Water Quality Survey and Assessment for the Township of Piscataway

Prepared for:
Township of Piscataway
Middlesex County, New Jersey

Prepared by:
Louis Berger & Associates, Inc.
East Orange, New Jersey

December 1995

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

I. INTRODUCTION

The objectives of this report have been to: 1) summarize the flow characteristics of selected waterbodies within the Township of Piscataway (Raritan River, Bound Brook, Ambrose Brook, Doty's Brook); 2) develop a volunteer water quality sampling plan for New Market Pond; 3) research available data regarding the water quality and aquatic ecosystem of the Raritan River; and 4) prepare a water quality profile report of the Raritan River and New Market Pond. Only secondary source data were used. A digitized map of stream flow characteristics within the township is also provided.

Numerous written sources were used for this report, in addition to personal communications with local, state, and federal agencies. A list of references used and agencies contacted are provided. The appendices contain correspondence and other data referred to in the body of the text.

II. STREAM FLOW ANALYSES

The Township of Piscataway lies within the watershed of the Raritan River. The Raritan River borders Piscataway on the southwest. Green Brook is a tributary of the Raritan River, entering the Raritan River approximately 0.4 miles upstream of Piscataway. Ambrose Brook and Bound Brook, both tributaries of Green Brook, flow through the township. Doty's Brook is a tributary of Ambrose Brook.

A. Raritan River

For a distance of approximately 5.5 miles, the Raritan River borders Piscataway on the southwest between the Borough of Middlesex to the north and the Borough of Highland Park to the south. River width decreases in the upstream direction from approximately 700 feet in Highland Park to approximately 300 feet in Middlesex.

The overall Raritan River drainage area is approximately 1105 square miles. Upstream of Piscataway, measured from Queens Bridge at Bound Brook which is about half a mile upstream of the Piscataway-Middlesex border, the drainage area is approximately 804 square miles.

The Raritan River is a tidal waterbody. The New Jersey Department of Environmental Protection (NJDEP), Bureau of Tidelands Management, places the head of tide 1.1 miles upstream of the Landing Lane bridge. Head of tide is defined as the point along a tidal waterway at which the measurement of vertical movement of the water surface due to tidal action is no longer a practical measurement. The maximum possible upstream extent of tidal influence has been placed by researchers at Rutgers University at Fieldville Dam, located 400-500 feet upstream of the bridge crossing of Route 287. The Fieldville Dam was built in the early 19th century to feed the Delaware and Raritan Canal.

The tidal effects just below Fieldville Dam are small, being felt only at times of very low nontidal freshwater flows and high tidal range conditions. During these times the seaward flow is slowed, there is no landward flow, and the water surface fluctuation is usually less than one foot. In contrast, near Landing Lane bridge, very weak landward flows occur during flood tides with the tidal water surface fluctuation typically under 3.3 feet. The mean tidal range of the Raritan River at New Brunswick/Highland Park, about 3/4 of a mile downstream of Piscataway near the Raritan Avenue bridge, is 5.65 feet.

Anadromous fish live in salt water and spawn in freshwater. The Fieldville Dam has been identified in a NJDEP report as a barrier blocking or limiting anadromous fish passage and reducing potential spawning habitat. However, it is a low dam and is overtopped during spring high flows thus allowing some fish migration to occur in these instances.

The United States Geological Survey (USGS) maintains two monitoring stations near Piscataway along the nontidal Raritan River: station 01403300 and station 01403060. Station 01403300 is located at Queens Bridge at Bound Brook, approximately half a mile upstream of the Piscataway-Middlesex border. This station monitors water quality only. Station 01403060 is located just under two miles upstream of the Piscataway-Middlesex border. This station monitors flow only. The most recent stream flow data available from this station are provided in Table 1.

B. Ambrose Brook and Doty's Brook

Ambrose Brook is a tributary of Green Brook. The headwaters of the Ambrose Brook system and its confluence with Green Brook both lie outside of Piscataway. Green Brook empties to the nontidal Raritan River approximately 0.4 miles upstream of the Piscataway-Middlesex border. Most of the Ambrose Brook drainage is within the township. Doty's Brook is a tributary of this system. Stream flow data for Ambrose Brook and Doty's Brook were not identified.

Lake Nelson is located along Ambrose Brook. There is a concrete dam at the lake. A report by the American Littoral Society identifies the dam at Lake Nelson as a primary impediment to the upstream migration of anadromous fish. Anadromous fish live in salt water and spawn in freshwater. This dam is the first site along the Ambrose Brook system that prevents migrating fish from reaching spawning habitat.

C. Bound Brook

Bound Brook is a tributary of Green Brook. The headwaters of the Bound Brook system and its confluence with Green Brook both lie outside of Piscataway. Green Brook empties to the nontidal Raritan River approximately 0.4 miles upstream of the Piscataway-Middlesex border. Most of the Bound Brook drainage lies outside of the township. Stream flow data for Bound Brook within the township were not identified.

New Market Pond is located along Bound Brook. There is a dam at the lake. A report by the American Littoral Society identifies the dam at New Market Pond as a primary impediment to the upstream migration of anadromous fish. Anadromous fish live in salt water and spawn in freshwater. This dam is the first site along the Bound Brook system that prevents migrating fish from reaching spawning habitat. Secondary and tertiary impediments were identified upstream of New Market Pond, outside Piscataway, at the Spring Lake Dam and Cedar Brook Lake impoundment.

III. RARITAN RIVER WATER QUALITY AND AQUATIC BIOTA

A. Water Quality

The Raritan River downstream of the Landing Lane bridge has a NJDEP surface water classification of SE1. This classification applies to saline waters of estuaries. Saline waters are defined as having salinities generally greater than 3.5 parts per thousand at mean high tide. Designated uses for the Raritan River at this location are the maintenance, migration and propagation of natural and established biota; primary and secondary contact recreation; and any other reasonable uses.

TABLE 1

[1]STREAM DISCHARGE DATA: RARITAN RIVER (USGS STATION 01403060)

AUGUST 1994 TO JULY 1995

	[2]Mean Discharge (cfs)	[3]Maximum Discharge (cfs)	[3] Minimum Discharge (cfs)
Aug	800	5140	197
Sep	228	528	128
Oct	179	388	133
Nov	500	3500	167
Dec	841	3130	356
Jan	1258	4680	371
Feb	861	3720	460
Mar	1378	8780	365
Apr	465	1630	262
May	345	704	177
Jun	248	1160	92
Jul	310	1600	143

Notes:

1 Below Calco Dam at Bound Brook.
2 Arithmetic mean of daily mean discharges during each month.
3 Maximum and minimum daily mean discharges during each month.

cfs cubic feet per second

Source: United States Geological Survey.

Upstream of the Landing Lane bridge, the Raritan River has an FW2-NT classification. This classification applies to nontrout freshwater. Freshwater is defined as nontidal and tidal waters generally having a salinity, due to natural sources, of less than or equal to 3.5 parts per thousand at mean high tide. Nontrout waters are generally not suitable for trout production or maintenance because of their physical, chemical, or biological characteristics, but are suitable for other fish species. Designated uses for this classification are maintenance, migration and propagation of the natural and established biota; primary and secondary contact recreation; industrial and agricultural water supply; public potable water supply after treatment; and any other reasonable uses.

New Jersey State Water Quality Inventory reports present water quality assessments at USGS station 01403300 monitored for two 5-year periods: 1983-1987 and 1986-1990. A comparison of the data for these two periods is presented in Table 2. The 1994 Water Quality Inventory considered the overall reduction of 5 for the water quality index as a sign of improvement. However, the primary contact designated use (swimming) at this station is not supported. This is due to elevated levels of fecal coliform bacteria for the 1986-1990 monitoring period during which violations of state criteria occurred in 58 percent of the samples.

The most recent water quality data available for this station are provided in Table 3 along with state surface water quality criteria. Phosphorus and fecal coliform levels are high.

Piscataway influences Raritan River water quality by means of its effect on the water quality of Green Brook and through direct discharge from tributaries. The township's impact to Green Brook water quality is related to the township's impact on Ambrose Brook and Bound Brook waters. Known and potential point discharges and nonpoint sources of pollution to the Ambrose Brook and Bound Brook systems, and to tributaries that empty directly to the Raritan River, have been identified.

The New Jersey Pollutant Discharge Elimination System (NJPDES) permit program regulates point source discharges to the Raritan River. The 1992 Water Quality Inventory report lists five NJPDES permitted discharges to the Raritan River watershed from facilities located within the Township of Piscataway. These facilities and receiving waters are listed in Table 4. None of these facilities were listed as not in compliance with their permits. It is not possible to account for illegal, non-permitted point source discharges.

The Middlesex County Hazardous Materials Unit responds to calls regarding spills in Piscataway. According to this unit, waterways in the township are protected today from industrial sources of pollution to a much greater extent than they were 10 to 15 years ago. Industrial sites are not a source of spills today due to regulations requiring secondary containment structures around storage tanks and containment structures during offloading of materials. However, spills that endanger township waterways occur today from motor vehicles and home fuels that enter storm sewer systems.

