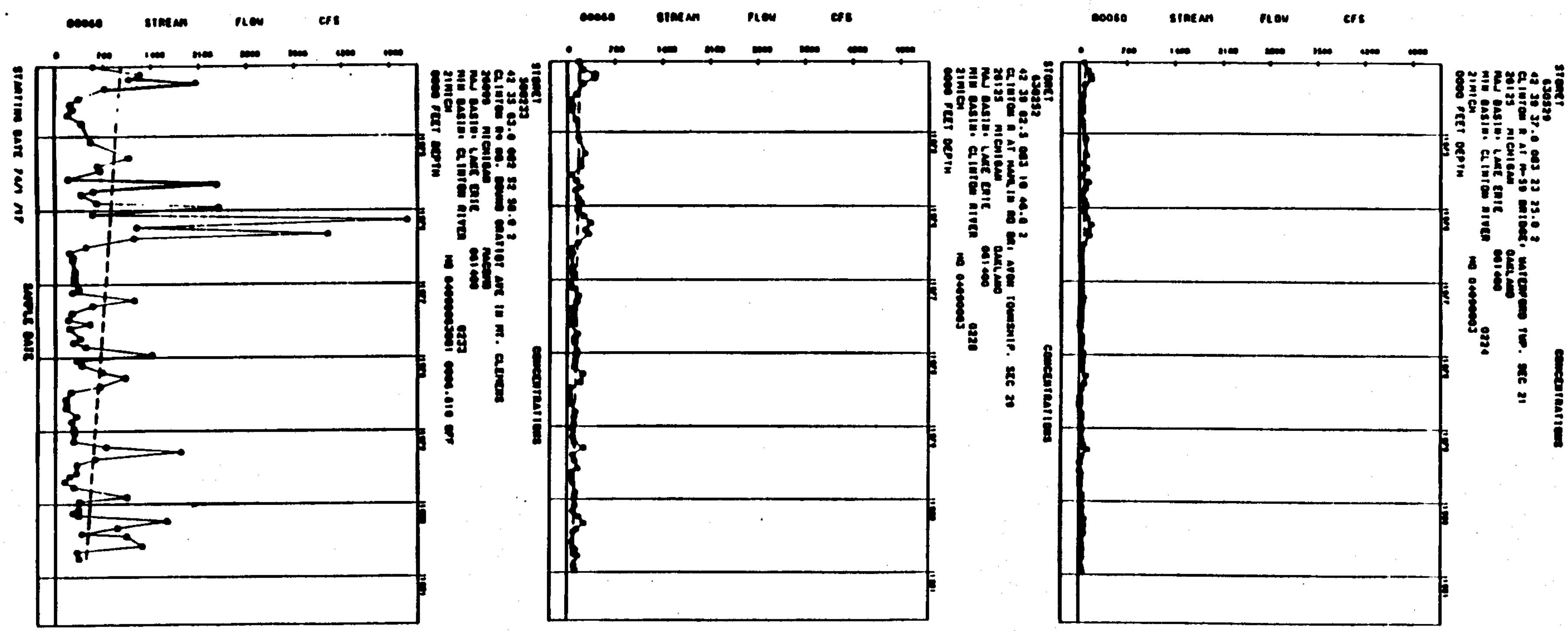
Appendix 4.7. List of References to the background documents which describe the conditions under which the water quality criteria used for the Clinton River apply and the assumptions made in their development.

1. Michigan Department of Natural Resources, Water Resources Commission, General Rules. November 14, 1986. Part 4. Water Quality Standards. Rule 323.1057. Toxic Substances.

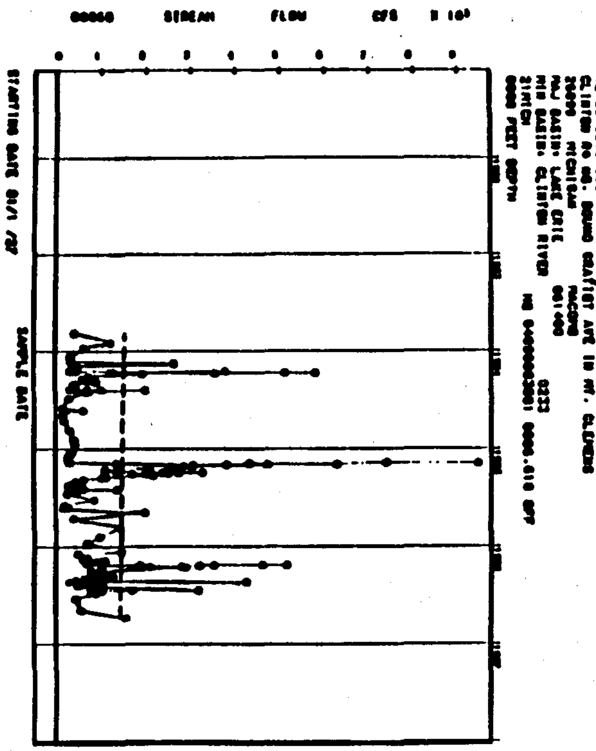
2. State of Michigan, Department of Natural Resources, Environmental Protection Bureau. Guidelines for Rule 57(2). January 2, 1985

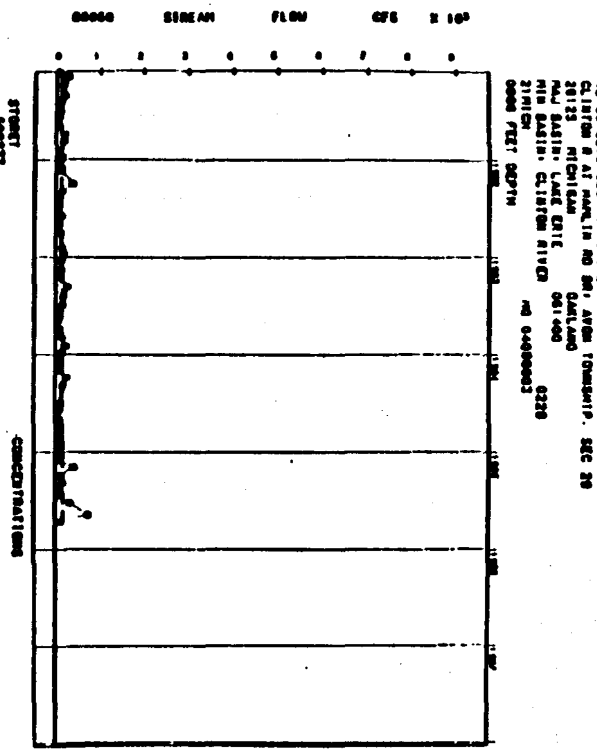
3. Michigan Department of Natural Resources. March 26, 1984. Support Document for the Proposed Rule 57 Package. Environmental Protection Bureau.

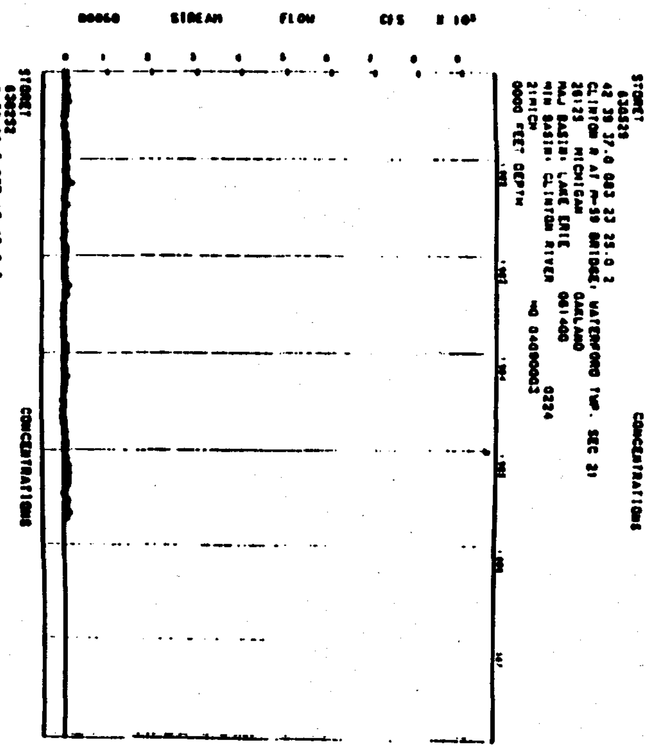
4. Creal, W. and R. Basch. 1981. Water Quality Based Effluent limits for Heavy Metals and Cyanide. Biology Section, Water Quality Division, Michigan Department of Natural Resources, October, 1981.



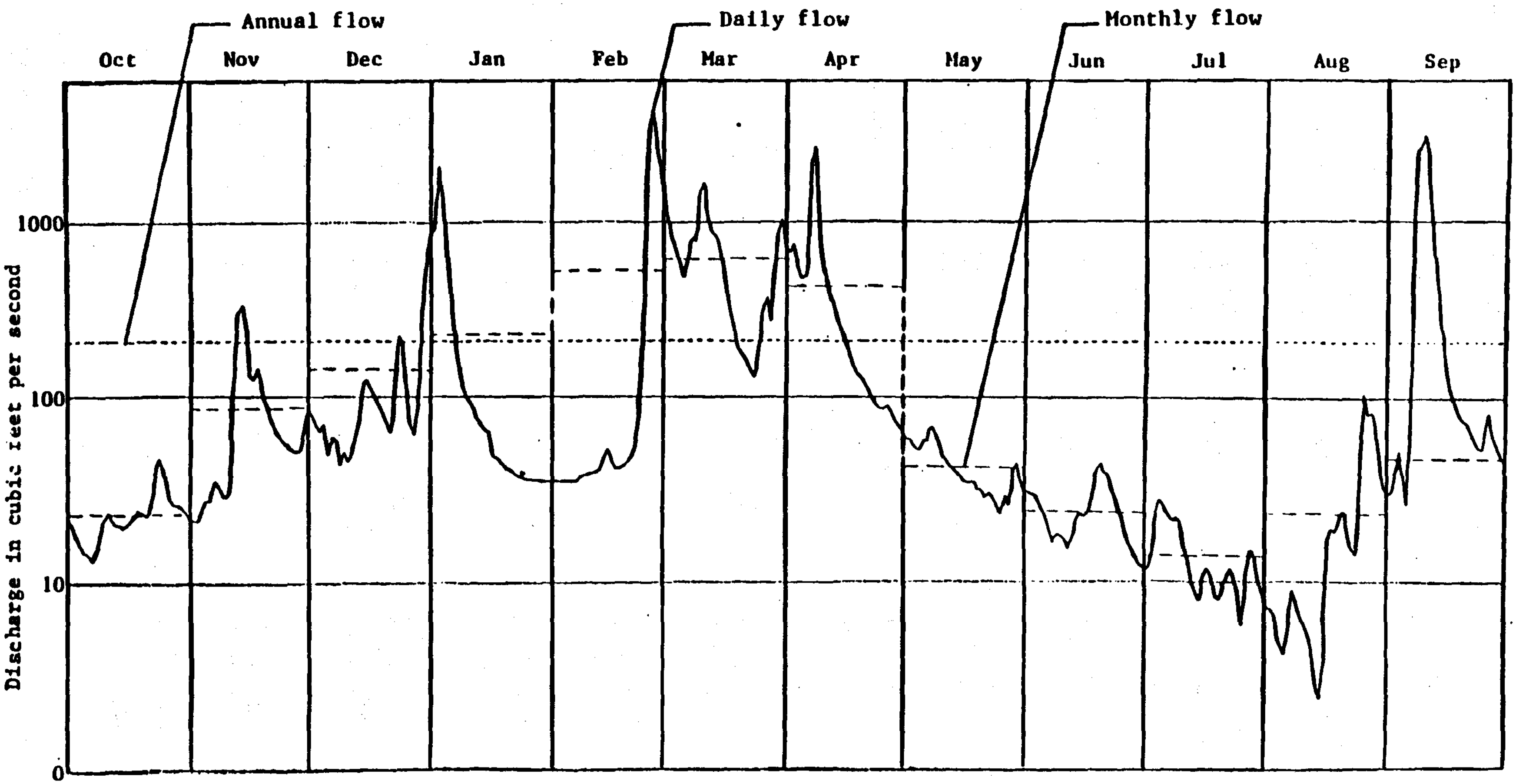
Appendix 4.8 Flow of the Clinton River at M-59 Bridge in Waterford(502), Hamlin Road Bridge(518), and Gratiot Avenue at Mt. Clemens(310), in cubic feet per second, 1974 to 1986.







Appendix 4.8 continued



Appendix 4.8a North Branch Clinton River Average Annual, Monthly, and Daily Flows near Mt. Clemens in water year 1985.
Source: USGS 1987, station # 04164500

Appendix 4.9 Clinton River Macroinvertebrate Communities by River Section, 1972 through 1984.

Quantitative benthic macroinvertebrate sampling in Section 1 Clinton River, natural channel downstream of the spillway (1973-1983). Results in organisms/sq. meter.

Toler. Status	Taxa	1973			1979			1978			
	Map ID	101	105	109	101	105	109	103	108	112	114
	Storet	500213	500214	500000	500213	500214	500000				
	Document	12	12	12	12	12	12	49	49	49	49
	Method	h-dn	h-d	h-d	ponar	ponar	ponar	ponar	ponar	ponar	ponar
T	Turbellaria (flatworms)										
F	Nematoda (roundworms)										113
F	Bryozoa (moss animals)										
T	Oligochaeta (aq earthworms)	105			1147	2080	1204	6	349	63	330
F	Hirudinea (leeches)									6	25
F	Gastropoda (snails)										
F	Ancylidae			33							
F	Hydrobiidae										
F	Lymnaeidae										
T	Physidae	32		16							12
F	Planorbidae										19
T	Valvatidae										
F	Pelecypoda (clams)										
T	Sphaeriidae										
T	Isopoda (sow bugs)										6
F	Amphipoda (scuds)										426
T	Decapoda (crayfish)										
I	Plecoptera (stoneflies)										
I	Perlidae										
F	Ephemeroptera (mayflies)										
F	Baetidae										
F	Caenidae										
I	Ephemeridae							6		107	301
F	Heptageniidae										
I	Leptophlebiidae										
I	Siphlonuridae										
F	Tricorythidae										
F	Odonata (dragonflies, damselflies)										
F	Aeshnidae										
F	Agriidae										
F	Calopterygidae										
F	Coenagriidae	73	24	65							
F	Corduliogastridae										
F	Corduliidae										
F	Gomphidae										
F	Libellulidae							6			
T	Hemiptera (true bugs)										
T	Belostomatidae										
T	Corixidae										
T	Gerridae										
T	Mesoveliidae										
T	Nepidae										
T	Notonectidae										
I	Pleidae										
I	Veliidae										
I	Megaloptera (alderflies)										
F	Trichoptera (caddisflies)										
I	Brachycentridae										
I	Glossosomatidae										
I	Helicopsychidae										
F	Hydropsychidae				14						
I	Hydroptilidae										
I	Leptoceridae										6
I	Limnephilidae										
I	Molannidae										
I	Philopotamidae										
F	Polycentropodidae										12
F	Psychomyiidae			41							
I	Rhyacophilidae										
F	Lepidoptera (aq caterpillars)										
F	Coleoptera (beetles)										
F	Diptera (flies, midges)										
T	Ceratopogonidae										
F	Chironomidae	1107	1227	1330	14			94	25	125	731
F	Culicidae							6		25	
F	Dolichopodidae										
F	Empididae										
F	Heleidae									6	
F	Psychodidae							12			
F	Rhagionidae										
F	Simuliidae										
F	Stratiomyidae										
F	Syrphidae										
F	Tabanidae			6							
F	Tipulidae										