NJDEP's 1995 report *Known Contaminated Sites in New Jersey* lists 51 known contaminated sites in the Township of Piscataway. A review of the addresses of these sites indicates that some are located adjacent to township waterways and thus, could be a source of contaminants to these waterways by stormwater runoff or migration through the groundwater system. These sites are listed in Appendix A.

The Piscataway Health Department sampled 13 sites along Ambrose Brook in July and August of 1995. The results of the water quality analyses are presented in Table 5 along with state surface water quality criteria of detected constituents. Sample locations are presented in Appendix B. Fecal coliform levels are sometimes elevated. The state criteria for barium and silver are not exceeded, but those for lead and mercury are exceeded upstream. At downstream locations, however, lead standards are met and mercury is not detected.

TABLE 2

[1]WATER QUALITY INDEX PROFILES: RARITAN RIVER (USGS STATION 01403300)

	Temperature	Oxygen	pH	Bacteria	Nutrients	Solids	Ammonia	Metals
1983-1987								
Average WQI	3	7	4	39	28	7	5	10
Worst three months	Jun-Aug	Aug-Oct	Mar-May	Jul-Sep	Aug-Oct	Aug-Oct	May-Jul	Feb-Apr
1986-1990								
Average WQI	4	7	4	30	27	6	8	5
Worst three months	Jun-Aug	Aug-Oct	Dec-Feb	Aug-Oct	Jun-Aug	May-Jul	Jul-Sep	Sep-Nov

1983-1987 Overall average WQI 31

1986-1990 Overall average WQI 26

Legend: Water Quality Index Description Note: An index value of 20 is equivalent to the level of water quality criteria.

WQI	Condition	Description	WQI	Condition	Description
0-10	Excellent	Pollution minimal or absent; water uses met throughout the year.	61-80	Poor	Pollution present in high levels; water uses not met.
11-25	Good	Pollution generally in low amounts; water uses periodically not met.	81-100	Very Poor	Pollution present in extremely high levels; severe stress to streamlife; water uses not met.
26-60	Fair	Pollution varies from moderate to high levels; certain water uses prohibited.			

Note:

[1] At Queens Bridge at Bound Brook.

Sources: NJDEP Water Quality Inventory Reports: 1990, 1992, 1994.

[1]TABLE 3

[2]WATER QUALITY DATA: RARITAN RIVER (USGS STATION 01403300)

NOVEMBER 1994 TO AUGUST 1995

Date	Temperature Water (°C)	Barometric Pressure (mm of Hg)	Gage Height (feet)	Turbidity (NTU)	Specific Conductance (µs/cm)	*Oxygen, Dissolved (mg/l)	Oxygen, Dissolved (% saturation)	pH (standard units)	Alkalinity (mg/l as $CaCO_3$)
11-23-94	8.5	761	—	8.8 (50)	273	10.1 (4.0)	86	7.6 (6.5-8.5)	51
03-09-95	5.0	762	25.21	82 (50)	146	11.4 (4.0)	89	7.2 (6.5-8.5)	22
06-01-95	21.5	765	16.92	4.0 (50)	335	9.7 (4.0)	110	7.9 (6.5-8.5)	55
08-17-95	26.5	759	—	2.3 (50)	331	7.3 (4.0)	91	7.6 (6.5-8.5)	45

Date	Nitrogen, Ammonia Dissolved (mg/l as N)	Nitrogen, Nitrite Dissolved (mg/l as N)	Nitrogen, Ammonia & Organic Total (mg/l as N)	Nitrogen, NO_2+NO_3 Dissolved (mg/l as N)	Nitrogen, Ammonia Dissolved (mg/l as NH_4)	Phosphorus Total (mg/l as P)	Phosphorus, Dissolved (mg/l as P)	Phosphorus Ortho, Dissolved (mg/l as P)	Calcium, Dissolved (mg/l as Ca)	Magnesium, Dissolved (mg/l as Mg)	Sodium, Dissolved (mg/l as Na)
11-23-94	0.120	0.010	0.50	1.70	0.15	0.220 (0.1)	0.160	0.160	21	7.4	17
03-09-95	0.070	<0.010	1.3	0.880	0.09	0.480 (0.1)	0.070	0.060	9.5	3.3	11
06-01-95	0.030	0.030	0.40	2.80	0.04	0.350 (0.1)	0.280	0.290	24	8.8	26
08-17-95	0.050	0.030	0.60	2.80	0.06	0.580 (0.1)	0.540	0.560	23	8.2	26

[1]TABLE 3 (CONTINUED)

[2]WATER QUALITY DATA: RARITAN RIVER (USGS STATION 01403300)

NOVEMBER 1994 TO AUGUST 1995

Date	Potassium, Dissolved (mg/l as K)	Chloride, Dissolved (mg/l as Cl)	Sulfate, Dissolved (mg/l as SO_4)	Fluoride, Dissolved (mg/l as F)	Silica, Dissolved (mg/l as SiO_2)	Barium, Dissolved (μg/l as Ba)	Cobalt, Dissolved (μg/l as Co)	Iron, Dissolved (μg/l as Fe)	Manganese, Dissolved (μg/l as Mn)	Molybdenum, Dissolved (μg/l as Mo)
11-23-94	3.7	27 (*)	27 (250)	0.10	7.5	35	<3	160	87	10
03-09-95	2.4	18 (*)	9.8 (250)	<0.10	8.3	26	3	540	78	<10
06-01-95	3.5	33 (*)	35 (250)	0.20	7.1	41	<3	56	25	<10
08-17-95	4.1	35 (*)	39 (250)	0.30	5.4	33	<3	73	38	30

Date	Nickel, Dissolved (μg/l as Ni)	Silver, Dissolved (μg/l as Ag)	Strontium, Dissolved (μg/l as Sr)	Vanadium, Dissolved (μg/l as V)	Aluminum, Dissolved (μg/l as Al)	Lithium, Dissolved (μg/l as Li)	Selenium, Dissolved (μg/l as Se)	**Fecal Coliform (#/100 ml)	Fecal Streptococci (#/100 ml)
11-23-94	<1 (**)	<1.0 (***)	140	<6	60	<4	<1	2100 (200)	>1200
03-09-95	1 (**)	<1.0 (***)	52	<6	1000	<4	<1	>2000 (200)	6400
06-01-95	4 (**)	<1.0 (***)	180	<6	30	<4	<1	220 (200)	78
08-17-95	2 (**)	<1.0 (***)	180	<6	<10	4	<1	340 (200)	100

[1]TABLE 3 (CONTINUED)

[2]WATER QUALITY DATA: RARITAN RIVER (USGS STATION 01403300)

NOVEMBER 1994 TO AUGUST 1995

Date	Solids, Dissolved (sum of individual constituents) (mg/l)	Sediment, Suspended (undissolved retained on 0.045 mm filter) (mg/l)
11-23-94	150	18 (40)
03-09-95	81	427 (40)
06-01-95	184	10 (40)
08-17-95	182	—

Refer to notes on the following page.

[1]TABLE 3 (CONTINUED)

[2]WATER QUALITY DATA: RARITAN RIVER (USGS STATION 01403300)

NOVEMBER 1994 TO AUGUST 1995

NOTES

1 State water quality criteria for FW2-NT waters in parentheses.
2 At Queens Bridge at Bound Brook.

* 860 mg/l is acute (1-hour average) aquatic life protection criterion; 230 mg/l is chronic (4-day average) aquatic life protection criterion; 250 mg/l is human health (taste) criterion.
** Criteria are hardness dependent; criteria reported here are at a total hardness of 100 mg/l of $CaCO_3$; acute (1-hour average) aquatic life protection criterion is 1400 μg/l; chronic (4-day average) aquatic life protection criterion is 160 μg/l.
*** Criterion is hardness dependent; criterion reported here is at a total hardness of 100 mg/l of $CaCO_3$; acute (1-hour average) aquatic life protection criterion is 3.4 μg/l; there is no chronic (4-day average) criterion.

♦ Not less than 4.0 mg/l at any time; 24-hour average not less than 5.0 mg/l.
♦♦ Not to exceed a geometric average of 200/100 ml over a 30-day period; no more than 10% of samples during 30-day period to exceed 400/100 ml.

Abbreviations

°C	degrees Celsius	Mg	magnesium	Ba	barium	Mo	molybdenum	V	vanadium
Hg	mercury	Na	sodium	Co	cobalt	Ni	nickel	Al	aluminum
N	nitrogen	K	potassium	Fe	iron	Ag	silver	Li	lithium
P	phosphorus	Cl	chloride	Mn	manganese	Sr	strontium	Se	selenium
Ca	calcium	F	fluoride						

Units

mm	millimeters
ml	milliliters
mg/l	milligram per liter = parts per million
μg/l	micrograms per liter = parts per billion
μs	microsiemens
NTU	nephelometric turbidity unit

Sources: United States Geological Survey; New Jersey Surface Water Quality Standards.

TABLE 4

NJPDES PERMITTED POINT SOURCE DISCHARGES IN PISCATAWAY

Facility	Facility Type	Discharge Type	Receiving Water
Captive Plastics	industrial	industrial/commercial	Ambrose Brook
Evans Partnership (K52 Building)	industrial	industrial/commercial	tributary of Ambrose Brook
Design and Molding Services	industrial	industrial/commercial	Bound Brook
Possumtown Road Landfill	industrial	industrial/commercial	Ambrose Brook
Eastern Steel Barrel Corp.	industrial	thermal	Bound Brook

Source: 1992 NJDEP Water Quality Inventory Report.

TABLE 5
[1]AMBROSE BROOK WATER QUALITY (JULY/AUGUST 1995)

	[2]VOC (µg/l)	Total Metals (mg/l)								BOD (mg/l)	Bacteria (organisms per 100 ml)		
		As	[4]Ba	Cd	[5]Pb	Cr	Se	[6]Ag	[7]Hg		TC	[8]FC	E. coli
Station 1 (Rivendall Way)	[3]chloroform (0.6)	ND	0.05	ND	0.008	ND	ND	0.001	0.002	—	Pos. —	2000 (Jul) 118 (Aug)	—
Station 2 (Stelton Road)	ND	ND	0.057	ND	0.004	ND	ND	0.003	ND	—	19,000	860	—
Station 3 (Ethel Road)	ND	ND	0.069	ND	0.011	ND	ND	ND	0.003	—	Pos.	—	—
Station 4 (School Street)	methyl tert-Butyl ether (0.6)	ND	0.069	ND	0.009	ND	ND	ND	ND	—	Pos.	232	—
Station 5 (Brookside Road)	—	—	—	—	—	—	—	—	—	52	Pos.	—	Neg.
Station 6 (Lake Nelson)	ND	ND	0.062	ND	0.003	ND	ND	ND	ND	24	Pos. (Jul)	378 (Aug)	Neg. (Jul)
Station 7 (So. Randolphville Rd.)	—	—	—	—	—	—	—	—	—	ND	Pos.	—	—
Station 8 (Sidney Road)	—	—	—	—	—	—	—	—	—	—	172	—	Pos.
Station 9 (Hoes Lane)	—	—	—	—	—	—	—	—	—	5	110 (Jul)	270 (Aug)	Pos. (Jul)
Station 10 (Centennial Avenue)	ND	ND	0.066	ND	0.005	ND	ND	ND	ND	7	—	—	—

TABLE 5 (CONTINUED)
[1]AMBROSE BROOK WATER QUALITY (JULY/AUGUST 1995)

	[2]VOC (µg/l)	Total Metals (mg/l)								BOD (mg/l)	Bacteria (organisms per 100 ml)		
		As	[4]Ba	Cd	[5]Pb	Cr	Se	[6]Ag	[7]Hg		TC	[8]FC	E. coli
Station 11 (Possumtown Road)	—	—	—	—	—	—	—	—	—	5	—	256	—
Station 12 (Rehobeth Brook)	ND	ND	0.064	ND	0.003	ND	ND	ND	ND	4	—	—	—
Station 13 (Bakeland Avenue)	Isopropyl ether (2.2)	ND	0.078	ND	0.003	ND	ND	ND	ND	8	—	126	—

Notes:

1 See Appendix B for sampling station locations.

2 62 volatile organic compounds were analyzed; only those detected are listed.

3 Human health criterion of 5.67 µg/l.

4 Total recoverable barium human health criterion is 2 mg/l.

5 Total recoverable lead human health criterion is 0.005 mg/l.

6 Total recoverable silver human health criterion is 0.164 mg/l.

7 Total recoverable mercury human health criterion is 0.00014 mg/l and the chronic (4-hour average) aquatic life protection criterion is 0.000012 mg/l.

8 Fecal coliform levels not to exceed a geometric average of 200/100 ml over a 30-day period; no more than 10% of samples during a 30-day period to exceed 400/100 ml.

Abbreviations:

VOC	volatile organic compounds	Hg	mercury
As	arsenic	TC	total coliform
Ba	barium	FC	fecal coliform
Cd	cadmium	Pos.	positive (present)
Pb	lead	Neg.	negative (not present)
Cr	chromium	ND	not detected; less than detection limit
Se	selenium	—	not analyzed
Ag	silver		

Units:

µg/l	micrograms per liter = parts per billion
mg/l	milligrams per liter = parts per million
ml	milliliter

Sources: Middlesex County Health Department; New Jersey Surface Water Quality Standards.

All of the township's surface waters receive contaminants from nonpoint sources that are conveyed through storm sewers and overland flow. These include runoff from impervious surfaces such as roads and parking lots; runoff from agricultural and undeveloped fields and forests; large expanses of corporate landscaped lawns and golf courses; and construction sites. A stream that traverses the Rutgers University golf course empties directly to the Raritan River.

B. Aquatic Biota

1. Rare, Threatened and Endangered Species

NJDEP, the United States Fish and Wildlife Service, and the National Marine Fisheries Service were contacted regarding rare, threatened, and endangered species of aquatic biota within the Township of Piscataway. To date, only NJDEP has responded. According to the Bureau of Freshwater Fisheries, NJ Division of Fish, Game, and Wildlife, no threatened or endangered fish species are found in the Raritan River near Piscataway.

2. Fisheries

The fish population of the Raritan River bordering Piscataway from Middlesex to the Landing Lane bridge is assessed by the NJDEP as moderately degraded, partially supporting the aquatic life use. This means minimal to no game fish reproduction and/or less than adequate species diversity and/or carp or goldfish are a major segment of the population.

The fish species found in the Raritan River adjacent to Piscataway are listed in Table 6. Most are recreation species. The Raritan River is a migratory pathway for anadromous fish. These are species that live in salt water and spawn in freshwater. The Fieldville Dam has been identified in a NJDEP report as a barrier blocking or limiting anadromous fish passage in the Raritan River and reducing potential spawning habitat. However, it is a low dam and is overtopped during spring high flows thus allowing some fish migration to occur in these instances.

The dams at New Market Pond and Lake Nelson are primary impediments to the migration of anadromous fish, particularly alewife. The dam at New Market Pond is the first site along the Bound Brook system that prevents migrating fish from reaching spawning habitat. Secondary and tertiary impediments were identified upstream of New Market Pond, outside Piscataway, at the Spring Lake Dam and Cedar Brook Lake impoundment. The dam at Lake Nelson is the first site along the Ambrose Brook system that prevents migrating fish from reaching spawning habitat.

3. Macroinvertebrates

NJDEP has assessed the macroinvertebrate community at Fieldville Dam as severely impaired by municipal/industrial and stormwater discharges.

NJDEP conducted macroinvertebrate surveys for Ambrose Brook in Piscataway in February 1992 (see Appendix D). Aquatic life support was found to be moderately impaired at School Street, possibly due to toxicity, and severely impaired at Behmer Road. There was a paucity of organisms typical of clean water at both sites. Chironomidae larvae (midges) were overwhelmingly dominant at Behmer Road and Hydropsychidae larvae (caddis flies) were overwhelmingly dominant at School Street. Both locations were

TABLE 6

FISH SPECIES FOUND IN RARITAN RIVER NEAR PISCATAWAY

American shad	common carp
alewife herring	rock bass
blueback herring	yellow perch
striped bass	channel catfish
largemouth bass	white perch
pumpkinseed sunfish	redbreast sunfish
bluegill sunfish	black crappie
common sucker	golden shiner
brown bullhead	common shiner
chain pickerel	spottail shiner
American eel	

Source: NJDEP, Division of Fish, Game and Wildlife, Bureau of Freshwater Fisheries.

assessed as being enriched with nutrients, impacted by nonpoint sources of pollution, and able to support a population of small fish.

IV. NEW MARKET POND

A. Existing Conditions

New Market Pond is located along Bound Brook. It has an FW2-NT NJDEP surface water classification. This classification applies to nontrout freshwater. Nontrout waters are generally not suitable for trout production or maintenance because of their physical, chemical, or biological characteristics, but are suitable for other fish species. Designated uses for this classification are maintenance, migration and propagation of the natural and established biota; primary and secondary contact recreation; industrial and agricultural water supply; public potable water supply after treatment; and any other reasonable uses.

Field reconnaissance visits to the pond in August and December 1995 found that the pond can be divided into three distinct morphologic segments: the downstream segment (I) with the dam near New Market Road on the west and the bridge at South Washington Avenue on the east; the central segment (II) with the South Washington Avenue bridge on the west; the upstream segment (III) receiving inflow from Bound Brook.

New Market Pond segment I is wider than the other two segments. Railroad embankment fill at South Washington Avenue reduces the width of the lake nearly in half and, thus, constricts the flow between segments I and II. Two aeration fountains were observed in operation in segment I in August. The presence of vegetation is more prominent in central segment II (e.g., *Phragmites* stands). Segment II also receives tributary inflow. Upstream segment III receives flow from Bound Brook and is more removed from roadway sources of stormwater runoff than the other segments.

NJDEP completed a lake inventory report in 1987. This report is provided in Appendix E. New Market Pond is described in this report as highly eutrophic experiencing algal blooms that lead to extreme dissolved oxygen and pH fluctuations. Water quality sampling for that report was limited. It suggests, however, both horizontal and vertical variations in water quality. While shallow (maximum depth of 5 to 6 feet), bottom waters were found to be depleted in oxygen compared to surface waters. The nutrient content of segments I and II differed. Horizontal variability between segments is also indicated by NJDEP data collected as part of other limited lake monitoring efforts 1976-1988 (see Appendix F).