Toler. Status	Taxa								
	Date	1983							
	Map ID	102	104	106	107	108	110	111	113
	Storet								
	Document	52	52	52	52	52	52	52	52
	Method	ponar	ponar	ponar	ponar	ponar	ponar	ponar	ponar
T	Turbellaria (flatworms)	989	2537	430	1462	602	473	1548	1032
T	Nematoda (roundworms)								
F	Bryozoa (moss animals)								
T	Oligochaeta (aq earthworms)								
T	Hirudinea (leeches)								
T	Gastropoda (snails)								
F	Ancylidae								
F	Hydrobiidae								
F	Lymnaeidae								
T	Physidae								
F	Planorbidae								
T	Valvatidae								
F	Pelecypoda (clams)								
T	Sphaeriidae								129
T	Isopoda (sow bugs)								
F	Amphipoda (scuds)								
T	Decapoda (crayfish)								
I	Plecoptera (stoneflies)								
I	Perlidae								
F	Ephemeroptera (mayflies)								
F	Baetidae								
F	Caenidae								
I	Ephemeridae								
F	Heptageniidae								
I	Leptophlebiidae								
I	Siphlonuridae								
F	Tricorythidae								
F	Odonata (dragonflies, damselflies)								
F	Aeshnidae								
F	Agriidae								
F	Calopterygidae								
F	Coenagriidae								
F	Cordulegastridae								
F	Corduliidae								
F	Gomphidae								
F	Libellulidae								
T	Hemiptera (true bugs)								
T	Belostomatidae								
T	Corixidae								
T	Gerridae								
T	Mesoveliidae								
T	Nepidae								
T	Notonectidae								
T	Pleidae								
T	Veliidae								
I	Megaloptera (alderflies)								
F	Trichoptera (caddisflies)								
I	Brachycentridae								
I	Glossosomatidae								
I	Helicopsychidae								
F	Hydropsychidae								
I	Hydroptilidae								
I	Leptoceridae								
I	Limnephilidae								
I	Molannidae								
I	Philopotamidae								
F	Polycentropodidae								
F	Psychomyiidae								
I	Rhyacophilidae								
F	Lepidoptera (aq caterpillars)								
F	Coleoptera (beetles)								
F	Diptera (flies, midges)								
T	Ceratopogonidae								
F	Chironomidae			43	86	66	43	172	817
T	Culicidae		43			129			
F	Dolichopodidae								
F	Empididae								
F	Heleidae								
F	Psychodidae								
F	Rhagionidae								
F	Simuliidae								
F	Stratiomyidae								
T	Syrphidae								
F	Tabanidae								
F	Tipulidae								

Quantitative benthic macroinvertebrate sampling in Section 2 Clinton River, the spillway (1973).
Results in organisms/sq. meter

Toler. Status	Taxa	1973		1973	
	Map ID	201	202	201	202
	Storet	500100	500229	500100	500229
	Document	12	12	12	12
	Method	h-dn	h-d	ponar	ponar
T	Turbellaria (flatworms)				
T	Nematoda (roundworms)				
F	Bryozoa (moss animals)				
T	Oligochaeta (aq earthworms)	242	57	8156	5005
T	Hirudinea (leeches)				
T	Gastropoda (snails)				
F	Ancylidae				
F	Hydrobiidae				
F	Lymnaeidae			14	
T	Physidae				
F	Planorbidae				
T	Valvatidae				
F	Pelecypoda (clams)				
T	Sphaeriidae				
T	Isopoda (sow bugs)				
F	Amphipoda (scuds)	•	•		
T	Decapoda (crayfish)				
I	Plecoptera (stoneflies)				
I	Perlidae				
F	Ephemeroptera (mayflies)				
F	Baetidae				
F	Caenidae				
I	Ephemeridae				
F	Heptageniidae				
I	Leptophlebiidae				
I	Siphlonuridae				
F	Tricorythidae				
F	Odonata (dragonflies, damselflies)				
F	Aeshnidae				
F	Agriidae				
F	Calopterygidae				
F	Coenagriidae	81	•		
F	Cordulegastridae				
F	Corduliidae				
F	Gomphidae				
F	Libellulidae				
T	Hemiptera (true bugs)				
T	Belostomatidae				
T	Corixidae				
T	Gerridae				
T	Mesoveliidae				
T	Nepidae				
T	Notonectidae				
T	Pleidae				
T	Veliidae				
I	Megaloptera (alderflies)				
F	Trichoptera (caddisflies)				
I	Brachycentridae				
I	Glossosomatidae				
I	Helicopsychidae				
F	Hydropsychidae				
I	Hydroptilidae				
I	Leptoceridae				
I	Limnephilidae				
I	Molannidae				
I	Philopotamidae				
F	Polycentropodidae				
F	Psychomyiidae				
I	Rhyacophilidae				
F	Lepidoptera (aq caterpillars)				
F	Coleoptera (beetles)	•			
F	Diptera (flies, midges)				
T	Ceratopogonidae				
F	Chironomidae	2035	1097		29
T	Culicidae				
F	Dolichopodidae				
F	Empididae				
F	Heleidae				
F	Psychodidae				
F	Rhagionidae				
F	Simuliidae				
T	Stratiomyidae				
T	Syrphidae				
F	Tabanidae				
F	Tipulidae				

Qualitative benthic macroinvertebrate sampling in Section 3 Clinton River, Red Run to spillway (1973-1982).
Counts represent number of organisms found, (P)-present, (O)-occasional, (C)-common, (VC)-very common.

Toler. Status	Taxa	1973			1979			1982
	Map ID	301	303	304	302	304	305	302
	Storet	500231	500230	500209	500208	500209	500225	500208
	Document	12	12	12	29	29	29	70
T	Turbellaria (flatworms)							P
T	Nematoda (roundworms)							
F	Bryozoa (moss animals)							
T	Oligochaeta (aq earthworms)	60	75	60	1	1	27	P
T	Hirudinea (leeches)	2	1	5	1	2	1	P
T	Gastropoda (snails)							P
F	Ancylidae	2			2	11	2	P
F	Hydrobiidae							
F	Lymnaeidae	1						
T	Physidae	8	5		2	2	2	
F	Planorbidae						1	
I	Valvatidae							
F	Pelecypoda (Clams)							
T	Sphaeriidae					8	2	
F	Isopoda (sow bugs)			5	1			
F	Amphipoda (scuds)			3	54	10		P
T	Decapoda (crayfish)					1		P
I	Plecoptera (stoneflies)							
I	Perlidae							
F	Ephemeroptera (mayflies)							
F	Baetidae	1	1	1				
F	Caenidae							
I	Ephemeridae							
F	Heptageniidae							
I	Leptophlebiidae							
I	Siphlonuridae							
F	Tricorythidae							
F	Odonata (dragonflies, damselflies)							
F	Aeshnidae		1					
F	Agriidae	2						P
F	Calopterygidae					2	1	P
F	Coenagriidae	17	7	23		3	2	P
F	Cordulegastridae							
F	Corduliidae							
F	Gomphidae							
F	Libellulidae		1	3				
T	Hemiptera (truebugs)							
T	Belostomatidae							
F	Corixidae							
F	Gerridae						1	
F	Mesoveliidae							
F	Nepidae							
F	Notonectidae							
F	Pleidae							
F	Veliidae						1	
I	Megaloptera (alderflies)							
F	Trichoptera (caddisflies)							
I	Brachycentridae							
I	Glossosomatidae							
I	Helicopsychidae							
F	Hydropsychidae			2	6	1		P
I	Hydroptilidae							
I	Leptoceridae							
I	Limnephilidae							
I	Molannidae							
I	Philopotamidae							
F	Polycentropodidae							
F	Psychomyiidae							
I	Rhyacophilidae							
F	Lepidoptera (aq caterpillars)							
F	Coleoptera (beetles)	17		5		1		P
F	Diptera (flies, midges)							
F	Ceratopogonidae							
F	Chironomidae	23		6	61	25	34	P
T	Culicidae							
F	Dolichopodidae							
F	Empididae							
F	Heleidae							
F	Psychodidae							
F	Rhagionidae				2	1		
I	Simuliidae							P
F	Stratiomyidae							
I	Syrphidae							
F	Tabanidae							
F	Tipulidae							

Quantitative benthic macroinvertebrate sampling in Section 3 Clinton River, Red Run to spillway (1973-1979).
Results in organisms/sq. meter.

Toler. Status	Taxa	1973					1979			1975	
	Map ID	301	303	304	305	306	302	304	305	305	306
	Storet	500231	500230	500209	500225	500010	500208	500209	500225	500225	500010
	Document	12	12	12	12	12	29	29	29	12	12
	Method	h-dm	h-d	h-d	h-d	h-d	h-d	h-d	h-d	ponar	ponar
T	Turbellaria (flatworms)					16					
F	Nematoda (roundworms)										
F	Bryozoa (moss animals)										
T	Oligochaeta (aq earthworms)	162	404	33	1405	210	347		57	6800	126133
T	Hirudinea (leeches)	•									
F	Gastropoda (snails)										
F	Ancylidae						347	734	1203		
F	Hydrobiidae										
F	Lymnaeidae									14	
T	Physidae	•	•		106	4			24	57	7
F	Planorbidae					4	6			14	
T	Valvatidae										
F	Pelecypoda (Clams)										
T	Sphaeriidae										
T	Isopoda (sow bugs)										
F	Amphipoda (scuds)						412	33			
T	Decapoda (crayfish)										
I	Plecoptera (stoneflies)										
I	Perlidae										
F	Ephemeroptera (mayflies)										
F	Baetidae							•			
F	Caenidae										
I	Ephemeridae										
F	Heptageniidae										
I	Leptophlebiidae										
I	Siphlonuridae										
F	Tricorythidae										
F	Odonata (dragonflies, damselflies)										
F	Aeshnidae										
F	Agriidae						16				
F	Calopterygidae										
F	Coenagriidae				•	•			57	14	
F	Cordulegastridae										
F	Corduliidae										
F	Gomphidae										
F	Libellulidae										
T	Hemiptera (truebugs)										
T	Belastomatidae										
T	Corixidae										
T	Gerridae										
T	Mesoveliidae										
T	Nepidae										
T	Notonectidae						•				
T	Pleidae										
T	Veliidae										
I	Megaloptera (alderflies)										
F	Trichoptera (caddisflies)										
I	Brachycentridae										
I	Glossosomatidae								•		
I	Helicopsychidae										
F	Hydropsychidae	•				4	606	307	24		
I	Hydroptilidae										
I	Leptoceridae										
I	Limnephilidae										
I	Molannidae										
I	Philopotamidae										
F	Polycentropodidae										
F	Psychomyiidae				•						
I	Rhyacophilidae										
F	Lepidoptera (aq caterpillars)										
F	Coleoptera (beetles)						•				
F	Diptera (flies, midges)										
T	Ceratopogonidae										
F	Chironomidae	2010	1032	3914	404	356	2009	524	307	215	530
T	Culicidae										
F	Dolichopodidae										
F	Empididae										
F	Heleidae										
F	Psychodidae										
F	Rhagionidae	16		16			40	6	8		
F	Simuliidae										
F	Stratiomyidae										
F	Syrphidae										
F	Tabanidae										
F	Tipulidae										

Qualitative benthic macroinvertebrate sampling in Section 4 Clinton River, Red Run to the spillway (1973-1982).
Counts represent number of organisms found, (P)-present, (O)-occasional, (C)-common, (VC)-very common.

Toler. Status	Taxa	401	402	403	404	405	406	407	408	409	406
	Date	1973									1982
	Map ID	401	402	403	404	405	406	407	408	409	406
	Storet						500227				
	Document	17	17	17	17	17	23,12	17	17	17	70
T	Turbellaria (flatworms)										
T	Nematoda (roundworms)										
F	Bryozoa (moss animals)										P
T	Oligochaeta (eg earthworms)	18	3		108	100	27	7	12	500	
T	Hirudinea (leeches)				8						
T	Gastropoda (snails)										P
F	Ancylidae										
F	Hydrobiidae										
F	Lymnaeidae										
T	Physidae	29	11	25	25		2		36		P
F	Planorbidae	1			2						
T	Valvatidae										
F	Pelecypoda (Clams)										
T	Sphaeriidae								1		
T	Isopoda (sow bugs)							10			
F	Amphipoda (scuds)				1			15			
T	Decapoda (crayfish)				4			3	6		P
I	Plecoptera (stoneflies)										
I	Perlidae										
F	Ephemeroptera (mayflies)										
F	Baetidae		1		1			1	1		
F	Caenidae										
I	Ephemeridae										
F	Heptageniidae										
I	Leptophlebiidae										
I	Siphlonuridae										
F	Tricorythidae										
F	Odonata (dragonflies, damselflies)										
F	Aeshnidae				1						
F	Agriidae										
F	Calopterygidae										
F	Coenagriidae	4	17		35		7	10	1		P
F	Cordulegastridae										
F	Corduliidae										
F	Gomphidae										
F	Libellulidae										
T	Hemiptera (truebugs)										
T	Belostomatidae		1		1						
T	Corixidae	1									
T	Gerridae										
T	Mesoveliidae										
T	Nepidae										
T	Notonectidae		1						1		
T	Pleidae										
I	Veliidae										
I	Megaloptera (alderflies)										
F	Trichoptera (caddisflies)										
I	Brachycentridae										
I	Glossosomatidae										
I	Helicopsychidae										
F	Hydropsychidae								2		
I	Hydroptilidae							1			
I	Leptoceridae										
I	Limnephilidae										
I	Molannidae										
I	Philopotamidae										
F	Polycentropodidae										
F	Psychomyiidae										
I	Rhyacophilidae										
F	Lepidoptera (eg caterpillars)										
F	Coleoptera (beetles)	12	19	1	4		4	3	7		
F	Diptera (flies, midges)										
T	Ceratopogonidae	1	1								
F	Chironomidae	212	60	50	94	4		10	4	31	P
T	Culicidae	5			1						
F	Dolichopodidae										
F	Empididae										
F	Heleidae										
F	Psychodidae										
F	Rhagionidae										
F	Simuliidae										
F	Stratiomyidae										
T	Syrphidae				1						
F	Tabanidae										
F	Tipulidae										

Quantitative benthic macroinvertebrate sampling in Section 4 Clinton River, Red Run to the spillway (1973). Results in organisms/sq. meter.

Toler. Status	Taxa	1973
	Date	1973
	Map ID	406
	Storet	500227
	Document	23,12
	Method	h-dm
T	Turbellaria (flatworms)	
F	Nematoda (roundworms)	
F	Bryozoa (moss animals)	
T	Oligochaeta (aq earthworms)	170
T	Hirudinea (leeches)	
F	Gastropoda (snails)	
F	Ancylidae	
F	Hydrobiidae	
F	Lymnaeidae	
T	Physidae	
F	Planorbidae	
T	Valvatidae	
F	Pelecypoda (Clams)	
T	Sphaeriidae	
T	Isopoda (sow bugs)	
F	Amphipoda (scuds)	
T	Decapoda (crayfish)	
I	Plecoptera (stoneflies)	
I	Perlidae	
F	Ephemeroptera (mayflies)	
F	Baetidae	
F	Caenidae	
I	Ephemeridae	
F	Heptageniidae	
I	Leptophlebiidae	
I	Siphlonuridae	
F	Tricorythidae	
F	Odonata (dragonflies, damselflies)	
F	Aeshnidae	
F	Agriidae	
F	Calopterygidae	
F	Coenagriidae	24
F	Cordulegastridae	
F	Corduliidae	
F	Gomphidae	
F	Libellulidae	
T	Hemiptera (truebugs)	
T	Belostomatidae	
T	Corixidae	
T	Gerridae	
T	Mesoveliidae	
T	Nepidae	
T	Notonectidae	
T	Pleidae	
T	Veliidae	
I	Megaloptera (alderflies)	
F	Trichoptera (caddisflies)	
I	Brachycentridae	
I	Glossosomatidae	
I	Helicopsychidae	
F	Hydropsychidae	
I	Hydroptilidae	
I	Leptoceridae	
I	Limnephilidae	
I	Molannidae	
I	Philopotamidae	
F	Polycentropodidae	
F	Psychomyiidae	
I	Rhyacophilidae	
F	Lepidoptera (aq caterpillars)	
F	Coleoptera (beetles)	
F	Diptera (flies, midges)	
T	Ceratopogonidae	
F	Chironomidae	
T	Culicidae	
F	Dolichopodidae	
F	Empididae	
F	Heleidae	
F	Psychodidae	
F	Rhagionidae	
F	Simuliidae	
F	Stratiomyidae	
F	Syrphidae	
[illegible]	[illegible]	

Qualitative benthic macroinvertebrate sampling in Section 5 Clinton River, upstream of Red Run (1972-1984).
Counts represent number of organisms found, (P)-present, (O)-occasional, (C)-common, (VC)-very common.

Toler. Status	Taxa	S11	S12	S13	S14	S15	S17	S18	S21	S22	S23	S34	S35	S01
	Date	1972												
	Map ID	S11	S12	S13	S14	S15	S17	S18	S21	S22	S23	S34	S35	S01
	Storet	630631	630600	630599	630632		630633	630595	630594		630635	630622	630636	630623
	Document	10	10	10	10	10	10	10	10	9,10	9	9	9 R-L	12
T	Turbellaria (flatworms)	O												
T	Nematoda (roundworms)													
F	Bryozoa (moss animals)	C												
T	Oligochaeta (aq earthworms)	O	C	O	VC	VC	VC	VC	VC	C		C	O-O	
T	Hirudinea (leeches)		P						P	P		O		
T	Gastropoda (snails)													
F	Ancylidae							VC	VC	VC			C-C	
F	Hydrobiidae	O												
F	Lymnaeidae													1
T	Physidae			VC				C	VC	VC		C	C-C	
F	Planorbidae													
T	Valvatidae	O												
F	Pelecypoda (Clams)													
T	Sphaeriidae	O										P		
T	Isopoda (sow bugs)	O										P	M-P	
F	Amphipoda (scuds)	VC	C						P			P	C-O	15
T	Decapoda (crayfish)		C											2
I	Plecoptera (stoneflies)													
I	Perlidae													3
F	Ephemeroptera (mayflies)													
F	Baetidae								C				P-M	54
F	Caenidae													1
I	Ephemeridae													
F	Heptageniidae											O	M-C	1
I	Leptophlebiidae													
I	Siphlonuridae													
F	Tricorythidae													
F	Odonata (dragonflies, damselflies)													
F	Aeshnidae													4
F	Agriidae								C	P		P		
F	Calopterygidae													19
F	Coenagriidae	O	O	VC	VC	VC	O	C	VC	O				
F	Cordulegastridae													
F	Corduliidae													
F	Gomphidae													
F	Libellulidae													
T	Hemiptera (truebugs)													
T	Belostomatidae			C	P				P	P		P		
T	Corixidae			VC	VC	O			O	VC		O	M-O	
T	Gerridae													
T	Mesoveliidae													
T	Nepidae			P										1
T	Notonectidae													
T	Pleidae													
T	Veliidae													
I	Megaloptera (alderflies)													
F	Trichoptera (caddisflies)													
I	Brachycentridae													15
I	Glossosomatidae													
I	Helicopsychidae													
F	Hydropsychidae	C							VC	VC		O	O-O	19
I	Hydroptilidae													
I	Leptoceridae													
I	Limnephilidae													23
I	Molannidae													
I	Philopotamidae													1
F	Polycentropodidae													
F	Psychomyiidae													
I	Rhyacophilidae													
F	Lepidoptera (aq caterpillars)													
F	Coleoptera (beetles)		P	C					O	P				2
F	Diptera (flies, midges)													
T	Ceratopogonidae													
F	Chironomidae	C	C	C	C	C	C	C	VC	VC		C	C-C	6
T	Culicidae													
F	Dolichopodidae													
F	Empididae													
F	Heleidae													
F	Psychodidae													
F	Rhagionidae								O					
F	Simuliidae	O						O						25
F	Stratiomyidae													
T	Syrphidae													
F	Tabanidae													
F	Tipulidae								P	P		P		

Appendix 4.9 continued

Toler. Status	Taxa	S03	S04	S06	S07	S08	S09	S10	S11	S12	S13	S14	S16	S17	S18
	Date					1973									1973
	Storet	630624	630625	630626	630627	630628	630629	630630	630631	630600	630599	630632	630597	630633	630595
	Document	12	12	12	12	12	12	12	12	12	12	12	12	12	12
T	Turbellaria (flatworms)		1				8	10	5						
T	Nematoda (roundworms)														
F	Bryozoa (moss animals)														
T	Oligochaeta (aq earthworms)			4	2					8	100	31	100	40	35
T	Hirudinea (leeches)						1			1					1
T	Gastropoda (snails)														
F	Ancylidae														2
F	Hydrobiidae														
F	Lymnaeidae	1			1										
T	Physidae						3	5			16	5	7		17
F	Planorbidae						1	1			2				5
T	Valvatidae														
F	Pelecypoda (Clams)								4						
T	Sphaeriidae		2	6											
T	Isopoda (sow bugs)							10	4						
F	Amphipoda (scuds)		12	11	25	21	21	24	11	2					
T	Decapoda (crayfish)	1	1			2	4	1	1	7	2				2
I	Plecoptera (stoneflies)														
I	Perlidae									8					
F	Ephemeroptera (mayflies)														
F	Baetidae	15	5	6	1	4		8							
F	Caenidae	1	3	2	1	2			3						
I	Ephemeridae														
F	Heptageniidae	4	1	12		6		11							
I	Leptophlebiidae														
I	Siphlonuridae														
F	Tricorythidae		3												
F	Odonata (dragonflies, damselflies)														
F	Aeshnidae						1				4		1		5
F	Agriidae	5				1		1							
F	Calopterygidae														
F	Coenagriidae		5	3	6	23	4	5	8		6	8	6	5	3
F	Cordulegastridae														
F	Corduliidae				1										
F	Gomphidae														
F	Libellulidae														3
T	Hemiptera (truebugs)														
T	Belostomatidae						2	1			2				
T	Corixidae			1		17	3	12				1			1
T	Gerridae						4	3	2						1
T	Mesoveliidae								2				1		
T	Nepidae														
T	Notonectidae														
T	Pleidae														
T	Veliidae														
I	Megaloptera (alderflies)								1						
F	Trichoptera (caddisflies)														
I	Brachycentridae														
I	Glossosomatidae														
I	Helicopsychidae														
F	Hydropsychidae	8	88	15	37	1	6	12	10						
I	Hydroptilidae														
I	Leptoceridae		2		8	10	1	2	1						
I	Limnephilidae														
I	Molannidae														
I	Philopotamidae	33													
F	Polycentropodidae														
F	Psychomyiidae														
I	Rhyacophilidae														
F	Lepidoptera (aq caterpillars)						1								
F	Coleoptera (beetles)	16	2	2			7	7			2	2		1	8
F	Diptera (flies, midges)														
T	Ceratopogonidae														
F	Chironomidae	4	13	5	23	8	3	4	1	3				14	1
T	Culicidae														
F	Dolichopodidae														
F	Empididae														
F	Heleidae														
F	Psychodidae														
F	Rhagionidae		1		1										
F	Simuliidae	3	4					10	19						
F	Stratiomyidae														
T	Syrphidae														
F	Tabanidae							1							
F	Tipulidae	7							1				3		

Appendix 4.9 continued

Toler. Status	Taxa	S19	S20	S21	S23	S24	S25	S26	S27	S30	S31	S32	S33	S34	S35
	Date	1975													
	Storet	630252	630037	630594	630635	630313	630614	630615	630616	630618	630619	630620	630621	630622	630636
	Document	12	12	12	12	13	13	13	13	13	13	13	13	12	12
T	Turbellaria (flatworms)					C		C	P				O	P	
T	Nematoda (roundworms)														
F	Bryozoa (moss animals)					P					P		P		
T	Oligochaeta (aq earthworms)	100	30	9	50		P	VC	C	O		VC	VC	125	16
T	Hirudinea (leeches)		3	4	5		C	C				P	O	3	2
T	Gastropoda (snails)														
F	Ancylidae				1				O	O	P		P	1	
F	Hydrobiidae					O			O		P				
F	Lymnaeidae	3													
T	Physidae	10	5	5	1	O	O			C	O	P	O	3	1
F	Planorbidae	1					C	P							
T	Valvatidae														
F	Pelecypoda (Clams)														
T	Sphaeriidae							C	VC	O	P		P		
T	Isopoda (sow bugs)		3				VC	O	C	P	VC	C	C	P	
F	Amphipoda (scuds)					VC	O	O	O	O	O	O	P	25	
T	Decapoda (crayfish)	2	3	3	3			VC	O	O	VC	VC	P	1	3
I	Plecoptera (stoneflies)														
I	Perlidae									O	O	O			
F	Ephemeroptera (mayflies)														
F	Baetidae					P	C	C	VC	C	P	VC	VC	21	14
F	Caenidae						P								
I	Ephemeridae														
F	Heptageniidae					C	P	VC	VC	C	C		O	1	
I	Leptophlebiidae														
I	Siphlonuridae														
F	Tricorythidae														
F	Odonata (dragonflies, damselflies)														
F	Aeshnidae	2	1	4				O	P						1
F	Agriidae		7	12	6										1
F	Calopterygidae						P		O	O	P	P		2	
F	Coenagriidae	13	2	4		O	C								
F	Corduliegastridae														
F	Corduliidae						P								
F	Gomphidae														
F	Libellulidae	5													
T	Hemiptera (truebugs)														
T	Belostomatidae	1	2	1			P								
T	Corixidae	1	5				P	O		O					
T	Gerridae		2						O	P	O				
T	Mesoveliidae														
T	Nepidae									P					
T	Notonectidae	2	2												
T	Pleidae														
T	Veliidae								O						
I	Megaloptera (alderflies)										O	O	P		
F	Trichoptera (caddisflies)														
I	Brachycentridae								O						
I	Glossosomatidae										O				
I	Helicopsychidae														
F	Hydropsychidae					VC	VC	VC	VC	VC	VC	VC	O	16	2
I	Hydroptilidae														
I	Leptoceridae					C		P					P		
I	Limnephilidae								C	O					
I	Molannidae														
I	Philopotamidae														
F	Polycentropodidae								O						
F	Psychomyiidae														
I	Rhyacophilidae														
F	Lepidoptera (aq caterpillars)														
F	Coleoptera (beetles)	5	13	2			P		VC	O	O	O	O		2
F	Diptera (flies, midges)														
T	Ceratopogonidae														
F	Chironomidae			5		VC	VC	VC	VC	C*	VC	VC	VC	27	30
T	Culicidae														
F	Dolichopodidae														
F	Empididae										O				
F	Heleidae														
F	Psychodidae														
F	Rhagionidae								O	O	F	C	F	1	
F	Simuliidae					VC	C	C	O	F	P	O	P		
F	Stratiomyidae														
T	Syrphidae														
F	Tabanidae									F					
F	Tipulidae		1	1					C		O	O	O		

Toler. Status	Taxa	1975 S36 630637 Doc. 12	1975 S37 630606 Doc. 12	1975 S39 500201 Doc. 12	1975 S43 500202 Doc. 12	1975 S44 500203 Doc. 12	1975 S45 500224 Doc. 12	1975 S46 500205 Doc. 12	1975 S47 500047 Doc. 12	1976 S10 630630 Doc. 31	1976 S13 630539 Doc. 31	1976 S17 630635 Doc. 31	S10 630630 Doc. 31
T	Turbellaria (flatworms)												
T	Nematoda (roundworms)												
F	Bryozoa (moss animals)												
T	Oligochaeta (aq earthworms)	7		10	9	13		27	26	1	100	119	91
T	Hirudinea (leeches)	2	3		1	4	1	2		32			
T	Gastropoda (snails)												
F	Ancylidae			4		2							
F	Hydrobiidae												
F	Lymnaeidae												
T	Physidae	3		8	1	2	2	8	9			1	4
F	Planorbidae												
T	Valvatidae												
F	Pelecypoda (Clams)												
T	Sphaeriidae												2
T	Isopoda (sow bugs)			1				2					1
F	Amphipoda (scuds)		4	5	5	20	3	11	4	55	10		33
T	Decapoda (crayfish)	3	3	3	3	5	3	3			1		1
I	Plecoptera (stoneflies)												
I	Perlidae												
F	Ephemeroptera (mayflies)												
F	Baetidae		9	17		2		2				1	13
F	Caenidae												
I	Ephemeridae									2			
F	Heptageniidae									2			5
I	Leptophlebiidae												
I	Siphlonuridae										1		
F	Tricorythidae												
F	Odonata (dragonflies, damselflies)												
F	Aeshnidae	1	4	2	1	1				2			3
F	Agriidae	15	8	6	3	9	5	15	2				2
F	Calopterygidae												
F	Coenagriidae		7	26	8	1	6	2	2	16	9	10	1
F	Cordulegastridae												
F	Corduliidae												
F	Gomphidae												
F	Libellulidae												1
T	Hemiptera (truebugs)												
T	Belostomatidae									1			1
T	Corixidae									1		1	11
T	Gerridae	1			2		3						
T	Mesoveliidae									1			
T	Nepidae					1						3	1
T	Notonectidae												
T	Pleidae												
T	Veliidae												
I	Megaloptera (alderflies)				1								
F	Trichoptera (caddisflies)												
I	Brachycentridae												
I	Glossosomatidae												
I	Helicopsychidae												
F	Hydropsychidae		31	8		5	13	1	7	4			10
I	Hydroptilidae												
I	Leptoceridae												1
I	Limnephilidae												2
I	Molannidae												
I	Philopotamidae												
F	Polycentropodidae												
F	Psychomyiidae												
I	Rhyacophilidae												
F	Lepidoptera (aq caterpillars)					1				2		1	1
F	Coleoptera (beetles)	10	1	9	1	1		9				1	4
F	Diptera (flies, midges)												
T	Ceratopogonidae												
F	Chironomidae	6	11	34	9	36	6	29	25	8	10	15	33
T	Culicidae												
F	Dolichopodidae											1	
F	Empididae												
F	Heleidae												
F	Psychodidae												
F	Rhagionidae			1		1							
F	Simuliidae	1								10			4
F	Stratiomyidae						1						
T	Syrphidae												
F	Tabanidae												
F	Tipulidae		1	1									

Toler. Status	Taxa	1977		1978				1979				
	Map ID	513	517	510	513	517	518	546	547	602	604	606
	Storet	630599	630633	630630	630599	630633	630595	500205	500047		630625	630626
	Document	31	31	31	31	31	31	29	29	70	70	70
F	Turbellaria (flatworms)									P	C	F
T	Nematoda (roundworms)											
F	Bryozoa (moss animals)											F
T	Oligochaeta (aq earthworms)	22	46		11	11	1		2	P	F	
T	Hirudinea (leeches)						2	2	1	P	C	
T	Gastropoda (snails)											
F	Ancylidae								1	P		
F	Hydrobiidae											
F	Lymnaeidae			1						P	P	F
T	Physidae	7	3	3	4	6		3	1		P	
F	Planorbidae										P	F
T	Valvatidae											
F	Pelecypoda (Clams)											
T	Sphaeriidae			3		1				P	P	F
T	Isopoda (sow bugs)								1		F	F
F	Amphipoda (scuds)			24				20	50		F	F
T	Decapoda (crayfish)				1	1	4	1	1	P	P	F
I	Plecoptera (stoneflies)											
I	Perlidae									P		
F	Ephemeroptera (mayflies)											
F	Baetidae		1	1			10	2		C	P	
F	Caenidae											F
I	Ephemeridae			1								
F	Heptageniidae			3						C	P	F
I	Leptophlebiidae									P		
I	Siphlonuridae									UC	P	
F	Tricorythidae									P	F	
F	Odonata (dragonflies, damselflies)											
F	Aeshnidae	3		4	1					P		F
F	Agriidae						1	4			F	
F	Calopterygidae			2		2	1		2			
F	Coenagriidae	6	23	5	4	3	2				P	F
F	Cordulegastridae					2						
F	Corduliidae											
F	Gomphidae											
F	Libellulidae	1	1									
T	Hemiptera (truebugs)											
T	Belostomatidae	2		2			2					
T	Corixidae	3	2			1	1			P		
T	Gerridae			4			2			F		F
T	Mesoveliidae									P	P	F
T	Nepidae	1	1	1			1					
T	Notonectidae											
T	Pleidae		1									
T	Veliidae			1								
I	Megaloptera (alderflies)									P		
F	Trichoptera (caddisflies)											
I	Brachycentridae									P		
I	Glossosomatidae											
I	Helicopsychidae									C	F	
F	Hydropsychidae			3		1	7	44	23	C	F	F
I	Hydroptilidae						2					
I	Leptoceridae			1							F	
I	Limnephilidae											
I	Molannidae			1								
I	Philopotamidae									P	F	
F	Polycentropodidae											
F	Psychomyiidae											
I	Rhyacophilidae											
F	Lepidoptera (aq caterpillars)	2		3								
F	Coleoptera (beetles)	4	1	3					1	F	F	F
F	Diptera (flies, midges)											
T	Ceratopogonidae								1			
F	Chironomidae	37	23	2	5	20	60	57	23	P	F	F
T	Culicidae	3										
F	Dolichopodidae	5										
F	Empididae		1			4						
F	Heleidae											
F	Psychodidae											
F	Rhagionidae							2	8			
F	Simuliidae					1	3			P	14	0
F	Stratiomyidae											
T	Syrphidae											
F	Tabanidae						2					
F	Tipulidae					2						