More recent water quality sampling and analyses of New Market Pond (1992 and 1994) was conducted by the Piscataway Health Department and Middlesex County Health Department. These more recent data are presented in Table 7 with surface water quality criteria of detected constituents. These criteria are met.

The records of the Middlesex County Hazardous Materials Unit indicate that, over the past 10 years, two calls regarding oil sheens on the surface of New Market Pond were verified and attributed to specific spills.

The fountains observed in August 1995 were installed by the Piscataway Health Department at the recommendation of the Middlesex County Health Department as a means of preventing fish kills in the lake. Several fish kills occurred in New Market Pond between 1988 and 1990. Aeration fountains typically act to bring bottom waters depleted in oxygen to the surface to be replenished with atmospheric oxygen. Waters depleted in oxygen often lead to fish kills.

TABLE 7
NEW MARKET POND WATER QUALITY (1992 AND 1994)

September 1992	[1]Volatile Organic Compounds (μg/l)	[2]Base/Neutral Compounds (μg/l)
Base of Waterfall		
Sample #1	ND	—
Sample #2	ND	—
Floating Dock at 100 Lakeview Avenue		
Sample #1	ND	—
Sample #2	methyl tert-Butyl ether (0.5)	—
Sample #3	methyl tert-Butyl ether (0.5)	—
Sample #4	methyl tert-Butyl ether (0.5)	—
Floating Dock at Auto Body Shop on Lakeview Avenue		
Sample #1	ND	ND
Sample #2	ND	ND

October 1994	Volatile Organic Compounds (μg/l)	Total Metals (mg/l)							Nitrate-Nitrogen (mg/l)	F (mg/l)
		As	Ba	[3]Cd	[4]Pb	[5]Cr	Se	Hg		
	methyl tert-Butyl ether (1.6)	ND	ND	0.0002	0.002	0.001	ND	ND	ND	0.10

Notes:

1 62 volatile organic compounds were analyzed; only those detected are listed.

2 45 base/neutral compounds were analyzed.

3 Human health criterion is 0.010 mg/l.

4 Human health criterion is 0.005 mg/l.

5 Human health criterion is 0.160 mg/l.

Abbreviations:

As	arsenic	Cr	chromium	F	fluoride
Ba	barium	Se	selenium	ND	not detected; less than detection limit
Cd	cadmium	Ag	silver	—	not analyzed
Pb	lead	Hg	mercury		

Units:

μg/l	micrograms per liter = parts per billion
mg/l	milligrams per liter = parts per million

Sources: Middlesex County Health Department; New Jersey Surface Water Quality Standards.

The fish population was dominated by carp and goldfish in 1987. The fish species found to be inhabiting the pond in 1987 are presented in Table 8. A report by the American Littoral Society identifies the dam at New Market Pond as a primary impediment to the upstream migration of anadromous fish. Anadromous fish live in salt water and spawn in freshwater. This dam is the first site along the Bound Brook system that prevents migrating fish from reaching spawning habitat.

B. Water Quality Sampling Plan

Any sampling plan must have focused objectives. Since fish kills are a known water quality problem of New Market Pond, the sampling plan presented here is designed to collect data to help identify the causes of fish kills and determine best management practices to prevent them in the future.

The physical, biological, and chemical processes that influence the water quality of the three lake segments differ. A lake monitoring program will likely find that the measured water quality of each segment differs. This is already indicated by the data provided by the NJDEP. Thus, any water quality sampling plan aimed at identifying water quality problems and developing management solutions should address each segment.

1. Volunteers

This sampling plan will be conducted by volunteers. In order to ensure that the data collected are of a quality that will meet the objectives of the monitoring program, a Quality Assurance Project Plan will be prepared and the volunteers trained in its implementation. Decisions will need to be made regarding the purchase of sampling equipment suitable for lay volunteers. Volunteers will be trained in the proper use of this equipment.

2. Sample Locations

Sampling should be conducted at six locations. Two sampling sites will be located within each of the three New Market Pond segments described above. A field review is necessary to finalize the sample site locations.

3. Time and Frequency of Sampling

The fundamental lake processes of overturning and stratification are seasonal, being temperature dependent. Sampling should take place from the spring overturn through the end of the summer, and, if feasible, during the fall overturn. A sample frequency of every two weeks would be adequate to monitor changing parameters. Sampling after a major storm event should be included.

4. Parameters to Monitor

a. Dissolved Oxygen and Temperature

The dissolved oxygen concentrations will be characterized by measuring dissolved oxygen and temperature profiles of the water column. Measurements will be made of surface and bottom waters, and where appropriate, at mid-depth.

TABLE 8

FISH SPECIES FOUND IN NEW MARKET POND (1987)

carp
goldfish
golden shiner
white sucker
brown bullhead
pumpkinseed
bluegill
largemouth bass

Source: NJDEP, Division of Fish, Game and Wildlife, Bureau of Freshwater Fisheries.

b. Algal Conditions

Algal conditions will be characterized by measuring the Secchi disk transparency of the water column and by determining the chlorophyll *a* and phosphorous content of water samples.

c. Acidification

Lake acidification will be characterized by monitoring the acidity (pH) and alkalinity of lake waters.

V. WATER QUALITY PROFILE SUMMARY

A. Raritan River

The water quality found in the Raritan River adjacent to the Township of Piscataway is the result of the combined quality of upstream waters, tributaries flowing directly to the Raritan River, and flooding tidal waters from downstream. Small tributaries drain directly to the Raritan River not only from Piscataway, but from Franklin Township and New Brunswick on the opposite bank. Thus, water quality of the Raritan River near Piscataway is greatly influenced by sources outside of Piscataway. However, Piscataway does have the potential to affect the water quality of the Raritan River by being a source of pollutants to Ambrose Brook and Bound Brook or to the Raritan River directly.

Much of the Bound Brook watershed lies outside of Piscataway, thus, much of the existing water quality of Bound Brook is a function of the quality of reaches that do not pass through Piscataway. The overall contribution of Piscataway to any pollution of Bound Brook is difficult to assess without existing data from within Piscataway and concurrent data from upstream and downstream of Piscataway. Prior to contributing pollutants to the Raritan River, however, Bound Brook waters mix with Green Brook. The impact of Bound Brook on the water quality of Green Brook also cannot be evaluated due to the lack of data.

In contrast, most of the watershed of Ambrose Brook lies within the borders of Piscataway. The water quality data provided in this report indicate that while bacteria, lead and mercury levels may be elevated upstream, at downstream locations prior to leaving Piscataway, levels have diminished to acceptable values. Thus, Piscataway is not a source of contamination to the Raritan River from the Ambrose Brook watershed.

The tributaries that empty directly to the Raritan River deliver contaminants directly to the river. However, the river discharge (cubic feet per second) is so overwhelmingly greater than the discharge of Piscataway's tributary streams, that the mass balance of contaminants after mixing is such that elevated contaminant concentrations in the tributaries, if present, would not affect the existing concentrations of contaminants in the Raritan River.

While there are point sources of pollution in Piscataway, and nonpoint sources from stormwater runoff are ubiquitous, existing information suggests that the nonsupport of designated uses of the Raritan River bordering Piscataway cannot be attributed to activities taking place in Piscataway. Ambrose Brook and direct tributary discharge do not adversely impact the water quality of the Raritan River. However, further study of the Bound Brook system is needed to fully evaluate the role of Bound Brook.

B. New Market Pond

New Market Pond is a complex lake system. Dissolved oxygen depletion appears to be a cause of recurrent fish kills. Very little data have been collected that describe or explain horizontal and vertical variability of lake properties. Previous data collection efforts have not been comprehensive. A comprehensive, systematic program is needed to establish baseline conditions in the lake and to monitor seasonal changes of water chemistry in each of three distinct segments of the lake in order to identify water quality problems and their causes.