	Date	1982													1982
	Map ID	S07	S08	S09	S10	S11	S13	S14	S16	S17	S19	S20	S34	S35	S36
	Storet	630427	630628	630629	630630	630631	630819	630632	630597	630633	630282	630067	630628	630636	630637
Toler. Status	Taxa / Document	70	70	70	70	70	70	70	70	70	70	70	70	70	70
T	Turbellaria (flatworms)	P	P	P	P	P	P	P					P	P	
T	Nematoda (roundworms)														
F	Bryozoa (moss animals)							P				P	P	P	P
T	Oligochaeta (aq earthworms)		P		P		P		P		P	P	P		
T	Hirudinea (leeches)			P		P	P	P	P		P	P	P	P	P
T	Gastropoda (snails)		P												
F	Ancylidae							P	P	P	P	P		P	P
F	Hydrobiidae														
F	Lymnaeidae	P								P					
T	Physidae	P		P	P	P	P	P	P			P	P		P
F	Planorbidae						P	P	P						
T	Valvatidae														
F	Pelecypoda (Clams)														
T	Sphaeriidae	P		P	P	P	P	P							
T	Isopoda (sow bugs)	P	P	P	C	P							P	P	P
F	Amphipoda (scuds)	P	VC	P	VC	P						P	P	P	P
T	Decapoda (crayfish)		P	P	P	P	P	P	P	P	P	P	P	P	P
I	Plecoptera (stoneflies)														P
I	Perlidae												P	P	
F	Ephemeroptera (mayflies)														
F	Baetidae				P	P				P	P	P	P	P	VC
F	Caenidae	P	P		P	P							P		
I	Ephemeridae														
F	Heptageniidae	P	P	P	P	P							P		O
I	Leptophlebiidae														
I	Siphlonuridae														
F	Tricorythidae			P											P
F	Odonata (dragonflies, damselflies)														
F	Aeshnidae						P		P		P	P			
F	Agriidae				P					P	P	P		P	P
F	Calopterygidae														P
F	Coenagriidae	P	P	P			P	P	P	P	P				P
F	Cordulegastridae														
F	Corduliidae														
F	Gomphidae														
F	Libellulidae														
T	Hemiptera (truebugs)														
T	Belostomatidae			P											
T	Corixidae		P	P	P	P	P		P						P
T	Gerridae	P	P		P		P			P	P	P			P
T	Mesoveliidae	P	P	P	P	P	P		P		P				P
T	Nepidae														
T	Notonectidae								P						
T	Pleidae										P				
T	Veliidae														
I	Megaloptera (alderflies)	P	P												
F	Trichoptera (caddisflies)														
I	Brachycentridae														
I	Glossosomatidae														
I	Helicopsychidae			P	P								P		
F	Hydropsychidae	P	P	P	P	P				P	P	P	P	P	P
I	Hydroptilidae														
I	Leptoceridae				P										
I	Limnephilidae			P											
I	Molannidae														
I	Philopotamidae	P											P		
F	Polycentropodidae														
F	Psychomyiidae														
I	Rhyacophilidae														
F	Lepidoptera (aq caterpillars)						P								
F	Coleoptera (beetles)	O	P	P	P			P	P		P	P	P	P	P
F	Diptera (flies, midges)														
T	Ceratopogonidae														
F	Chironomidae	P	P	P	P	P	P	P	P	P	P	P	P	P	P
T	Culicidae														
F	Dolichopodidae														
F	Empididae									P					
F	Heleidae														
F	Psychodidae														
F	Rhagionidae												P	P	VC
F	Simuliidae			P	C	P						P	P	P	VC
F	Stratiomyidae														
T	Syrphidae														
F	Tabanidae														
F	Tipulidae											P	P	P	P

Toler. Status	Taxa	S37	S39	S43	S46	S47	S38	S39	S40	S41	S42	S20	S29
	Date						1983					1984	
	Map ID	S37	S39	S43	S46	S47	S38	S39	S40	S41	S42	S20	S29
	Storet	630606	500201	500202	500205	500047		500201					
	Document	70	70	70	70	70	38	38	38	38	38	39	39
T	Turbellaria (flatworms)		P	P	P				O	O			
T	Nematoda (roundworms)												
F	Bryozoa (moss animals)		P	P	P			P					
T	Oligochaeta (aq earthworms)		P										
T	Hirudinea (leeches)	P	P	P	P	P							
T	Gastropoda (snails)					P		C	C	C	C		VC
F	Ancylidae	P	P	P	P								
F	Hydrobiidae												
F	Lymnaeidae												
T	Physidae	P			P		C						
F	Planorbidae				P							VC	
T	Valvatidae												
F	Pelecypoda (Clams)												C
T	Sphaeriidae											VC	
T	Isopoda (sow bugs)	P	P	P	P	P	C	C	C	C	C		O
F	Amphipoda (scuds)	P	P	P	P	P	C	C	O	O	C	O	VC
T	Decapoda (crayfish)	P	P	P	P	P	VC	O	C	C	VC	C	VC
I	Plecoptera (stoneflies)						C	C	VC	VC	C		
I	Perlidae	P	P								P		
F	Ephemeroptera (mayflies)												
F	Baetidae	P	VC	VC	P	P		O	O	O			
F	Caenidae						C	VC	C	C	C		
I	Ephemeridae												
F	Heptageniidae	P	C	P	P	P	C	VC	C	C	C		
I	Leptophlebiidae	P											
I	Siphlonuridae												
F	Tricorythidae	P	P	P	P								
F	Odonata (dragonflies, damselflies)						C	C	VC	VC	C	VC	C
F	Aeshnidae	P	P	P									
F	Agriidae	P		P	P								
F	Calopterygidae		P										
F	Coenagriidae			P									
F	Cordulegastridae												
F	Corduliidae												
F	Gomphidae												
F	Libellulidae												
T	Hemiptera (truebugs)												
T	Belostomatidae												
T	Corixidae											P	
T	Gerridae	P	P	P	P		C	C	C	C	C		P
T	Mesoveliidae												
T	Nepidae												
T	Notonectidae												
T	Pleidae												
T	Veliidae					P		C			C		
I	Megaloptera (alderflies)			P			C		C	C	O		
F	Trichoptera (caddisflies)												
I	Brachycentridae												
I	Glossosomatidae												
I	Helicopsychidae												
F	Hydropsychidae	P	P	P	P	P	VC	VC	VC	VC	VC		C
I	Hydroptilidae						C	C			C		
I	Leptoceridae												
I	Limnephilidae												C
I	Molannidae												
I	Philopotamidae												
F	Polycentropodidae												
F	Psychomyiidae												
I	Rhyacophilidae												
F	Lepidoptera (aq caterpillars)												
F	Coleoptera (beetles)	P	P	P	P	P	C	C	C	C	C	VC	
F	Diptera (flies, midges)												
T	Ceratopogonidae												
F	Chironomidae	P	P	P	P	P		C	C	C	C	C	C
T	Culicidae												
F	Dolichopodidae												
F	Empididae												
F	Heleidae												
F	Psychodidae												
F	Rhagionidae	P	P	P	P	P							
F	Simuliidae	P	VC	P	VC	P		C			C		
F	Stratiomyidae												
T	Syrphidae												
F	Tabanidae							C	C	C	C		
F	Tipulidae						C	VC	C	C	C		

Quantitative benthic macroinvertebrate sampling in Section 5 Clinton River, upstream of Red Run (1973-1979).
Results in organisms/sq. meter.

Toler. Status	Taxa	Date	1973												1973	
		Map ID	S09	S10	S11	S12	S13	S14	S16	S17	S18	S19	S21	S24	S25	S26	S27
		Storet	630629	630630	630631	630600	630599	630632	630597	630633	630595	630282	630594	630313	630614	630615	630616
		Document	12	12,23	12	12	12	12	12	12,23	12	12	12	13	13	13	13
		Method	h-d*	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d
T	Turbellaria (flatworms)			113													
T	Nematoda (roundworms)																
F	Bryozoa (moss animals)													VC			
T	Oligochaeta (aq earthworms)							1049	65			1477			5		
T	Hirudinea (leeches)													11	5		
T	Gastropoda (snails)																
F	Ancylidae						8				24		73		11	16	92
F	Hydrobiidae													420			
F	Lymnaeidae																
T	Physidae		8				278				57		8	5			
F	Planorbidae													11			
T	Valvatidae																
F	Pelecypoda (Clams)																
T	Sphaeriidae																
T	Isopoda (sow bugs)														176	40	
F	Amphipoda (scuds)		405	2390	8	8	16							576			
T	Decapoda (crayfish)																
I	Plecoptera (stoneflies)																
I	Perlidae																16
F	Ephemeroptera (mayflies)																
F	Baetidae			8									1106	11	75	500	118
F	Caenidae													16			
I	Ephemeridae																
F	Heptageniidae			259										21	11	220	490
I	Leptophlebiidae																
I	Siphlonuridae																
F	Tricorythidae																
F	Odonata (dragonflies, damselflies)																
F	Aeshnidae																
F	Agriidae															11	
F	Calopterygidae															5	
F	Coenagrionidae						97		81		8		8	5	16		
F	Cordulegastridae																
F	Corduliidae																
F	Gomphidae																
F	Libellulidae																
T	Hemiptera (truebugs)																
T	Belostomatidae																
T	Corixidae																
T	Gerridae																
T	Mesoveliidae																
T	Nepidae																
T	Notonectidae																
T	Pleidae																
T	Veliidae																
I	Megaloptera (alderflies)																
F	Trichoptera (caddisflies)																
I	Brachycentridae																
I	Glossosomatidae																
I	Helicopsychidae																
F	Hydropsychidae		242	694	3330									956	177	1033	323
I	Hydroptilidae			8													
I	Leptoceridae				8									5			
I	Limnephilidae																
I	Molannidae																
I	Philopotamidae																
F	Polycentropodidae																
F	Psychomyiidae																
I	Rhyacophilidae																
F	Lepidoptera (aq caterpillars)																
F	Coleoptera (beetles)													22		16	21
F	Diptera (flies, midges)																
T	Ceratopogonidae																
F	Chironomidae		113	64	443	1590	630	565	40	4600	16	97	406	645	[illegible]	263	150
T	Culicidae																
F	Dolichopodidae																
F	Empididae													27		5	5
F	Heleidae																
F	Psychodidae																
F	Rhagionidae																
F	Simuliidae				8	8										81	16
F	Stratiomyidae																
	Syrphidae																
	Tabanidae																
	Tipulidae												8				

Toler. Status	Taxa	530	531	532	533	534	535	536	537	539	543	544	545	546	547
	Date	1973													
	Storet	630618	630619	630620	630621	630622	630636	630637	630606	500201	500202	500203	500224	500205	500047
	Document	13	13	13	13	12,13	12	12	12	12	12	12	12	12	12
	Method	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d
T	Turbellaria (flatworms)						16								
T	Nematoda (roundworms)					21									
F	Bryozoa (moss animals)														
T	Oligochaeta (aq earthworms)					54	24				41			662	24
T	Hirudinea (leeches)													6	
T	Gastropoda (snails)														
F	Ancylidae	11	21	16	32	5	49		40	8	137	194	57	57	226
F	Hydrobiidae														
F	Lymnaeidae														
T	Physidae						32				8				
F	Planorbidae														
T	Valvatidae														
F	Pelecypoda (Clams)														
T	Sphaeriidae														
T	Isopoda (sow bugs)	5	145	5	11	59	8				8			6	
F	Amphipoda (scuds)		5								41				
T	Decapoda (crayfish)														
I	Plecoptera (stoneflies)														
I	Perlidae		5	11											
F	Ephemeroptera (mayflies)														
F	Baetidae	1501	65	495	1216		33	8	565	1364		360	961		323
F	Caenidae														
I	Ephemeridae														
F	Heptageniidae	366	27	75	65					16	24	8		24	
I	Leptophlebiidae														
I	Siphlonuridae														
F	Tricorythidae														
F	Odonata (dragonflies, damselflies)														
F	Aeshnidae			5				16							
F	Agriidae		11	5											
F	Calopterygidae	11													
F	Coenagriidae						24	8						16	
F	Cordulegastridae														
F	Corduliidae														
F	Gomphidae														
F	Libellulidae														
T	Hemiptera (truebugs)														
T	Belostomatidae														
T	Corixidae														
T	Gerridae														
T	Mesoveliidae														
T	Nepidae														
T	Notonectidae														
T	Pleidae														
T	Veliidae														
I	Megaloptera (alderflies)	5				5					8				
F	Trichoptera (caddisflies)														
I	Brachycentridae														
I	Glossosomatidae														
I	Helicopsychidae														
F	Hydropsychidae	721	850	753	791	16		8	4690	1953	969	1429	904	162	1074
T	Hydroptilidae														
I	Leptoceridae														
I	Limnephilidae														
I	Molannidae														
I	Philopotamidae														
F	Polycentropodidae		11	32											
F	Psychomyiidae				5										
I	Rhyacophilidae		5												
F	Lepidoptera (aq caterpillars)														
F	Coleoptera (beetles)	59	75	32	16				8						
F	Diptera (flies, midges)														
T	Ceratopogonidae														
F	Chironomidae	827	1390	909	1274	639	355	1550	1129	766	1234	1331	2495	566	1969
T	Culicidae														
F	Dolichopodidae														
F	Empididae	16	16	16		5			8			8		6	16
F	Heleidae														
F	Psychodidae														
F	Rhagionidae			5				16		16	41	16	40		97
F	Simuliidae	463			670			16	16	129		331	8		75
F	Stratiomyidae														
T	Syrphidae														
F	Tabanidae														
F	Tipulidae		32	21	21										

Toler. Status	Taxa	1976			1977		1978				1979	
	Map ID	S10	S13	S17	S10	S13	S10	S13	S17	S18	S46	S47
	Storet	630630	630599	630633	630630	630599	630630	630599	630633	630595	500205	500047
	Document	31	31	31	31	31	31	31	31	31	29	29
	Method	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d	h-d
T	Turbellaria (flatworms)				1275		65					
T	Nematoda (roundworms)						0					
F	Bryozoa (moss animals)											
T	Oligochaeta (aq earthworms)		146			16	0	5367	0			0
T	Hirudinea (leeches)						0					
T	Gastropoda (snails)							16				
F	Ancylidae									16	364	194
F	Hydrobiidae											
F	Lymnaeidae											
T	Physidae				0	1009				0		
F	Planorbidae											
T	Valvatidae											
F	Pelecypoda (Clams)											
T	Sphaeriidae											
T	Isopoda (sow bugs)	0										
F	Amphipoda (scuds)	363	65		396		670	0			16	154
T	Decapoda (crayfish)											
I	Plecoptera (stoneflies)											
I	Perlidae										0	
F	Ephemeroptera (mayflies)											
F	Baetidae				16		32			1332	32	
F	Caenidae											
I	Ephemeridae											
F	Heptageniidae	210			65		318					
I	Leptophlebiidae											
I	Siphlonuridae											
F	Tricorythidae											
F	Odonata (dragonflies, damselflies)											
F	Aeshnidae											
F	Agriidae						0					
F	Calopterygidae											
F	Coenagriidae	38	24				57	105	65	0		
F	Cordulegastridae											
F	Corduliidae											
F	Gomphidae											
F	Libellulidae											
T	Hemiptera (truebugs)											
T	Belostomatidae											
T	Corixidae											
T	Gerridae											
T	Mesoveliidae											
T	Nepidae											
T	Notonectidae											
T	Pleidae											
T	Veliidae											
I	Megaloptera (alderflies)											
F	Trichoptera (caddisflies)											
I	Brachycentridae											
I	Glossosomatidae											
I	Helicopsychidae											
F	Hydropsychidae	500			840		3761		32	193	1704	2647
I	Hydroptilidae				0		16			113		
I	Leptoceridae						97					
I	Limnephilidae											
I	Molannidae											
I	Philopotamidae											
F	Polycentropodidae				0							
F	Psychomyiidae											
I	Rhyacophilidae											
F	Lepidoptera (aq caterpillars)											
F	Coleoptera (beetles)	40			57	0	153				0	32
F	Diptera (flies, midges)											
T	Ceratopogonidae											
F	Chironomidae	97	363	2969	669	16	1630	65	1655	1544	2647	5601
T	Culicidae					16						
F	Dolichopodidae											
F	Empididae			122					106			
F	Heleidae											
F	Psychodidae											
F	Rhagionidae											16
F	Simuliidae						24					0
F	Stratiomyidae											
T	Syrphidae											
F	Tabanidae											
F	Tipulidae											

Appendix 4.9 continued

Qualitative benthic macroinvertebrate sampling in Section 6 Clinton River, the North Branch (1973-1983).
Counts represent organisms found, (P)-present, (O)-occasional, (C)-common, (VC)-very common.