VI. REFERENCES

A. Documents and Materials

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B. Persons and Agencies

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Division of Fish, Game, and Wildlife

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Bureau of Water Monitoring

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Bureau of Water Monitoring

Schopp, Bob
U.S. Geological Survey

Stimpf, Andrew
Piscataway Health Department

APPENDICES

APPENDIX A
KNOWN CONTAMINATED SITES IN PISCATAWAY
Source: NJDEP

SITE NAME	STREET ADDRESS	IDENTIFIER
PISCATAWAY TOWNSHIP		
1 SUMMERSHADE CIRCLE	1 SUMMERSHADE CIR	NJL800003410
STATUS: PENDING - 04/06/1995	LEAD/CONTACT: BFO-S - 950417	
214 OVERBROOK ROAD	214 OVERBROOK RD	NJL800146870
STATUS: ACTIVE - 06/26/1995	LEAD/CONTACT: BFO-S - 950619083719	
220 CENTENNIAL AVENUE	220 CENTENNIAL AVE	NJL800105280
STATUS: ACTIVE - 06/07/1995	LEAD/CONTACT: BUST - 0305570	
23 REVERE ROAD	23 REVERE RD	NJL800024812
STATUS: ACTIVE - 02/16/1994	LEAD/CONTACT: BFO-S - 931213095507	
509 UNION STREET	509 UNION ST	NJL800065468
STATUS: ACTIVE - 08/31/1994	LEAD/CONTACT: BFO-S - 940122131807	
64 GRANT AVENUE	64 GRANT AVE	NJL800103095
STATUS: ACTIVE - 01/24/1995	LEAD/CONTACT: BFO-S - 941201110358	
80 CENTENNIAL AVENUE	80 CENTENNIAL AVE	NJL600058606
STATUS: PENDING - 02/08/1995	LEAD/CONTACT: BFCM - 950238	
83 SCHOOL STREET	83 SCHOOL ST	NJL000053538
STATUS: PENDING - 12/07/1992	LEAD/CONTACT: BFO-CA - 921230	
ANCHOR SAVINGS BANK	233 STELTON RD	NJL000052886
STATUS: ACTIVE - 12/09/1992	LEAD/CONTACT: BFO-S - 9212041610	
ATLANTIC DETROIT DIESEL ALLISON	169 OLD NEW BRUNSWICK RD	NJD980500730
STATUS: ACTIVE - 12/12/1994	LEAD/CONTACT: BFO-S - 941101194010	
CHANEL INCORPORATED	876 CENTENNIAL AVE	NJD002199826
STATUS: ACTIVE - 06/28/1991	LEAD/CONTACT: BUST - 0266871	
CHEMSOL INCORPORATED	FLEMING ST	NJD980528889
STATUS: ACTIVE -	LEAD/CONTACT: BFCM - NJD980528889	
STATUS: ACTIVE - 12/19/1991	LEAD/CONTACT: EPA - 910237	
CLOVERLEAF INDUSTRIAL PARK	28 HOWARD ST	NJL800067662
STATUS: ACTIVE - 09/15/1994	LEAD/CONTACT: BFO-S - 940614151112	
COASTAL COMPANY OF AMERICA	39 COLONIAL DR	NJL600133409
STATUS: ACTIVE - 04/03/1991	LEAD/CONTACT: BUST - 0206769	
CONTINENTAL PLASTICS CONTAINERS INC	170 CIRCLE DR N	NJD980651723
STATUS: ACTIVE - 04/13/1992	LEAD/CONTACT: BEECRA - E91698	
DYNAMIT NOBEL HARTE INCORPORATED	NEW MARKET RD	NJD000818559
STATUS: ACTIVE - 06/29/1988	LEAD/CONTACT: BEECRA - E84311	
EASTERN STEEL BARREL CORPORATION	4100 NEW BRUNSWICK AVE	NJD002144525
STATUS: ACTIVE - 10/13/1992	LEAD/CONTACT: BEECRA - E91081	
EXXON SERVICE STATION PISCATAWAY TWP	1000 STELTON RD	NJD986600047
STATUS: ACTIVE - 09/13/1991	LEAD/CONTACT: BUST - 0091406	
FRANKLIN AVENUE GRD WTR CONTAMINATION	FRANKLIN AVE	NJL000070763
STATUS: ACTIVE - 04/25/1994	LEAD/CONTACT: BSM - NJL000070763	
GEORGIA GULF CORPORATION	100 NORMANDY RD	NJD980654032
STATUS: ACTIVE - 03/22/1990	LEAD/CONTACT: BEECRA - E84418	
STATUS: ACTIVE - 03/22/1990	LEAD/CONTACT: BEECRA - E89007	
GETTY SERVICE STATION PISCATAWAY TWP	5 STELTON RD	NJX000293860
STATUS: ACTIVE - 01/05/1995	LEAD/CONTACT: BUST - 0016472	
J & M SERVICE CENTER	436 STELTON RD	NJL600067649
STATUS: ACTIVE - 06/30/1995	LEAD/CONTACT: BFCM - 0108047	

II. KNOWN CONTAMINATED SITES IN NEW JERSEY
MIDDLESEX COUNTY

SITE NAME	STREET ADDRESS	IDENTIFIER
	PISCATAWAY TOWNSHIP	
L TEC COMPANY	239 OLD NEW BRUNSWICK RD	NJD063173322
STATUS: ACTIVE - 01/11/1995	LEAD/CONTACT: BUST	- NJD063173322-001
LISI AMERICA	600 PROSPECT AVE	NJD087624623
STATUS: PENDING - 09/19/1994	LEAD/CONTACT: BSCM	- 940944
MOBIL SERVICE STATION PISCATAWAY TWP	152 OLD NEW BRUNSWICK RD	NJD986606226
STATUS: ACTIVE - 01/02/1990	LEAD/CONTACT: BUST	- 0037389
MOORES TRUCKING COMPANY	571 STELTON RD	NJD986611861
STATUS: ACTIVE - 06/05/1990	LEAD/CONTACT: BUST	- 0018579
STATUS: ACTIVE - 02/27/1995	LEAD/CONTACT: BFO-S	- 940930144359
NUODEX INCORPORATED	TURNER PL	NJD068246313
STATUS: ACTIVE - 02/28/1990	LEAD/CONTACT: BEECRA	- E85376
PACK TECHNICAL SERVICES	7 TURNER PL	NJD980770309
STATUS: PENDING - 08/27/1993	LEAD/CONTACT: BFO-S	- 9308122
PCA EAST INCORPORATED	39 TO 49 COLONIAL DR	NJD980785455
STATUS: ACTIVE - 05/18/1995	LEAD/CONTACT: BUST	- 0206750
PISCATAWAY TOWNSHIP DEPARTMENT PUB WKS	455 HOES LN	NJL600215370
STATUS: ACTIVE - 03/23/1995	LEAD/CONTACT: BFCM	- 0241913
RUTGERS UNIVERSITY BUELL BROOK	AVENUE E	NJL000035782
STATUS: PENDING - 07/06/1993	LEAD/CONTACT: BFO-S	- 930767
RUTGERS UNIVERSITY ENGINEERING DEPT	BRETT RD (C WING ENG BLDG BUSH CAMPUS)	NJL880000799
STATUS: PENDING - 05/20/1993	LEAD/CONTACT: BFO-S	- 9305105
RUTGERS UNIVERSITY GAMMA GREENHOUSE	DAVIDSON RD (KILMER CAMPUS BLDG 4217)	NJD000582387
STATUS: PENDING - 07/10/1993	LEAD/CONTACT: BFO-S	- 930644
RUTGERS UNIVERSITY LIVINGSTON CAMPUS	METLARS LN	NJL600195853
STATUS: ACTIVE - 02/02/1989	LEAD/CONTACT: BUST	- NJL600195853-001
S S WHITE INDUSTRIAL PRODUCTS	151 OLD NEW BRUNSWICK RD	NJD058163684
STATUS: ACTIVE - 05/01/1989	LEAD/CONTACT: BEECRA	- E88668
SHELL SERVICE STATION PISCATAWAY TWP	1649 STELTON RD	NJD981177751
STATUS: ACTIVE - 11/21/1991	LEAD/CONTACT: BUST	- 0157313
SHELL SERVICE STATION PISCATAWAY TWP	780 STELTON RD & RTE 287	NJD981185325
STATUS: ACTIVE - 02/01/1983	LEAD/CONTACT: BUST	- 0052409
SUNOCO SERVICE STATION PISCATAWAY TWP	421 WASHINGTON AVE	NJD000803999
STATUS: PENDING - 05/20/1993	LEAD/CONTACT: BFO-S	- 9305102
SUNOCO TERMINAL	1028 STELTON RD	NJD980650170
STATUS: PENDING - 03/30/1993	LEAD/CONTACT: BFO-S	- 9303165
TEXACO SERVICE STATION PISCATAWAY TWP	450 STELTON RD	NJD986581171
STATUS: ACTIVE - 06/23/1995	LEAD/CONTACT: BFCM	- 0110846
TEXTILE CHEMICAL COMPANY	600 PROSPECT AVE	NJD980650238
STATUS: PENDING - 09/19/1994	LEAD/CONTACT: BSCM	- 940945
THERMA SYSTEMS	140 CIRCLE DR	NJL000057745
STATUS: PENDING - 05/14/1993	LEAD/CONTACT: BFO-S	- 930555
UNION CARBIDE CORPORATION	10 POSSUMTOWN RD	NJD002444719
STATUS: ACTIVE - 04/01/1992	LEAD/CONTACT: BFCM	- M157
UNION CARBIDE CORPORATION POLYOLIFINS DI	RIVER RD	NJD000564328
STATUS: ACTIVE -	LEAD/CONTACT: BFCM	- NJD000564328