Toler. Status	Taxa	601	602	603	604	605	606	607	608	609	610	611	612
	Date	1973											1973
	Map ID	601	602	603	604	605	606	607	608	609	610	611	612
	Storet	500236	440057	440058	440059	440060	440061	500237	500238	500239	500240	500241	500242
	Document	16	16	16	16	16	16	16	16	16	16	16	16
T	Turbellaria (flatworms)				1								
T	Nematoda (roundworms)												
F	Bryozoa (moss animals)												
T	Oligochaeta (aq earthworms)	2			5				5				
T	Hirudinea (leeches)			1	1		1	6	4	2			4
T	Gastropoda (snails)												
F	Ancylidae		1										
F	Hydrobiidae												
F	Lymnaeidae		2					2	2	11			
T	Physidae	2	3	3	5	8		2	2	3	2	11	
F	Planorbidae												1
T	Valvatidae												
F	Pelecypoda (clams)												
T	Sphaeriidae	1	4	3	6		3	1		1			14
T	Isopoda (sow bugs)						2						2
F	Amphipoda (scuds)	3	14	3	9	8	2	13	15	38	9	33	16
T	Decapoda (crayfish)		1		5	2	3	1	1	2	1	11	1
I	Plecoptera (stoneflies)												
I	Perlidae												
F	Ephemeroptera (mayflies)												
F	Baetidae												
F	Caenidae	1	4	4	20				5	1	1	19	52
I	Ephemeridae		2					1	1		5	3	7
F	Heptageniidae	2											
I	Leptophlebiidae		3				2		8	20	24	32	18
I	Siphlonuridae												
F	Tricorythidae				7								
F	Odonata (dragonflies, damselflies)												
F	Aeshnidae	1	4	1		2	2						4
F	Agriidae									1			
F	Calopterygidae	1	4		2		2					1	
F	Coenagriidae		1		6	5	8	1	3	2		17	13
F	Cordulegastridae												
F	Corduliidae												
F	Gomphidae										1		1
F	Libellulidae								1	2	1		
T	Hemiptera (true bugs)												
T	Belostomatidae	1		1								10	2
T	Corixidae		1	2	5				3	4	1	8	
T	Gerridae				4		3			1		1	
T	Mesoveliidae											2	1
T	Nepidae											1	
T	Notonectidae				1								
T	Pleidae												
T	Veliidae												
I	Megaloptera (alderflies)		3	1	2								
F	Trichoptera (caddisflies)												
I	Brachycentridae												
I	Glossosomatidae												
I	Helicopsychidae												
F	Hydropsychidae	6	23	25	34		15	6	17	13	24	15	20
I	Hydroptilidae											2	
I	Leptoceridae		1										
I	Limnephilidae	1			4					12		9	3
I	Molannidae												
I	Philopotamidae												
F	Polycentropodidae		1										
F	Psychomyiidae		1										
I	Rhyacophilidae												
F	Lepidoptera (aq caterpillars)		1	1									
F	Coleoptera (beetles)	1	6	2	24	4	9	5	1	6	8	21	16
F	Diptera (flies, midges)												
T	Ceratopogonidae												
F	Chironomidae	16	57	26	19	66	16	32	26	5	20	8	96
F	Culicidae												
F	Dolichopodidae												
F	Empididae		1										
F	Heleidae												
F	Psychodidae												
F	Rhagionidae												
F	Simuliidae		2		2	1							2
F	Stratiomyidae												
I	Syrphidae												
F	Tabanidae	1	2	3			3	1		2	1		
F	Tipulidae		3		1		1						

Appendix 4.9 Continued

Toler. Status	Taxa	613	614	615	616	617	618	619	620	621
	Date				1979			1983		
	Map ID	613	614	615	616	617	618	619	620	621
	Storet	500243	500244	500245						
	Document	16	16	16	30	30	30	37	37	37
T	Turbellaria (flatworms)			2						
T	Nematoda (roundworms)									
F	Bryozoa (moss animals)									
T	Oligochaeta (aq earthworms)		4	1		C			VC	VC
T	Hirudinea (leeches)		1	1						P
T	Gastropoda (snails)							C	C	C
F	Ancylidae				C	C	C			
F	Hydrobiidae									
F	Lymnaeidae		2							
T	Physidae		1		P	VC	P			
F	Planorbidae			1						
T	Valvatidae									
F	Pelecypoda (clams)									
T	Sphaeriidae	4	3	3						
T	Isopoda (sow bugs)			2	P	C	C			C
F	Amphipoda (scuds)	20	5	23	C		C			
T	Decapoda (crayfish)	6		5	VC		C	C		C
I	Plecoptera (stoneflies)									
I	Perlidae									
F	Ephemeroptera (mayflies)									
F	Baetidae									
F	Caenidae	6		43			VC			
I	Ephemeridae	3	3	3	C		VC			
F	Heptageniidae				P		P	VC		P
I	Leptophlebiidae	10	30	22	P		VC			
I	Siphlonuridae									
F	Tricorythidae		3	10						
F	Odonata (dragonflies, damselflies)									
F	Aeshnidae	1	2	3			P			
F	Agriidae		1							
F	Calopterygidae		4							
F	Coenagriidae	12		1	C					
F	Cordulegastridae									
F	Corduliidae									
F	Gomphidae			1						
F	Libellulidae									
T	Hemiptera (true bugs)									
T	Belostomatidae									
T	Corixidae						P	C	VC	PM
T	Gerridae	4	2		P		P		VC	PM
T	Mesoveliidae	1								
T	Nepidae									
T	Notonectidae									
T	Pleidae								VC	
T	Veliidae		3		VC		VC			
I	Megaloptera (alderflies)									
F	Trichoptera (caddisflies)									
I	Brachycentridae									
I	Glossosomatidae									
I	Helicopsychidae									
F	Hydropsychidae	6	52	73	P		C			
I	Hydroptilidae									
I	Leptoceridae									
I	Limnephilidae	1	1							PM
I	Molannidae									
I	Philopotamidae									
F	Polycentropodidae									
F	Psychomyiidae									
I	Rhyacophilidae									
F	Lepidoptera (aq caterpillars)									
F	Coleoptera (beetles)	44	2	15	P	P	P			PM
F	Diptera (flies, midges)									
T	Ceratopogonidae									
F	Chironomidae	40	27	16	VC	VC	VC	VC	C	VC
T	Culicidae						C			P
F	Dolichopodidae									
F	Empididae									
F	Heleidae									
F	Psychodidae									
F	Rhagionidae									
F	Simuliidae				C		VC			
F	Stratiomyidae			1						
I	Syrphidae									
F	Tabanidae	1								
F	Tipulidae	1		3						

Quantitative benthic macroinvertebrate sampling in Section 6 Clinton River, the North Branch (1973). Results in organisms/sq. meter.

Toler. Status	Taxa	1973	1973
	Date	1973	1973
	Map ID	622	622
	Storet	500210	500210
	Document	12	12
	Method	h-dm	ponar
T	Turbellaria (flatworms)		
T	Nematoda (roundworms)		
F	Bryozoa (moss animals)		
T	Oligochaeta (aq earthworms)		2523
T	Hirudinea (leeches)		14
T	Gastropoda (snails)		
F	Ancylidae		
F	Hydrobiidae		
F	Lymnaeidae		
T	Physidae		29
F	Planorbidae		
T	Valvatidae		
F	Pelecypoda (clams)		
T	Sphaeriidae		
T	Isopoda (sow bugs)		
F	Amphipoda (scuds)	8	
T	Decapoda (crayfish)		
I	Plecoptera (stoneflies)		
I	Perlidae		
F	Ephemeroptera (mayflies)		
F	Baetidae		
F	Caenidae		
I	Ephemeridae		
F	Heptageniidae		14
I	Leptophlebiidae	783	
I	Siphlonuridae		
F	Tricorythidae		
F	Odonata (dragonflies, damselflies)		
F	Aeshnidae	65	
F	Agriidae		
F	Calopterygidae		
F	Coenagriidae		
F	Cordulegastridae		
F	Corduliidae		
F	Gomphidae		
F	Libellulidae		
T	Hemiptera (true bugs)		
T	Belostomatidae		
T	Corixidae		
T	Gerridae		
T	Mesoveliidae		
T	Nepidae		
T	Notonectidae		
T	Pleidae		
T	Veliidae		
I	Megaloptera (alderflies)	8	
F	Trichoptera (caddisflies)		
I	Brachycentridae		
I	Glossosomatidae		
I	Helicopsychidae		
F	Hydropsychidae	24	
I	Hydroptilidae		
I	Leptoceridae		
I	Limnephilidae		
I	Molannidae		
I	Philopotamidae		
F	Polycentropodidae	89	
F	Psychomyiidae		
I	Rhyacophilidae		
F	Lepidoptera (aq caterpillars)		
F	Coleoptera (beetles)	16	57
F	Diptera (flies, midges)		
T	Ceratopogonidae		
F	Chironomidae	1605	430
T	Culicidae		14
F	Dolichopodidae		
F	Empididae		
F	Heleidae		
F	Psychodidae		
F	Rhagionidae		
F	Simuliidae		
F	Stratiomyidae		14
I	Syrphidae		
T	Tabanidae		
F	Tipulidae		

Hester-dendy sampler

Appendix 5.1.

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Final Effluent Limitations

a. During the period beginning on permit issuance and lasting until permit expiration, the permittee is authorized to discharge treated municipal wastewaters from the Pontiac wastewater treatment plant through outfall 001 to Clinton River. Such discharges shall be limited and monitored by the permittee as follows:

Effluent Characteristic	Discharge Limitations				
	Dates In Effect	Daily Minimum	Daily Maximum	30-Day Average	7-Day Average
Flow (in MGD)	All Year	—	—	—	—
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	5/1-11/30	—	10 mg/1	4 mg/1 500 lb/d	1250 lb/d
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	12/1-4/30	—	22 mg/1	15 mg/1 1880 lb/d	2750 lb/d
Total Suspended Solids	5/1-11/30	—	—	20 mg/1 2500 lb/d	30 mg/1 3750 lb/d
Total Suspended Solids	12/1-4/30	—	—	30 mg/1 3750 lb/d	45 mg/1 5630 lb/d
Ammonia Nitrogen (as N)	5/1-11/30	—	2.0 mg/1	0.7 mg/1 90 lb/d	250 lb/d
Ammonia Nitrogen (as N)	12/1-3/31	—	—	9.0 mg/1 1130 lb/d	—
Ammonia Nitrogen (as N)	4/1-4/30	—	—	10.3 mg/1 1290 lb/d	—
Total Phosphorus (as P)	All Year	—	—	1.0 mg/1 125 lb/d	—
Dissolved Oxygen	All Year	6.0 mg/1	—	—	—
Fecal Coliform Bacteria	5/1-10/31	—	—	200/100ml	400/100ml
Total Residual Chlorine	All Year	—	0.036 mg/1	—	—

PART I

Section A.1

Effluent Characteristic	Dates In Effect	Discharge Limitations: Daily Minimum	Daily Maximum	30-Day Average	7-Day Average
pH (standard units)	All Year	6.5	9.0	--	--
Cadmium	All Year	--	--	--	--
Cadmium	All Year beginning 7/1/88	--	--	0.7 ug/l	--
Lead	All Year	--	--	--	--
Lead	All Year beginning 7/1/88	--	--	9.0 ug/l	--
Hexavalent Chromium	10/87-11/87	--	--	--	--
Total Silver	10/87-11/87	--	--	--	--
Cyanide (amenable to chlorination)	10/87-11/87	--	--	--	--

The following design flows were used in determining the above limitations, but are not to be considered limitations or actual capacities themselves: 15 MGD

Permit No. MI 0023931

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Final Effluent Limitations

a. During the period beginning upon permit issuance and lasting until permit expiration date the permittee is authorized to discharge treated municipal wastewaters from the City of Rochester wastewater treatment plant through outfall 001 to the Clinton River. Such discharges shall be limited and monitored by the permittee as follows:

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS				TESTING FREQUENCY
		Minimum	Maximums			
		Daily	Daily	30-Day Avg.	7-Day Avg.	
5-Day 20°C Carbonaceous Biochemical Oxygen Demand	May 1 to Sept. 30	---	30 mg/l	20 mg/l 152 kg/day 334 lb/day	228 kg/day 500 lb/day	5 x weekly
	Oct. 1 to Apr. 30	---	---	25 mg/l 189 kg/day 417 lb/day	40 mg/l 302 kg/day 667 lb/day	
Total Suspended Solids	All Year	---	---	30 mg/l 228 kg/day 500 lb/day	45 mg/l 341 kg/day 751 lb/day	5 x weekly
Dissolved Oxygen	All Year	---	---	---	---	5 x weekly
	All Year beginning 12/31/85	5.0 mg/l	---	---	---	
pH	All Year	6.0	9.0	---	---	5 x weekly
Fecal Coliform Bacteria	May 15 to Oct. 15	---	---	200/100 ml	400/100 ml	5 x weekl
Total Residual Chlorine	All Year	---	---	---	---	Daily during periods of disinfection
	All Year beginning 7/31/88	---	0.148 mg/l	---	---	
Total Phosphorus (as P)	All Year	---	---	1.0 mg/l	---	5 x weekly
Ammonia Nitrogen	All Year	---	---	---	---	1 x weekly
Trichloro-ethylene	All Year	---	---	---	---	Quarterly

The following design flows were used in determining the above limitations, but are not to be considered limitations or actual capacities themselves: 2 MGD.

Permit No. MI 0024295

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS.

1. Final Effluent Limitations

a. During the period beginning on the date of issuance and lasting until the date of expiration the permittee is authorized to discharge treated municipal wastewaters from the City of Warren wastewater treatment plant through outfall 001 to the Clinton River. Such discharges shall be limited and monitored by the permittee as follows:

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS				TESTING FREQUENCY
		Minimum	Maximums			
		Daily	Daily	30 Day Avg.	7 Day Avg.	
Carbonaceous 5-Day 20°C Biochemical Oxygen Demand	May 1 to Sept. 30	---	10 mg/l	4 mg/l 910 kg/day 2002 lb/day	2275 kg/day 5004 lb/day	7 x weekly
	Oct. 1 to Nov. 30	---	17 mg/l	11 mg/l 2502 kg/day 5505 lb/day	3867 kg/day 8507 lb/day	7 x weekly
	Dec. 1 to Mar. 31	---	25 mg/l	17 mg/l 3867 kg/day 8507 lb/day	5687 kg/day 12,510 lb/day	7 x weekly
	Apr. 1 to Apr. 30	---	30 mg/l	20 mg/l 4550 kg/day 10,008 lb/day	6824 kg/day 15,012 lb/day	7 x weekly
Ammonia Nitrogen (as N)	May 1 to Nov. 30	---	2 mg/l	0.5 mg/l 114 kg/day 251 lb/day	455 kg/day 1,001 lb/day	7 x weekly
	Dec. 1 to Mar. 31	---	---	7.7 mg/l 1752 kg/day 3853 lb/day	---	7 x weekly
	Apr. 1 to Apr. 30	---	---	6.8 mg/l 1547 kg/day 3403 lb/day	---	7 x weekly
Total Suspended Solids	May 1 to Sept. 30	---	---	20 mg/l 4550 kg/day 10,008 lb/day	30 mg/l 6824 kg/day 15,012 lb/day	7 x weekly
	Oct. 1 to Apr. 30	---	---	30 mg/l 6824 kg/day 15,012 lb/day	45 mg/l 10,236 kg/day 22,518 lb/day	7 x weekly
Dissolved Oxygen	All Year	5 mg/l	---	---	---	7 x weekly
Fecal Coliform Bacteria	May 15 to Oct. 15	---	---	200/100 ml	400/100 ml	7 x weekly
Total Residual Chlorine	All Year beginning 5-31-88	---	0.024 mg/l	---	---	Daily during periods of chlorination
Total Phosphorus (as P)	All Year	---	---	1.0 mg/l	---	7 x weekly
pH	All Year	6.0	9.0	---	---	7 x weekly

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS				TESTING FREQUENCY
		Minimum	Maximums			
		Daily	Daily	30 Day Avg.	7 Day Avg.	
Total Cadmium	All Year	---	---	---	---	7 x Weekly
Total Copper	All Year	---	---	---	---	1 x Weekly
Free Cyanide	All Year	---	---	---	---	1 x Weekly
Total Mercury	All Year	---	---	---	---	1 x Weekly
Total Silver	All Year	---	---	---	---	1 x Weekly
Total Zinc	All Year	---	---	---	---	1 x Weekly
Total Residual Chlorine	All Year	---	---	---	---	Daily During Periods of Disinfection
5-Day 20°C Biochemical Oxygen Demand	All Year	---	---	30 mg/l	45 mg/l	1 x Monthly

The following design flows were used in determining the above limitations, but are not to be considered limitations or actual capacities themselves: 60 MGD.

b. Effluent Limitations for carbonaceous BOD_5, Ammonia Nitrogen, Total Phosphorus and metals shall apply to samples collected at the tertiary filter effluent, and effluent limitations for Total Residual Chlorine, Fecal Coliform, Dissolved Oxygen, pH and Cyanide shall apply to samples collected at the chlorine contact tank effluent. Monitoring of the Retention Basin overflow shall be conducted for Carbonaceous BOD_5, Suspended Solids, Total Phosphorus, Ammonia Nitrogen and flow prior to mixing with tertiary filter effluent. Samples shall be grab samples for every twelve hours of overflow.

c. All samples shall be 24-hour composite samples taken prior to disinfection except Fecal Coliform Bacteria, Total Residual Chlorine, Dissolved Oxygen, and pH which shall be grab samples of the effluent.

d. The total daily effluent flow shall be measured daily.

Permit No. MI 0026115

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS.

Final Effluent Limitations

During the period beginning on the effective date and lasting until December 31, 1978 discharges from the County of Oakland's Southeastern Oakland County Sewage Disposal Syst combined sewer overflow control retention basin outfall 001 shall be limited and monitored by the permittee as specified below:

(a) The following shall be limited and monitored by the permittee as specified:

EFFLUENT CHARACTERISTIC	Discharge Load Limitations kg/day (lb/day)		Discharge Concentration Limitations		Monitoring Requirements	
	30 Day Aver.	Daily Maximum	30 Day Aver.	Daily Maximum	Measure. Frequency	Sample Type & Location
Fecal Coliform Bacteria	---	---	200/100 ml	400/100 ml	4 x daily during overflow discharge period	Grab following chlorine contact tank
5-Day 20°C Biochemical Oxygen Demand	---	---	See "Special Conditions" on following page		1 x daily during overflow discharge period	Composite during overflow period
Suspended Solids	---	---	See "Special Conditions" on following page		1 x daily during overflow discharge period	Composite during overflow period
Dewatering	The retention basin shall be promptly dewatered to the Detroit sewerage system following the storm flow period to regain storage capacity prior to the advent of another storm flow period. The full available Detroit outlet capacity of 260 cfs shall be effectively utilized during and following storm flow periods.					