II. KNOWN CONTAMINATED SITES IN NEW JERSEY
MIDDLESEX COUNTY

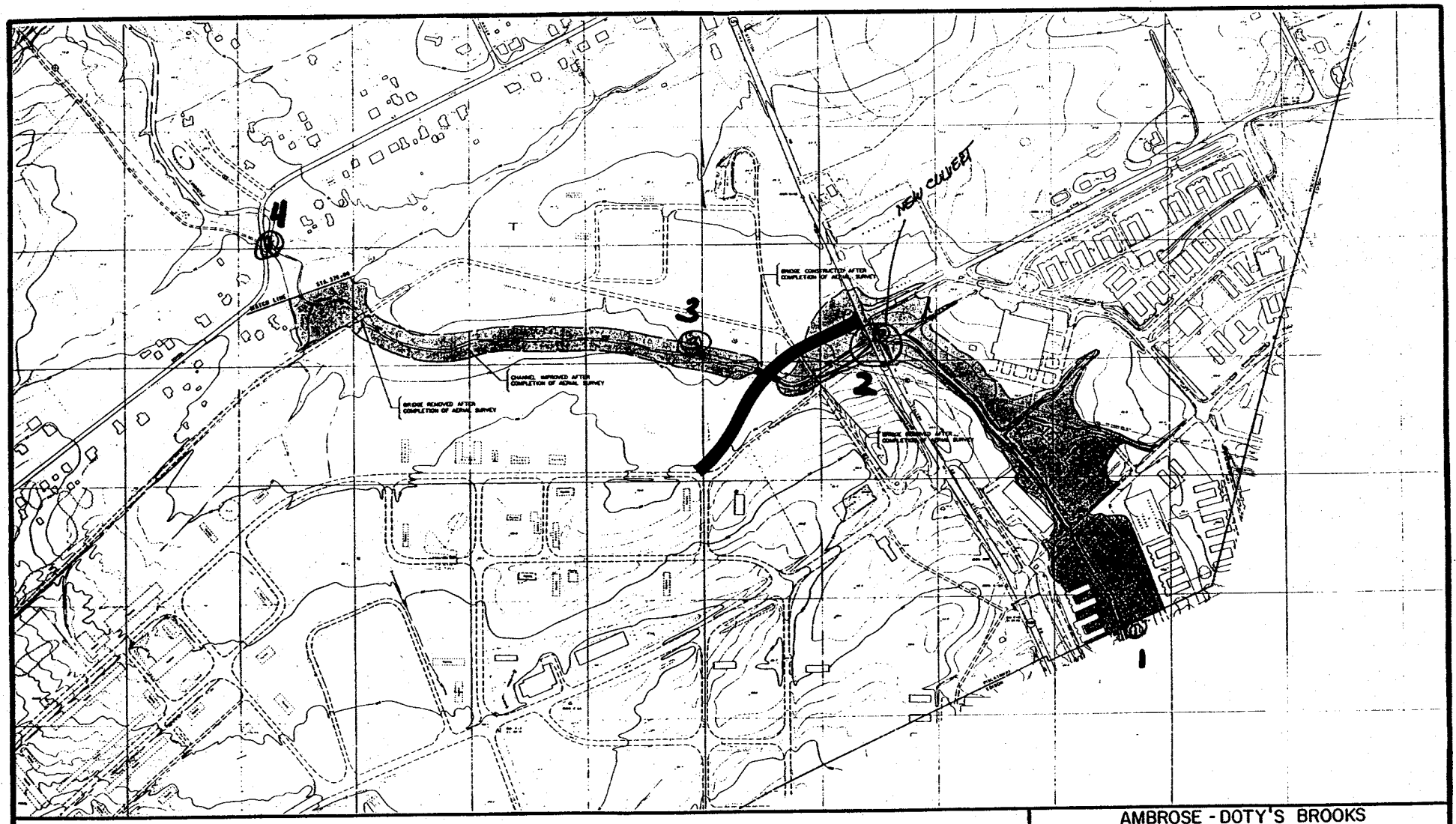
SITE NAME	STREET ADDRESS	IDENTIFIER

PISCATAWAY TOWNSHIP

UNION CARBIDE POSSUMTOWN ROAD LANDFILL	POSSUMTOWN RD	NJD986575124
STATUS: ACTIVE - 04/01/1992	LEAD/CONTACT: BFCM - NJD986575124	
UNION CARBIDE RIVER ROAD LANDFILL	RIVER RD	NJL000010504
STATUS: ACTIVE - 04/01/1992	LEAD/CONTACT: BFCM - NJL000010504	
UNION STEEL CORPORATION PISCATAWAY PLANT	160 OLD NEW BRUNSWICK RD	NJD099295677
STATUS: ACTIVE - 05/25/1990	LEAD/CONTACT: BEECRA - E86116	
WESTERN AUTOMOTIVE WAREHOUSE	31 COLONIAL DR	NJL600133391
STATUS: ACTIVE - 04/03/1991	LEAD/CONTACT: BUST - 0206741	
WETLANDS MITIGATION AREA	OLD NEW BRUNSWICK RD & RTE 287	NJL800142119
STATUS: ACTIVE - 06/13/1995	LEAD/CONTACT: BFO-S - 950531110109	
WHITESTONE PRODUCTS INCORPORATED	30-40 TURNER PL	NJD063158901
STATUS: ACTIVE - 03/13/1995	LEAD/CONTACT: BEECRA - E95060	
ZIEGLER CHEMICAL & MINERAL COMPANY	600 PROSPECT AVE	NJD002187086
STATUS: ACTIVE -	LEAD/CONTACT: BFCM - NJD002187086	

51 known contaminated site(s) in PISCATAWAY TOWNSHIP

APPENDIX B
SAMPLE LOCATIONS ALONG AMBROSE BROOK
Source: Piscataway Health Department