(b) The pH shall not be less than 6.5 nor greater than 9.5. The pH shall be monitored as follows: Daily grab during overflow periods. The pH limitation is not subject to averaging and must be met at all times.

(c) The effluent discharge shall be measured daily.

Permit No. MI 0021679

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Final Effluent Limitations

a. During the period beginning on permit issuance and lasting until permit expiration the permittee is authorized to discharge treated municipal wastewaters from the Romeo wastewater treatment plant through outfall 001 to East Pond Creek. Such discharges shall be limited and monitored by the permittee as follows:

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS Minimum Daily	Maximums Daily	30-Day Avg.	7-Day Avg.	TESTING FREQUENCY
Carbonaceous Biological Oxygen Demand	May 1 to Sept.30	---	12 mg/l	8 mg/l 48 kg/day 106 lb/day	73 kg/day 160 lb/day	5 x weekly
	Oct. 1 to April 30	---	40 mg/l	25 mg/l 150 kg/day 330 lb/day	242 kg/day 532 lb/day	
Total Suspended Solids	May 1 to Sept.30	---	---	24 mg/l 145 kg/day 319 lb/day	36 mg/l 218 kg/day 479 lb/day	5 x weekly
	Oct. 1 to April 30	---	---	30 mg/l 181 kg/day 399 lb/day	45 mg/l 272 kg/day 599 lb/day	
Ammonia Nitrogen as (N)	May 1 to Sept.30	---	---	1.3 mg/l 7.9 kg/day 17 lb/day	---	5 x wee[illegible]
	Oct. 1 to Nov. 30	---	---	2.4 mg/l 14 kg/day 31 lb/day	---	
	Dec. 1 to Mar. 31	---	---	6.9 mg/l 42 kg/day 92 lb/day	---	
	April 1 to April 30	---	---	6.2 mg/l 37 kg/day 82 lb/day	---	
Total Phosphorus as (p)	All Year	---	---	1 mg/l 6 kg/day 13.3 lb/day	---	5 x weekly
Dissolved Oxygen	May 1 to Nov. 30	7.0 mg/l	---	---	---	5 x weekly
	Dec. 1 to April 30	3.0 mg/l	---	---	---	
Total Residual Chlorine	All Year beginning July 1, 1988	---	0.040 mg/l	---	---	Daily during chlorination

Permit No. MI 0021679

PERMIT CONDITIONS

PART I, Section A-

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS				TESTING FREQUENCY
		Minimum	Maximums			
		Daily	Daily	30-Day Avg.	7-Day Avg.	
Fecal Coliform Bacteria	May 1 to Oct. 31	---	---	200/100 ml	400/100 ml	

The following design flows were used in determining the above limitations, but are not to be considered limitations or actual capacities themselves: 1.6 MGD.

Permit No. MI 0020931

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Interim Effluent Limitations

a. During the period beginning on permit issuance and lasting until June 30, 1988 the permittee is authorized to discharge treated municipal wastewaters from the Almont wastewater treatment plant through outfall 001 to North Branch of the Clinton River. Such discharges shall be limited and monitored by the permittee as follows:

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	LOAD LIMITATIONS		CONCENTRATION LIMITATIONS		MONITORING REQUIREMENTS
		30-Day Average	7-Day Average	30-Day Average	7-Day Average	Testing Frequency
5-Day 20°C Biochemical Oxygen Demand	All Year	49 kg/day 107 lb/day	73 kg/day 160 lb/day	40 mg/l	60 mg/l	3 x weekly
Suspended Solids	All Year	49 kg/day 107 lb/day	73 kg/day 160 lb/day	40 mg/l	60 mg/l	3 x weekly
Total Phosphorus (as P)	All Year	---	---	---	---	3 x weekly
Fecal Coliform Bacteria	May 1 to Oct. 31	---	---	200/100 ml	400/100 ml	3 x weekly
Ammonia Nitrogen	All Year	---	---	---	---	3 x weekly
				Daily Min.	Daily Max.	
pH	All Year	---	---	6.0	9.0	3 x weekly
Dissolved Oxygen	All Year	---	---	---	---	3 x weekly

The following design flows were used in determining the above limitations, but are not to be considered limitations or actual capacities themselves: 0.32 MGD.

b. All samples shall be 24-hour composite samples taken prior to disinfection except Fecal Coliform Bacteria, Total Residual Chlorine, Dissolved Oxygen, and pH which shall be grab samples of the effluent.

c. The total effluent flow shall be measured daily.

d. During the periods that Coliform Bacteria Limitations are in effect, the permittee shall provide adequate control and facilities to ensure continuous disinfection.

e. In addition to the BOD and Suspended Solids limitations above, the 30-day average effluent BOD and Suspended Solids concentrations shall not exceed 15 percent of the average influent concentrations for approximately the same period.

Permit No. MI 0020931

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

2. Final Effluent Limitations

a. During the period beginning July 1, 1988 and lasting until permit expiration the permittee is authorized to discharge treated municipal wastewaters from the Almont wastewater treatment plant through outfall 001 to North Branch of the Clinton River. Such discharges shall be limited and monitored by the permittee as follows:

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS				TESTING FREQUENCY
		Minimum	Maximums			
		Daily	Daily	30-Day Avg.	7-Day Avg.	
5-Day 20°C Carbonaceous Biochemical Oxygen Demand	May 1 to May 31	---	11 mg/l	7 mg/l 8.4 kg/day 19 lb/day	13.4 kg/day 29.4 lb/day	5 x weekly
	Jun. 1 to Oct. 31	---	10 mg/l	4 mg/l 4.85 kg/day 10.7 lb/day	12.1 kg/day 27 lb/day	5 x weekly
	Nov. 1 to Nov. 30	---	22 mg/l	15 mg/l 18.2 kg/day 40 lb/day	27 kg/day 59 lb/day	5 x weekly
	Dec. 1 to Apr. 30	---	32 mg/l	21 mg/l 26 kg/day 56 lb/day	39 kg/day 86 lb/day	5 x weekly
Total Suspended Solids	May 1 to May 31	---	---	22 mg/l 27 kg/day 59 lb/day	33 mg/l 40 kg/day 88 lb/day	5 x weekly
	Jun. 1 to Oct. 31	---	---	20 mg/l 25 kg/day 54 lb/day	30 mg/l 36 kg/day 80 mg/l	5 x weekly
	Nov. 1 to Apr. 30	---	---	30 mg/l 36 kg/day 80 lb/day	45 mg/l 55 kg/day 120 lb/day	5 x weekly
Ammonia Nitrogen (as N)	May 1 to May 31	---	---	4.6 mg/l 5.6 kg/day 12.3 lb/day	---	5 x weekly
	Jun. 1 to Sept. 30	---	2.5 mg/l 3.0 kg/day 6.7 lb/day	1.5 mg/l 1.9 kg/day 4.0 lb/day	---	5 x weekly
	Oct. 1 to Oct. 31	---	---	2.3 mg/l 2.8 kg/day 6.1 lb/day	---	5 x weekly
	Nov. 1 to Apr. 30	---	---	6.1 mg/l 7.4 kg/day 16.3 lb/day	---	5 x weekly
Fecal Coliform Bacteria	May 1 to Oct. 31	---	---	200/100 ml	400/100 ml	5 x weekly
Total Residual Chlorine	All Year beginning 7/1/88	---	0.039 mg/l	---	---	5 x weekly

Permit No. MI 0020931

PERMIT CONDITIONS

PART I, Section A-2

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS				TESTING FREQUENCY
		Minimum	Maximums			
		Daily	Daily	30-Day Avg.	7-Day Avg.	
Dissolved Oxygen	Jun. 1 to Sept. 30	7.0 mg/l	---	---	---	5 x weekly
	Oct. 1 to May 31	5.0 mg/l	---	---	---	5 x weekly
Total Phosphorus (as P)	All Year	---	---	1.0 mg/l 1.2 kg/day 2.7 lb/day	---	5 x weekly
pH	All Year	6.0	9.0	---	---	5 x weekly

The following design flows were used in determining the above limitations, but are not to be considered limitations or actual capacities themselves: 0.32 MGD.

Permit No. MI 0022225

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Interim Effluent Limitations

a. During the period beginning upon permit issuance and lasting until June 30, 1988 the permittee is authorized to discharge treated municipal wastewaters from the Armada wastewater treatment plant through outfall 001 to the East Branch of Coon Creek. Such discharges shall be limited and monitored by the permittee as follows:

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	LOAD LIMITATIONS		CONCENTRATION LIMITATIONS		MONITORING REQUIREMENTS
		30-Day Average	7-Day Average	30-Day Average	7-Day Average	Testing Frequency
5-Day 20°C Biochemical Oxygen Demand	All Year	60 kg/day 131 lb/day	86 kg/day 190 lb/day	45 mg/l	65 mg/l	3 x weekly
Suspended Solids	All Year	60 kg/day 131 lb/day	86 kg/day 190 lb/day	45 mg/l	65 mg/l	3 x weekly
Fecal Coliform Bacteria	May 1 to Oct. 31	---	---	200/100 ml	400/100 ml	3 x weekly
				Daily Min.	Daily Max.	
pH	All Year	---	---	6.0	9.0	Daily

The following design flows were used in determining the above limitations, but are not to be considered limitations or actual capacities themselves: 0.35 MGD.

b. All samples shall be 8-hour composite samples taken prior to disinfection except Fecal Coliform Bacteria and pH which shall be grab samples of the effluent.

c. The total effluent flow shall be measured daily.

d. During the periods that Coliform Bacteria Limitations are in effect, the permittee shall provide adequate control and facilities to ensure continuous disinfection.

Permit No. MI 0022225

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

2. Final Effluent Limitations

a. During the period beginning July 1, 1988 and lasting until permit expiration the permittee is authorized to discharge treated municipal wastewaters from the Armada wastewater treatment plant through outfall 001 to the East Branch of Coon Creek. Such discharges shall be limited and monitored by the permittee as follows:

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS				TESTING FREQUENCY
		Minimum	Maximums			
		Daily	Daily	30-Day Avg.	7-Day Avg.	
5-Day 20°C Carbonaceous Biochemical Oxygen Demand	May 1 to Sept. 30	---	22 mg/l	15 mg/l 20 kg/day 44 lb/day	29 kg/day 64 lb/day	5 x weekly
	Oct. 1 to Apr. 30	---	---	25 mg/l 33 kg/day 73 lb/day	40 mg/l 53 kg/day 117 lb/day	5 x weekly
Ammonia Nitrogen (as N)	May 1 to Sept. 30	---	6.6 mg/l	4.0 mg/l 5 kg/day 12 lb/day	9 kg/day 19 lb/day	5 x weekly
	Oct. 1 to Nov. 30	---	---	4.0 mg/l 5 kg/day 12 lb/day	---	5 x weekly
	Dec. 1 to Mar. 31	---	---	5.9 mg/l 8 kg/day 17 lb/day	---	5 x weekly
	Apr. 1 to Apr. 30	---	---	6.5 mg/l 9 kg/day 19 lb/day	---	5 x weekly
Total Suspended Solids	All Year	---	---	30 mg/l 40 kg/day 88 lb/day	45 mg/l 60 kg/day 131 lb/day	5 x weekly
Fecal Coliform Bacteria	May 1 to Oct. 31	---	---	200/100 ml	400/100 ml	5 x weekly
Total Residual Chlorine	All Year	---	0.025 mg/l	---	---	Daily during periods of chlorination
Dissolved Oxygen	All Year	5.0 mg/l	---	---	---	5 x weekly
Total Phosphorus (as P)	All Year	---	---	1.0 mg/l	---	5 x weekly
pH	All Year	6.0	9.0	---	---	5 x weekly

The following design flows were used in determining the above limitations, but are not to be considered limitations or actual capacities themselves: 0.35 MGD.

Permit No. MI 0023647

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS.

4. Final Effluent Limitations

a. During the period beginning April 1, 1988 and lasting until permit expiration the permittee is authorized to discharge treated municipal wastewaters from the Mt. Clemens wastewater treatment plant through outfall 001 to the Clinton River. Such discharges shall be limited and monitored by the permittee as follows:

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS Minimum Daily	Maximums Daily	Maximums 30 Day Avg.	Maximums 7 Day Avg.	TESTING FREQUENCY
Carbonaceous 5-Day 20°C Biochemical Oxygen Demand	May 1 to Sept. 30	---	10 mg/1	4 mg/1 91 kg/day 200 lb/day	227 kg/day 500 lb/day	Daily
	Oct. 1 to Nov. 30	---	18 mg/1	12 mg/1 273 kg/day 600 lb/day	410 kg/day 900 lb/day	Daily
5-Day 20°C Biochemical Oxygen Demand	Dec. 1 to Apr. 30	---	---	30 mg/1 682 kg/day 1500 lb/day	45 mg/1 1024 kg/day 2251 lb/day	Daily
	May 1 to Nov. 30	---	---	30 mg/1 682 kg/day 1500 lb/day	45 mg/1 1024 kg/day 2251 lb/day	Weekl
Total Supsended Solids	May 1 to Sept. 30	---	---	20 mg/1 455 kg/day 1000 lb/day	30 mg/1 682 kg/day 1500 lb/day	Daily
	Oct. 1 to Apr. 30	---	---	30 mg/1 682 kg/day 1500 lb/day	45 mg/1 1024 kg/day 2251 lb/day	Daily
Ammonia Nitrogen as N	May 1 to Sept. 30	---	2 mg/1	0.5 mg/1 11 kg/day 25 lb/day	45 kg/day 100 lb/day	Daily
	Oct. 1 to Nov. 30	---	10 mg/1	7 mg/1 160 kg/day 350 lb/day	227 kg/day 500 lb/day	Daily
Dissolved Oxygen	All Year	5 mg/1	---	---	---	Daily
Fecal Coliform Bacteria	May 15 to Oct. 15	---	---	200/100 ml	400/100 ml	Daily
Total Residual Chlorine	All Year	---	0.061 mg/1	---	---	Daily
Total Phosphorus as P	All Year	---	---	1.0 mg/1	---	Daily
pH	All Year	6.0	9.0	---	---	Daily

The following design flows were used in determining the above limitations, but are not to be considered limitations or actual capacities themselves: Annual Average Design Flow 6 MGD.

Permit No. MI 0023647

PERMIT CONDITIONS

PART I, Section A-1

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS				TESTING FREQUENCY
		Minimum	Maximums			
		Daily	Daily	30-Day Avg.	7-Day Avg.	
Cadmium	All Year	---	21.5 ug/l	1.6 ug/l	---	5 x weekly
Hexavalent Chromium	All Year	---	67 ug/l	---	---	5 x weekly
Cyanide - A	All Year	---	15 ug/l	---	---	5 x weekly
Lead	All Year	---	160 ug/l	25 ug/l	---	5 x weekly
Mercury	All Year	___	---	---	---	5 x weekly
Silver	All Year	---	1.3 ug/l	0.4 ug/l	---	5 x weekly
Zinc	All Year	---	337 ug/l	---	---	5 x weekly

Permit No. MI 0023647

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS.

5. Final Effluent Limitations

a. During the period beginning April 1, 1988 and lasting until permit expiration the permittee is authorized to discharge treated municipal wastewaters from the Mt. Clemens wet weather facility through outfall 002 to the Clinton River. Such discharges shall be limited and monitored by the permittee as follows:

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS Minimum Daily	Maximums Daily	30 Day Avg.	7 Day Avg.	TESTING FREQUENCY
Carbonaceous 5-Day 20°C Biochemical Oxygen Demand	When stream flow is less than 300 cfs	---	5 mg/1 170 lb/day	---	---	Daily During Discharge
	When stream flow is between 300 cfs & 500 cfs	---	40 mg/1 1400 lb/day	---	---	Daily During Discharge
	When stream flow is greater than 500 cfs	---	60 mg/1 2000 lb/day	---	---	Daily During Discharge
Ammonia Nitrogen as N (in effect only from May 15 to September 30)	When stream flow is less than 300 cfs	---	2.0 mg/1 60 lb/day	---	---	Daily During Discharge
	When stream flow is between 300 cfs & 500 cfs	---	9.0 mg/1 300 lb/day	---	---	Daily During Discharge
	When stream flow is greater than 500 cfs	---	15.0 mg/1 500 lb/day	---	---	Daily During Discharge
pH	All Year	6.0	9.0	---	---	Daily During Discharge
Dissolved Oxygen	When stream flow is less than 300 cfs	5.0 mg/1	---	---	---	Daily During Discharge
Suspended Solids	All Year	---	---	15 mg/1	25 mg/1	Daily During Discharge

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS: Minimum Daily	Maximums: Daily	Maximums: 30 Day Avg.	Maximums: 7 Day Avg.	TESTING FREQUENCY
Total Phosphorus (as P)	All Year	---	---	---	1.0 mg/l	Daily During Discharge
Fecal Coliform Bacteria	May 15 to Oct. 15	---	---	200/100 ml	400/100 ml	Daily During Discharge

The stream flow of the Clinton River shall be monitored at the U.S.G.S. stream gauging station at Mt. Clemens daily during discharge from outfall 002 and the flow shall be reported in accordance with Part II, Section A of this permit.

The following design flows were used in determining the above limitations, but are not to be considered limitations or actual capacities themselves: 4 MGD (dewatering discharge flow).

Permit No. MI 0023647

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS.

3. Discharges From Outfall 003 (Retention Basin Overflow)

a. During the period beginning on the date of issuance and lasting until the date of expiration, overflows from the retention basin through outfall 003 to the Clinton River shall be monitored by the permittee as follows:

EFFLUENT CHARACTERISTICS	CONCENTRATION LIMITATIONS		MONITORING REQUIREMENTS
Parameter	Monthly Average	Average of 7 Consecutive Days	Testing Frequency
5 Day 20°C Biochemical Oxygen Demand	---	---	Daily During Discharge
Suspended Solids	---	---	Daily During Discharge
Total Phosphorus (as P)	---	---	Daily During Discharge
pH	---	---	Daily During Discharge
Fecal Coliform Bacteria	200/100 ml	400/100 ml	Daily During Discharge
Total Residual Chlorine	---	---	Daily During Discharge

b. All samples shall be composite during period of discharge taken prior to disinfectio except Fecal Coliform Bacteria, pH, and Total Residual Chlorine which shall be grab samples of the effluent.

c. The total daily effluent flow shall be measured daily.

d. The permittee shall provide adequate control and facilities to ensure continuous disinfection during periods of discharge.

e. An overflow shall not be permitted until the retention basin is full and the wastewater treatment plant is operating at its design hydraulic capacity.

f. The retention basin shall be promptly dewatered after each storm for subsequent treatment at the Mt. Clemens Wastewater Treatment Facility to regain storage capacit prior to subsequent storm flows. The full available dewatering capacity (maximum hydraulic flow rate of 2773 gallongs per minute) shall be effectively utilized during and following the wet weather period.

Appendix 5.2

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name and Location

Closed Hamlin Road Landfill West
3451 Hamlin Road
Utica, MI 48087

County: Macomb
Michigan Code Number: 50-03N-12E-19DC
DNR District: Detroit
EPA ID Number:

SAS Score/Screen No.: 05

Hamlin Road Landfill West is a closed landfill located between Hamlin Road Landfill (HRL) East on the east and Hamlin Road Development Co. Landfill on the west. It was first licensed under Act 87 in 1966, but is believed to have accepted wastes before this date. It was licensed to receive what are now known as type II wastes including household refuse. However, there is strong evidence that chemical wastes were dumped here. It was closed under Act 87 in 1971, the same year that HRL East was closed. Hamlin Road Dev. Co. Landfill is still operating, as is Mallow Landfill directly across Hamlin Road from HRL East and West.

HRL West, like most other landfills in this area is located in an old gravel pit. Gravel excavation proceeded below the water table which was lowered with draining. The pit was then filled in. A two foot clay layer was placed upon both HRL West and East although permeability within the clay is not known. So called "interceptor" drains help delineate HRL West and HRL East from each other, as they line the west, east and south sides of both facilities and drain off to the north. These interceptor drains were installed so that elevated water tables surrounding the two facilities did not flow through the landfills, but instead the groundwater is intercepted and diverted around, and out the north side.

Sampling of the outfall from the drain surrounding HRL West has determined that no contamination has entered the groundwater by-pass system.

HRL East has been oozing leachate on the north side forming a leachate tributary which flows via another tributary to the Clinton River less than ½ mile away. This raises serious questions about HRL West. HRL West was open longer presumably receiving more wastes. It received the same waste types as did the leaking HRL East, and was capped at the same time using the same material. Sampling from the HRL East seep has revealed benzene, xylene, methylene chloride and others.

Few if any wells are threatened by these landfills. Immediately downgradient is the Clinton River which probably represents a "sink" for groundwater contaminants.

Date of Previous Summary: 10/11/84
Previous Author: Lonnie Lee

Current Date: 4/24/86
Author: Barry J. Christi

Site Assessment Unit
Groundwater Quality Division
Michigan Dept. of Natural Resources

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name:
Closed Hamlin Rd Landfill Site
Street Number & Name:
3651 Hamlin Road
City:
Utica
State:
Michigan
Zip Code:
48087

County: Macomb
Michigan Code Number:
DNR District: Detroit
EPA ID Number:

SAS Score/Screen No.: 503

This site is a closed landfill in a moderately heavily populated area between Rochester and Utica, Michigan. It was one of two adjoining landfills, both closed, which accepted general refuse from Detroit. No liner is present, and the extent of the underlying clay is unknown. Cover is considered inadequate (leachage seeps on north slope), fencing is adequate. Presently the site is used as an auto junkyard. During operations, J. Fons Company disposed of wastes (listed as operator).

Surface water contamination from leachate seeps has been observed. The current owner's private well has been tested, and the Health Department has advised the owners not to use it for drinking. Groundwater contamination from this site will be difficult to define, as there are 16 known landfills/dumps within two miles of the site.

Date of Previous Summary: 8/3/84
Previous Author:

Current Date: 10/11/84
Author:

Site Assessment Unit
Groundwater Quality Division
Michigan Dept. of Natural Resources

Appendix 5.2

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name and Location

Fini Finish Products
24657 Mound Road
Warren, Michigan 48092

County: Macomb
Michigan Code Number: 50-01N-12E-29AA
DNR District: Detroit
EPA ID Number: None

SAS Score/Screen No.: 06

The Fini Finish Products facility currently operates as a small plating shop. The company's processes have allowed condensation, runoff and spillage, both inside and outside of their building. Ponded water in their unrestricted parking area revealed cyanide at 1500 ppm and chromium at 3900 ppm. The property owner performed a limited cleanup in the summer of 1987, but the soil is still contaminated by plating chemicals.

Date of Previous Summary:
Previous Author:

Current Date: 12/29/87
Author: S. Cunningham/
B. Fitzpatrick

Site Assessment Unit
Environmental Response Division
Michigan Dept. of Natural Resources

Appendix 5.2

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name and Location

South Macomb Disposal 9 and 9A
2001 Pleasant Avenue
St. Clair Shores, MI 48080

County: Macomb
Michigan Code Number: 50-03N-13E-15BC
DNR District: Detroit
EPA ID Number: MID069826170

SAS Score/Screen No.: 428

The South Macomb Disposal Authority Sites #9 and 9A are located in Section 15 of Macomb Township, just off of 24 mile road. For Act 307 purposes they are viewed as one site which is comprised of two parcels of land, parcel 9, owned by the Township and 9A which is owned by the Disposal Authority. Together they occupy roughly 150 acres. Estimated waste quantities at the site total approximately 1,300,000 cubic yards. The Disposal Authority operated both facilities. Site #9 was completed and capped in 1971 and #9A was completed and capped in 1975. Neither site is secured by fencing.

General refuse is the only known type of waste deposited in the landfills. Leachate problems have developed both on and off the sites. In 1983, a water balance analysis was conducted for #9A, it indicated that on the average, approximately 11 or 12 million gallons of leachate may be generated annually. Contaminants found in the leachate include heavy metals such as Arsenic, Cadmium, and Chromium and volatile organic compounds such as Benzene, 1,2-Dichloropropane, Phenols, 1,1 Dichloroethane, Tetrachloroethane, Vinyl Chloride, Methylene Chloride and Toluene.

The hydrogeologic conditions adjacent to the SMDA sites are comprised of a shallow water table aquifer and two deeper artesian aquifers. Volatile organic compounds have been found at varying concentrations in domestic water wells completed in both the water table and upper artesian aquifers. There is an indication that the two aquifers may be hydraulically connected. Four residential wells have shown contamination, the most likely source being the landfills. These residences are being provided with bottled water through Act 307 funds.

Date of Previous Summary: 10-12-84
Previous Author: Lonnie Lee

Current Date: 6-05-85
Author: Steve Cunningham

Site Assessment Unit
Groundwater Quality Division
Michigan Dept. of Natural Resources

Appendix 5.2

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name:
G and H LF
Street Number & Name:
23 Mile Road, Shelby Township
City:
Utica
State:
Michigan
Zip Code:
48087

County: Macomb
Michigan Code Number: 50-03N-12E-13AA
DNR District: Detroit
EPA ID Number:

SAS Score/Screen No.: 1036

From the late 1950's to 1966, millions of gallons of industrial waste liquids, including oils, solvents, and process sludges, were disposed of at this now closed landfill located at Ryan and 23 Mile Roads in Utica, Macomb County, Michigan. Liquid wastes were dumped in pits and lagoons on the 40-acre site. Pursuant to a law suit filed by the State of Michigan, a Consent Order was entered in 1967 requiring the company to cease disposal of all liquid wastes. The settlement, however, did not require the company to clean up the wastes already dumped at the site. The site was operated as a refuse landfill from 1967 until it closed in 1974. U.S. EPA apporved Superfund action on July 23, 1982, to erect a fence around a PCB-contaminated area. U.S. EPA and the State of Michigan have documented contamination of soil, surface water, and groundwater in the vicinity of the site.

A full field investigation and feasibility study is underway to determine the full extent of soil, surface water, and groundwater contamination at the site and to evaluate alternatives to eliminate or mitigate the impacts of the site.

Date of Previous Summary: 2/15/84
Previous Author:

Current Date: 10/12/84
Author: Lonnie Lee

Site Assessment Unit
Groundwater Quality Division
Michigan Dept. of Natural Resources

Appendix 5.2

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name: Red Run Drain LF
Street Number & Name: Between Maple Lane & Hayes Rd.
City: Sterling Heights
State: Michigan
Zip Code: 48078

County: Macomb
Michigan Code Number: 50-02N-12E-25A
DNR District: Detroit
EPA ID Number:

SAS Score/Screen No.: 815

There are approximately seven (7) landfills along the banks of the Red Run Drain in a two (2) mile stretch. Nine leachate outbreaks are visible in the vicinity, most evident at a residence on Maple Lane in Baumgartner Park, and at Sterling Heights High School. To a large degree, the leachate outbreaks may have occurred as a natural erosion of the banks or as a result of maintenance activities.

Date of Previous Summary:
Previous Author:

Current Date: 12/10/84
Author: Lonnie Lee

Site Assessment Unit
Groundwater Quality Division
Michigan Dept. of Natural Resources

Appendix 5.2

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name:
Pontiac GMC Truck and Coach Division

Street Number & Name:
660 S. Blvd. E.

City:
Pontiac

State: Michigan

Zip Code:

County: Oakland
Michigan Code Number: 63-02N-10E-03AA
DNR District: Detroit
EPA ID Number:

SAS Score/Screen No.: 08

Pontiac GMC Truck & Coach Division disposed of plating wastes and plating sludges in an area at their east plant. Barrels of cyanide plating sludges were buried at the site and could be leaking so there is a potential for groundwater contamination. The facility is in a clay bound area but the potential still exists for groundwater contamination and the City of Pontiac takes there drinking water from the ground.

There is known surface water contamination to Amy Creek and the Clinton River. Contamination includes PCB's and other contaminants that could be harmful to the aquaticecosystem.

It should be recommended that further groundwater studies be conducted to determine if contaminated groundwater is leaving the site.

Date of Previous Summary:
Previous Author:

Current Date: 10/3/84
Author: Lonnie Lee

Site Assessment Unit
Groundwater Quality Division
Michigan Dept. of Natural Resources

Appendix 5.2

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name: Liquid Disposal Inc.

Street Number & Name:

City: Utica

State: Michigan

Zip Code:

County: Macomb

Michigan Code Number: 50-03N-12E-30AA

DNR District: Detroit

EPA ID Number:

SAS Score/Screen No.: 676

Liquid Disposal, Inc. (LDI) is an abandoned liquid waste incineration facility located at 3901 Hamlim Road, Utica, Macomb County, Michigan. The 6-acre site contains an inoperative incinerator and various industrial liquid wastes and sludges contained in two waste lagoons, numerous above and below ground tanks, over 1,000 drums and numerous small containers. Following an incident in which toxic hydrogen sulfide gas was produced and two workers were killed, the citizens of Shelby Township filed suit on January 22, 1982, to permanently enjoin LDI from operating. On April 27, 1982, LDI was forced into voluntary bankruptcy. The firm was permanently closed on May 7, 1982, by the Macomb County Circuit Court. U.S. EPA and State investigations have revealed contamination of air, soil, surface water, and groundwater in the vicinity of LDI. On May 20, 1982, U.S. EPA approved a Superfund action to clean up a PCB - contaminated oil spill at the site. One July 23, 1982, U.S. EPA approved another Superfund action to remove liquid wastes from a lagoon that was threatening to overflow and to remove contaminated water from the area surrounding the abandoned incinerator.

A full field investigation and feasibility study is underway to determine the source(s) and full extent of soil, surface water, and groundwater contamination at the site and to evaluate alternatives to eliminate or mitigate the impacts of the site.

Control or removal of hazardous substances from above ground waste lagoons, drums, tanks, and other containers has been completed.

Date of Previous Summary: 11/17/83

Previous Author:

Current Date: 10/11/84

Author: Lonnie Lee

Site Assessment Unit
Groundwater Quality Division
Michigan Dept. of Natural Resources

Appendix 5.2

EXECUTIVE SUMMARY

Site Name and Location

Sanicem Landfill/J. Fons Co.	County: Oakland
4901 S. Lapeer Road	Michigan Code Number: 63-03N-10E-02AA
Pontiac, Michigan 48054	DNR District: Detroit
	EPA ID Number: MID 980678304

This is a closed landfill which operated from 1969-1978. No known disposal of anything other than general refuse occurred, but contaminants found indicate sludges and possible industrial wastes are present. This is uncertain, however, as at least two other landfills are located nearby: Silver Bell Ski Area, and Oakland County Road Commission Sanitary Landfill #2.

A leachate collection system is in place, but its effectiveness is uncertain. Several leachate outbreaks have been reported, with the collection system being extended each time to incorporate the new source.

The one problem definately attributable to Sanicem is the (low) potential for lateral gas migration, especially W-NW towards a house. Site inspections have found transient gas bubbles on the cover, some reaching explosive methane concentrations, despite numerous vents.

Follow Up Recommendation for EPA

Monitor wells on site should be sampled regularly. Additional wells may be needed to determine the source of contamination found in private wells.

The continuing problem of high gas concentrations is of more concern, and for this reason this site has been given a "medium" priority for site inspection.

Date: July 31, 1984
Name: Lonnie Lee
Mark Petrie

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name:
Oakland Co. Rd. Comm. Lk Orion

County: Oakland

Street Number & Name:
Clarkston Rd, West of M-24

Michigan Code Number:

DNR District: Detroit

EPA ID Number:

City:
Lake Orion

State:
Michigan

Zip Code:

SAS Score/Screen No.: 05

This site which should be combined with Residential Wells Lake Orion is the source of contamination to a number of residential well on Bald Mountain Rd. in Lake Orion. A thorough investigation and hydrogeo study confirmed the OCRC as being the source of chloride contamination in the residential wells.

Date of Previous Summary:
Previous Author:

Current Date: 10/11/84
Author: Lonnie Lee

Site Assessment Unit
Groundwater Quality Division
Michigan Dept. of Natural Resources

Appendix 5.2

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name and Location

Great Lakes Container Corporation
415 Collier Rd
Pontiac, Michigan 48055

County: Oakland
Michigan Code Number: 63-03N-10E-08AA
DNR District: Detroit
EPA ID Number:

SAS Score/Screen No.: 934

This Company, located 0.5 miles north of Pontiac, recycled 55 gallon drums. Their permit required: 1) no barrels with more than 1 inch of material on the bottom, 2) no waste material, 3) no herbicides or pesticides. Their operation included taking barrels that had one end removed, they were upended and placed on a trck which leads thru a spray wash and furnace. The furnace burned off all residue and water, and the only permitted emission was by air.

A 9/4/80 site inspection indicated "a lot of sludge (from the furnace - hauled by Standard Disposal) caked on the ground around the furnace", and "all along the northern end of the property it appeared that several hundred drums had been landfilled. All along a bank 8-15 feet high and 500-600 feet long there were drums sticking out of the bank." Most were empty, others had solids, no liquids were observed.