LEGEND

100 YR. FLOOD LIMITS

SCALE IN FEET

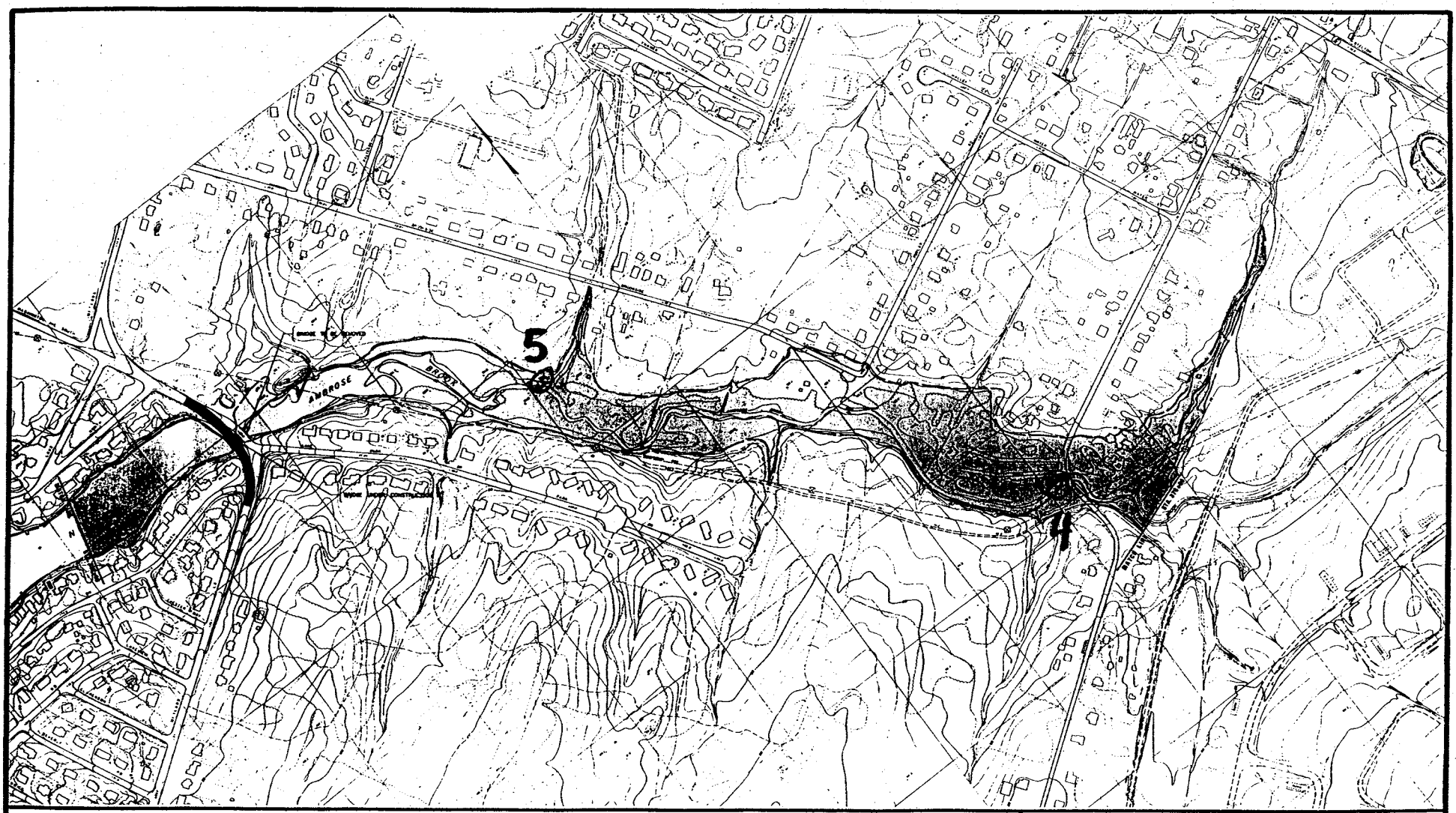
400 200 0 400 800 1200

AMBROSE - DOTY'S BROOKS
FLOOD CONTROL STUDY

FLOOD BOUNDARY MAP
AMBROSE BROOK
STA. 376+00 TO CORPORATE LIMIT

T&M ASSOCIATES CONSULTING AND MUNICIPAL ENGINEERS

PLATE 15



LEGEND

100 YR. FLOOD LIMITS

SCALE IN FEET

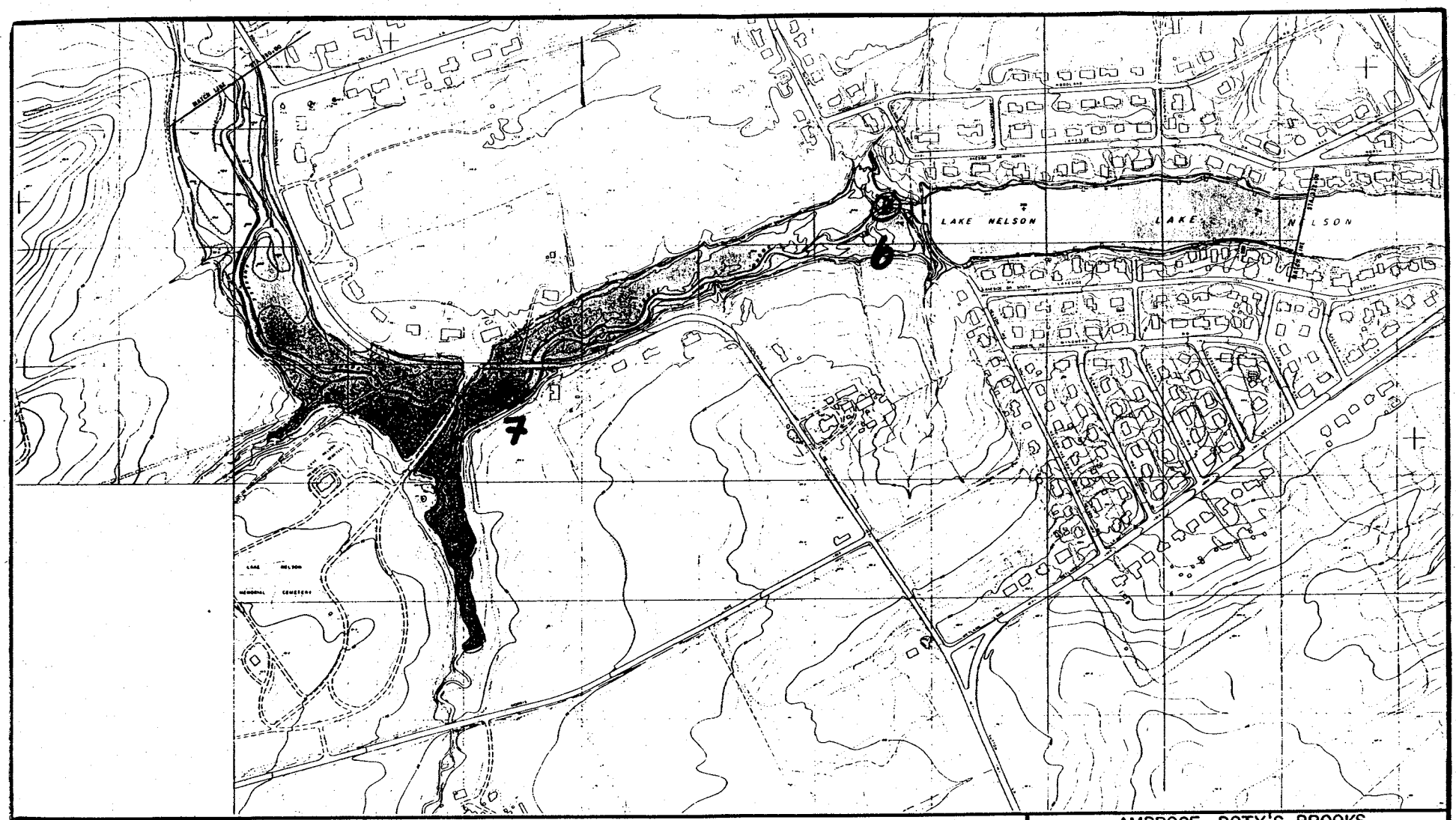
400 200 0 400 800 1200

AMBROSE - DOTY'S BROOKS
FLOOD CONTROL STUDY

FLOOD BOUNDARY MAP
AMBROSE BROOK
STA. 322+00 TO STA. 376+00

TM ASSOCIATES CONSULTING AND MUNICIPAL ENGINEERS

PLATE 14



LEGEND

100 YR. FLOOD LIMITS

SCALE IN FEET

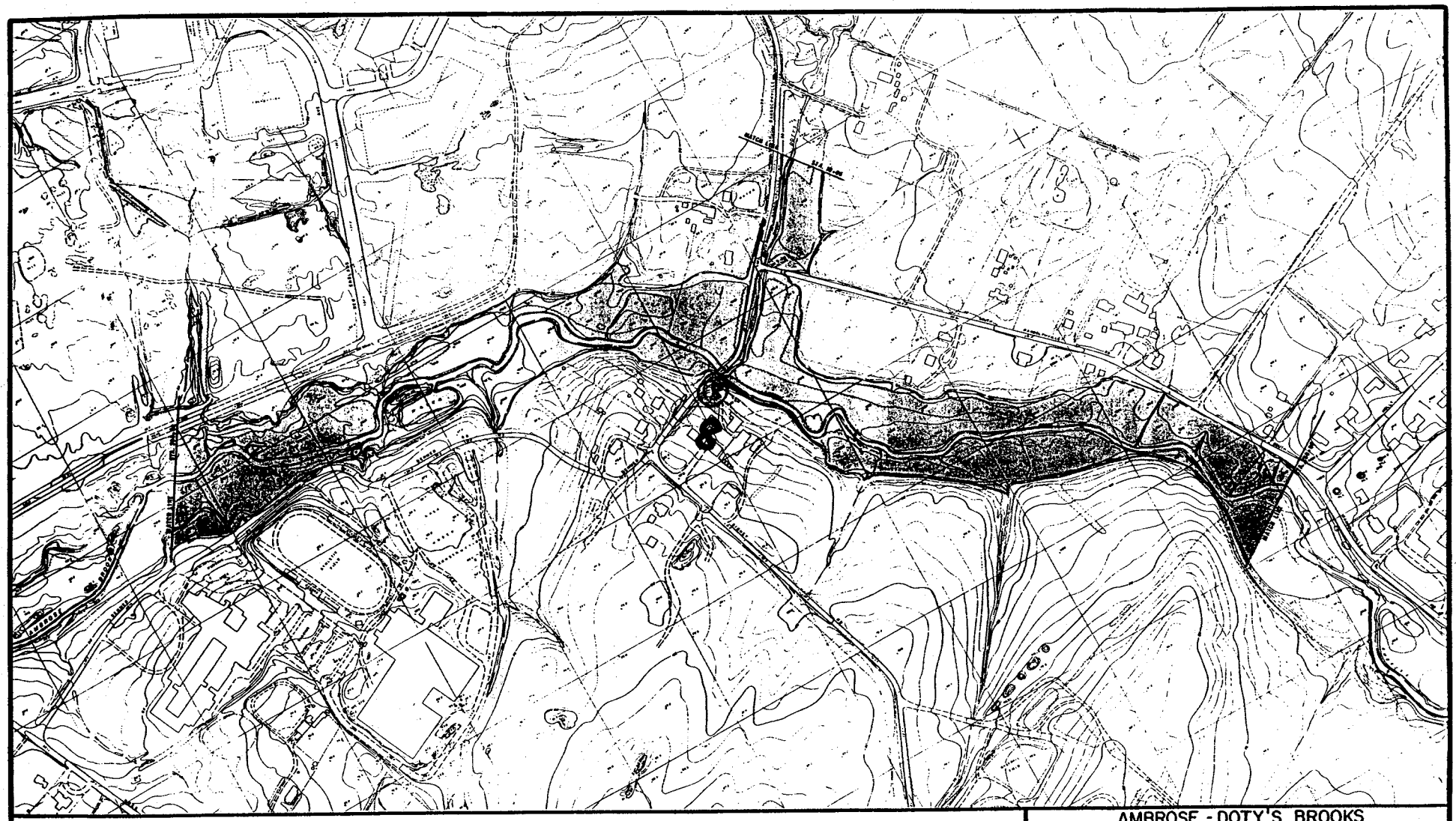
400 200 0 400 800 1200

AMBROSE - DOTY'S BROOKS FLOOD CONTROL STUDY

FLOOD BOUNDARY MAP AMBROSE BROOK STA. 260+00 TO STA. 322+00

T&M ASSOCIATES CONSULTING AND MUNICIPAL ENGINEERS

PLATE 13



LEGEND

100 YR. FLOOD LIMITS

SCALE IN FEET

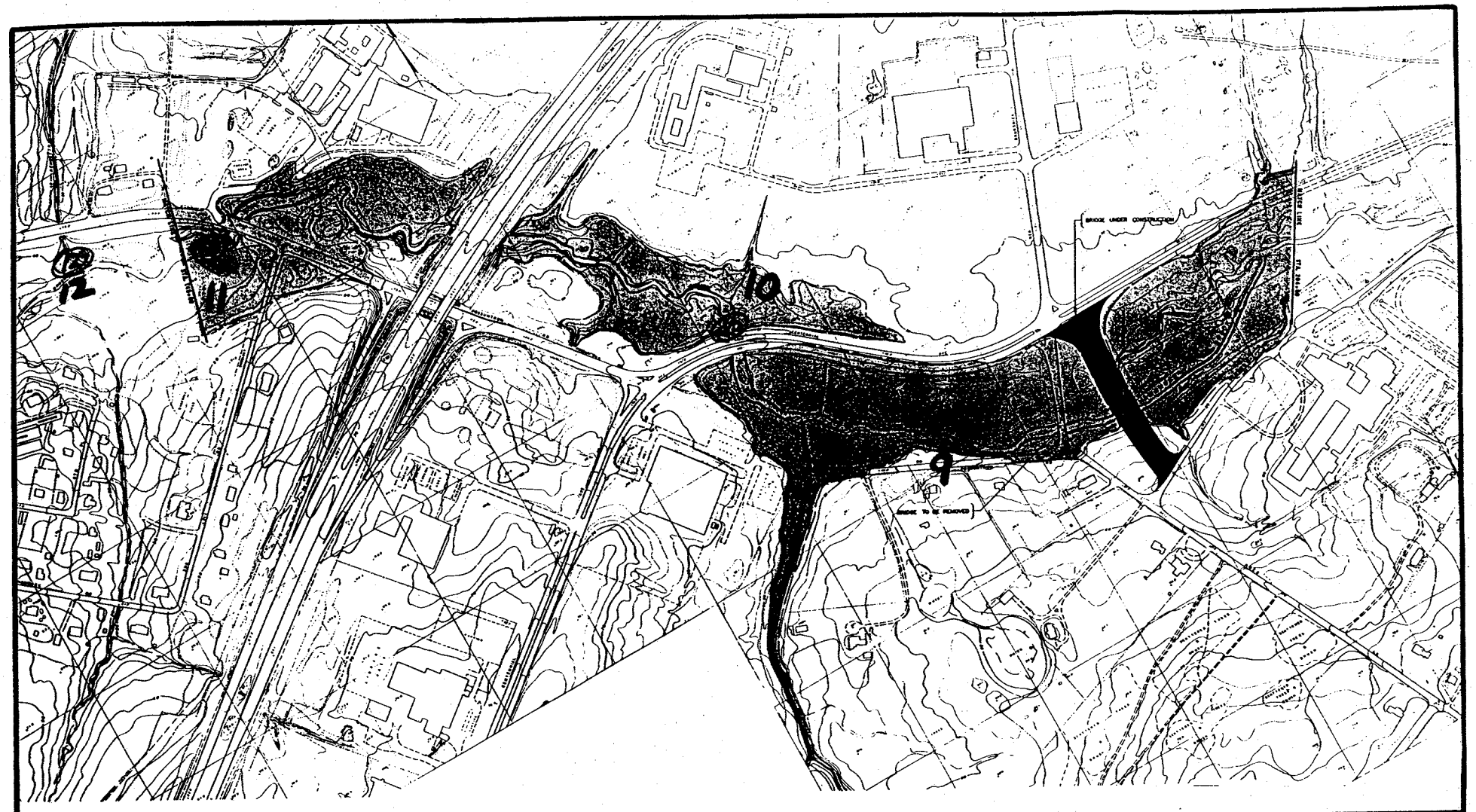
400 200 0 400 800 1200

AMBROSE - DOTY'S BROOKS
FLOOD CONTROL STUDY

FLOOD BOUNDARY MAP
AMBROSE BROOK
STA. 204+00 TO STA. 260+00