A Marsh on the north end drains into Galloway Creek which runs past several homes. Allegedly drums are buried right up to the marsh. It is also alleged that barrels were routinely tossed over the NE corner fence into the adjacent city landfill. Sediment and water samples (12/13/79) showed traces of C-56, dieldrin, other organics and metals such as Zn, Pb, Cr, Cd and Ni.

A site visit on May 13, 1986 by Bob Hayes (GQD, MDNR) reveled many drums had been burried at the site including areas under the driveways. Barrels at the site are labled to contain a variety of solvents, paint sludges, and oils. Stained soils are evident in many parts of the site. The estimated number of drums presently at the site is around 4,500. This number included about 3,000 drums which are partially burried. Groundwater Contamination is highly suspected.

Date of Previous Summary: 10-11-84
Previous Author: Lonnie Lee

Current Date: 11-10-86
Author: Steve Cunningham

Site Assessment Unit
Groundwater Quality Division
Michigan Dept. of Natural Resources

Appendix 5. 2

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name and Location

Anchor Motor Freight
1280 Joslyn
Pontiac, Michigan 48055

County: Oakland
Michigan Code Number: 63-03N-10E-26BA
DNR District: Detroit
EPA ID Number: None

SAS Score/Screen No.: 783

The Anchor Motor Freight site includes a three (3) acre marsh, which has been contaminated by years of floor drain waste being released into it. Contaminants include fuel oil, diesel fuel, solvents, gasoline, motor oil and other liquids associated with motor repair and maintenance.

Michigan Department of Natural Resources (MDNR) staff had observed one (1) inch of free product (petroleum) floating on the marsh surface. There was a large fire in April 1986, which burned off much of the free product.

MDNR staff became aware of the prior mentioned problem when responding to a leaking underground storage tank (LUST) problem. There was one (1) 2,000 gallon oil storage tank and one (1) 500 gallon waste oil tank, which were removed. Contamination of soil from the LUST problem was observed and the soil was removed. The effect on groundwater was not determined.

Date of Previous Summary:
Previous Author:

Current Date: 12-29-87
Author: S. Cunningham/
B. Fitzpatrick

Site Assessment Unit
Environmental Response Division
Michigan Dept. of Natural Resources

Appendix 5.2

SITE DESCRIPTION/EXECUTIVE SUMMARY

Site Name and Location

Mt. Clemens Plastics
151 Lafayette St.
Mt. Clemens, MI 48043

County: Macomb
Michigan Code Number: 50-02N-11E-02DC
DNR District: Detroit
EPA ID Number: MID076342708

SAS Score/Screen No.:

The Mt. Clemens Plastics Plant is located in northern Mt. Clemens, Macomb County. The plant produces over 80% of vinyl utilized by the Ford Motor Company. PVC, plasticizers and pigments are the primary ingredients used to produce vinyl sheets an extruded beads. Various solvents are used as carriers for pigments in the color process. Plasticizers are stored in two 20,000 gallon, two 15,000 gallon and two 8,000 gallon above-ground storage tanks. Solvents are stored in two 10,000 gallon and three 12,000 gallon underground storage tanks. There were at least 5 losses of solvents and plasticizers to Greiner Drain from 1968 to 1978. The number or magnitude of spills to the drain since 1978 is not presently known. No facilities or procedures are utilized which would detect slow leaks from the underground tanks. No underground drainage system is provided at this site to divert groundwaters or leakage to collection systems. The plant obtains its water supply from a municipal system. Stormwater from the grounds and unloading area carry various amounts of plasticizer, oil, phthalates, PVC powder and organic solvents to a drainage interceptor and oil-water separator. The interceptor diverts the dry weather flow to the sanitary sewer but storm water surges allow discharge to Greiner Drain, a tributary of the Clinton River. During sampling of wastewater in 7/72 and 3/77, elevated levels of PCBs (5.1 mg/l), phahalates (1.5 mg/l) and methyl ethyl ketone (110 mg/l) were detected. A high potential exists for the contamination of the waters and sediments of the drain due to the overflow of contaminated wastewater. No hydrogeological investigations or groundwater sampling have occurred on-site.

Recommendations for EPA

The site is given a high priority for inspection due to the high potential for contamination of the surface water and sediments in Greiner Drain and associated downstream bodies of water. Analysis of the drain's sediments and surface waters should be undertaken in order to allow for a more adequate evaluation of the site to occur.

Date of Previous Summary:
Previous Author:

Current Date: 11/25/85
Author: N. Rottschafer

Site Assessment Unit
Groundwater Quality Division
Michigan Dept. of Natural Resources

APPENDIX 9.1 Response to public concerns expressed at the Public Meeting held Thursday, July 29, 1986 at the Verkuilen Building, Mt. Clemens, Michigan.

C = Public Comment R = DNR Response

1. C. A watershed approach should be used for the NPDES permit.
   R. We are using the watershed approach to issue NPDES permits.

2. C. The water quality data base should be added to the existing Clinton computer model used by the Macomb County Public Works Commission as a tool for flood control and stormwater management.
   R. The data are all available on computer disks for anyone who desires a copy. Please submit 4 blank disks and we will send you a copy of all sediment, water, aquatic macroinvertebrates and fish data contained in this report.

3. C. There are many areas that need attention on the River and require state and local cooperation. There is a need to talk between levels of government on, for example, sedimentation.
   R. We need to work together, but local problems require local initiatives as well. We should work through the CRWC and SEMCOG to cut across government boundaries. The two listed above provide a forum for this kind of cooperation.

4. C. There is a need to upgrade any facilities that may be still discharging toxic chemicals to the River from the Mt. Clemens area.
   R. All NPDES permitted facilities were issued new permits in 1985. They will be reissued in another five years unless there is a reason to do so sooner.

5. C. We need funding for the Mt. Clemens wastewater treatment plant.
   R. Local issues need to be funded by local people. However, the state revolving fund may provide some relief.

6. C. Stormwater run-off is the main problem. We need to be treating it.
   R. Stormwater is a major problem in terms of flow and pollution. The plan suggests a pilot approach to monitor storm water impacts. Control is another problem. It's expensive!

7. C. Pollution from trash and debris is also a problem. For example, near Moravian and Cass Avenue. This causes flooding siltation, damming of the river, soil erosion, and the loss of trees and aquatic life.
   R. Get together for your "Clean up the Clinton" Days. These have occurred in the past and one is scheduled for 1988. Join your Clinton River Watershed Council and "Clean up the Clinton". You can help by doing your part.

8. C. Sediments are building up with the spillway. Short-term and long-term plans need to include removing debris, river maintenance, monitoring and sharing information, responsible development, and assistance to communities so they can comply with EPA and DNR regulations.

R. The Intracounty Drainage Board should be monitoring the sediment build-up and needs to set aside funds or raise a bond issue to fund sediment removal.

9. C. We need to look at both quantity and quality issues on the Clinton River.

R. Too much water can be as detrimental as not enough. Options for quality water start with control of the quantity. Again, stormwater management is the key here, but it won't solve all your problems.

10. C. We support the Joint Rules Committee passing the new Part IV. We believe they will help Clinton River problems a great deal.

R. The Part IV Rules for the Water Quality Standards were passed. Thank you for your support. Effective regulation is important to progress.

11. C. We are concerned about a dam on the Clinton River at the Old Cascade golf course owned by Pine Valley.

R. A memo to the MDNR dam inspector will be written to inform him of your concern.

12. C. We are concerned about development in the floodplain from the M-59 freeway extension in Utica.

R. This project has been reviewed and determined to be in the best interest of the greatest number of prople.

13. C. A caustic solution from Michigan Nut Products is going directly into the Clinton River because the storm sewer is hooked into the sanitary sewer.

R. A memo to the SWQD district staff will be written and an inspection by the district staff will be performed.

14. C. Concerned about the building permits for five duplexes in the floodplain. There has been a lack of response of state officials to this issue.

C. Commercial operations can build in a floodplain, but residential people cannot. We should control building in the floodplain with no exceptions and have policies to control easements.

R. Building in the floodplain should be discouraged. One way to discourage this type of development is to work on your own local ordinances so that they are even more restrictive than the State regulations. Local government needs to control local development.

16. C. Even though environmental conditions are getting better, there still are problems.

R. There will always be problems. But don't worry about tomorrows problems, each day has enough of its own.

17. C. Treatment plants need the capacity to hook up to the Detroit system and not to the Clinton River when the local systems get overloaded.
R. This is a local political issue which has been resolved by your own local officials. I agree with the concept and support it especially since the interceptor is so near.

18. C. We should retain stormwater in new developments so that it doesn't go directly to the Clinton River.
R. Stormwater retention basins would be extremely helpful in newly developing areas, especially in the upper river reaches. This is one area where your involvement with local building codes can really have an impact. Work with your watershed council to draft and implement these new regulations to preserve the excellent quality that exists in the upper reaches of the Clinton River.

19. C. Dumping in the River should not be allowed.
R. Dumping in the River is prohibited unless regulated by an NPDES permit which has been reviewed and limits issued which will assure that the effluent will not harm aquatic life or degrade water quality.

20. C. Sites like LDI should not be allowed to be built.
R. We have learned much from our past. We have made many mistakes. Cradle to grave management of toxic or hazardous wastes is coming but there are many ways to beat the system. It takes lots of local eyes and ears to maintain high quality surface waters. Let's all help by calling the PEAS number (1-800-292-4706) if we see something suspicious.

21. C. We need to quickly put in wells for people in areas of contamination or we need to connect them to sewer lines.
R. Good, safe drinking water is a must. Local governments need to be good stewards of their landfills as well as their people. Service should be provided by those who pollute.

22. C. What is the latest information on the newly discovered landfills in the Clinton River basin?
R. The details are partly in the RAP, but for more specific information on particular sites, call the district office at Northville, Environmental Response Division, 313-344-9440.

23. C. Why is the City of Mt. Clemens getting stagnant water at the spillway?
R. The problem is described in the RAP in chapter 3.

24. C. Where is the sedimentation coming from?
R. Sediments are naturally eroded by running water. The erosion problems are made worse by flooding, poor soil conservation practices, lack of green belting, no cover crops, erosion storm

water runoff and channel bank erosion due to out of control river hydraulics.

25. C. It seems as if the City of Mt. Clemens is being forced into the Detroit system, but we should get dollars to do it ourselves.
    R. The City of Mt. Clemens is building their own WWTP.

26. C. There was concern about the LDI site and that the Red Run Drain is being used as a dumping area.
    R. Both LDI and Red Run are receiving attention through 307 and Superfund monies.

27. C. There was concern that groundwater will eventually seep down from the 31 Mile Road landfill into the nature center below the landfill. There is concern about pollution from the Clawson Concrete Company and the lack of clarity as to whether or not this area has been cleaned up.
    R. The only way to tell the groundwater direction is to put down wells and measure the contaminants. This is expensive and without funding it won't be done. Again, those responsible for creating the dump need to do the cleanup.

    A memo will be written to Northville district SWQD staff concerning the Clawson Concrete Company and the district staff will make a site inspection and initiate any required action.

28. C. It was noted that cars have been dumped into streams of the Clinton River.
    R. Those cars should be removed by the local property owners or the township. Again, lots of local eyes and ears reduce these types of activities if they are reported.

29. C. It was mentioned that the DNR needs to do more inspections and to be allocated more money to do them.
    R. The MDNR is grossly understaffed. Letters to your congressman or congresswoman really do help. Write one today and explain your desire for them to lobby for additional funds for MDNR staff.

30. C. What part of the River will be included in the Remedial Action Plan? The RAP should cover the area up through Pontiac to get most of the urban run-off problem.
    R. The RAP includes the entire Clinton River watershed although the AOC is specifically stated as Sections 1, 2, and 3.

31. C. We need a systematic testing of all fish species to determine the magnitude of the fish contamination problem.
    R. An enhanced fish monitoring plan is part of the recommendations in Chapter 10.

32. C. We need to identify all the combined sewer overflows on the River and determine if the retention basins are working.
    R. CSO's and retention basins are discussed and described in the RAP in Chapters 3, 4 and 5.

33. C. Substances found in landfills are here for thousands of years and we can't ignore them.
R. Unfortunately, the statement is correct. We need to develop more of a recycling attitude than our present "throwaway society".

34. C. What is happening to the sediments from dredging operations?
R. This is described in the RAP in Chapters 3, 4, and 5.

35. C. The state needs to take the lead role so that each municipality is not competing with everyone else to develop in floodplains and wetlands.
R. There are state regulations but local regulations with local inspections and follow-up are more effective in the long-run.

36. C. We need stiff fines for pollution so that it is not profitable to pollute.
R. I'll say "yes" to that!

37. C. We need quicker response and a change of attitude on the part of governments. It shouldn't have taken six years to get action on 24 Mile landfill.
R. I agree but local people set local funding priorities. Get involved with your local government.

38. C. We need to be tougher in the issuance of permits in wetlands.
R. We need to be tough, fair and consistent. Local wetland ordinances have proved very effective where they have been developed, promulgated and enforced locally.

39. C. Landfills should be engineered ahead of time and to strict standards.
R. Agreed. Let's learn from the past. Not everything should go in landfills. We need to recycle, reuse, and rethink our attitudes toward our environment and our future.

40. C. We need to ask politicians what their commitments are to the lakes and the rivers of our state before we cast our ballots.
R. Good idea - then hold them to their claims after they are elected.

41. C. In the City of Mt. Clemens, sediments are accumulating where the River drops and we are getting stagnant water at the spillway.
R. This is discussed in the RAP in Chapters 3, 4, and 5.

42. C. We need to support the Part IV Water Quality Rules that have been in the works for over 10 years.
R. They were passed! Thanks for the support.

43. C. How does the audit trail that will not be available for hazardous cargos work so that we can reduce midnight dumping problems.

R. Call you Northville office on this one. Phone 313-344-4670 for Water Management Division.

44. C. There was a concern that the criteria used to clean up Areas of Concern meet the water quality objectives of the Great Lakes Water Quality Agreement especially in terms of fecal coliforms and dissolved oxygen.
R. This is addressed in Chapters 3, 4, and 5 in the RAP.

45. C. There are still many water quality problems in the River. There is sewage in the Red Run drain. There are dissolved oxygen problems, fecal coliform, heavy metals, and toxics contaminate the fish. Sedimentation is not meeting criteria for metals, and PCBs and mercury are bioaccumulating in fish. Combined sewer overflows could be bringing in toxics.
R. All of these issues are described in the RAP. Solutions or studies are proposed to look at those issues which we know what to do with.

46. C. Remedial action plans need to address the fisheries and headwaters problem.
R. The headwaters are in pretty good shape. See the fisheries section of Chapter 4.

47. C. Human pollution is the problem on the River in terms of no place to clean out the holding tanks on boats which have valves that allow the residue to be dumped right into the River and not be cleaned out. There are no ordinances for pumping out sites.
R. There are ordinances for this. It is illegal to dump human pollution. Pump out facilities are available at many marinas.

48. C. There are tons of debris that enter the Lake from the River every year. We need a screen at the mouth of the spillway to collect the debris before it goes out into the Lake and causes navigational problmes. Many large, 30-foot timbers flow through at the areas which are dangerous to boaters.
R. Rivers carry all kinds of debris, but it is a normal thing which occurs everywhere. A screen would soon be plugged and then flooding would occur. I don't have a good solution to this one.

49. C. Concern was raised about airborne pollution and the need for more research.
R. This is one of the Remedial Action Plan recommendations.

50. C. Recommendation for ongoing fish studies.
R. This is also a recommendation of the plan.

51. C. Recommendation to set up a secret witness program to report all polluters and give rewards to the reporters.
R. This could be done on a local basis. Local people seeing and hearing things shouldn't need to be paid to do what they know

is right to do. All who live there share the responsibility. It's not somebody elses problem, it's your problem.

52. C. Comment about spraying herbicides and pesticides. We should encourage use of the less toxic materials and closely monitor its use and train the personnel who handle these substances.
R. There are excellent instructions for use of herbicides and pesticides on the labels of the containers in which they come. The government takes tremendous care to see that they are written so people will use these chemicals properly. Hopefully, they will. A county soil conservation service person or local extension agent could help if this is deemed a problem.

53. C. Concern about the G&H Landfill and the five carcinogenic chemicals including Agent Orange that are still believed to be on the site.
R. There is a great deal of activity occurring at G&H landfill and the problem will be resolved.

54. C. Disagreement was expressed with the statement that there are metals in the Red Run. Does the DNR send reports only to Oakland County so that Macomb county does not know about heavy metal problems in the Red Run Drain.
R. All the sediment and water chemical data (including metals data) that could be found are in this document. Also, the CRWC has an extensive library of Clinton River Reports. There may be a lack of information on this subject, but it has not been hidden. All MDNR information is public information and anyone has a right to see it.

55. C. Believes that the DNR is already protective enough of wetlands.
R. We need to be firm and fair with wetlands protection when they are truly of use to wetland organisms.