T&M ASSOCIATES CONSULTING AND MUNICIPAL ENGINEERS

PLATE 12



LEGEND

100 YR. FLOOD LIMITS

SCALE IN FEET

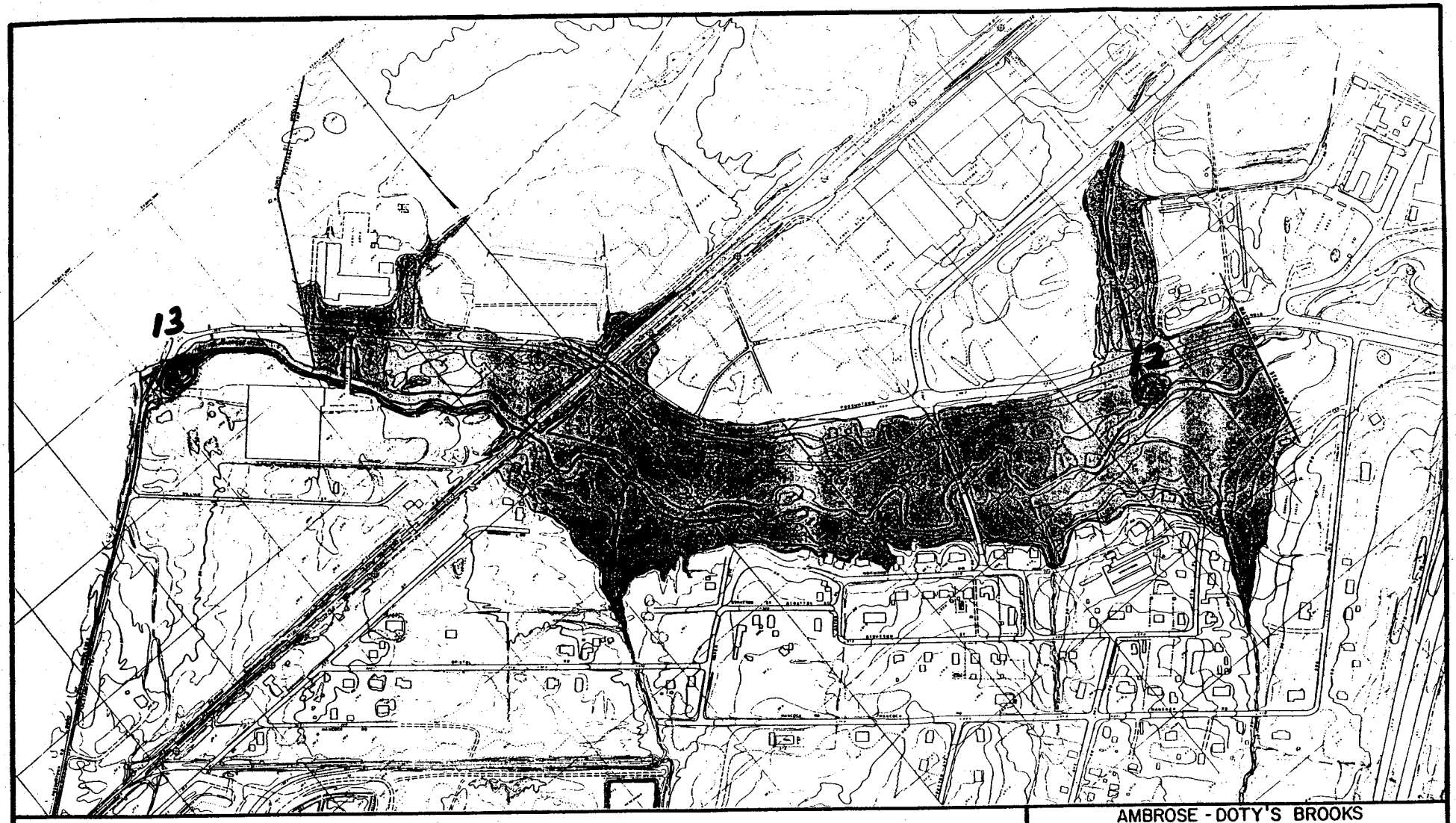
400 200 0 400 800 1200

AMBROSE - DOTY'S BROOKS
FLOOD CONTROL STUDY

FLOOD BOUNDARY MAP
AMBROSE BROOK
STA. 145+00 TO STA. 204+00

T&M ASSOCIATES CONSULTING AND MUNICIPAL ENGINEERS

PLATE 11



AMBROSE - DOTY'S BROOKS
FLOOD CONTROL STUDY

FLOOD BOUNDARY MAP
AMBROSE BROOK
CORPORATE LIMIT TO STA. 145+00

T&M ASSOCIATES CONSULTING AND MUNICIPAL ENGINEERS

PLATE 10

APPENDIX C
AGENCY CORRESPONDENCE

MIDDLESEX COUNTY HEALTH DEPARTMENT
DIVISION OF ENVIRONMENTAL HEALTH
928 LIVINGSTON AVENUE
NORTH BRUNSWICK, NJ 08902
(908) 745-4350
FAX # (908) 745-2410

STEPHEN "PETE" DALINA
CHAIRMAN

BERNARD G. MIHALKO
DIRECTOR

September 28, 1995

Louis Berger & Associates, Inc.
100 Halsted Street
P.O. Box 270
East Orange, NJ 07019-0270

Attn: David R. De Caro, Environmental Scientist

RE: Ambrose Brook, Piscataway

Dear Mr. De Caro:

Enclosed please find the information you requested on Ambrose Brook in Piscataway. These were samples taken this summer.

If we can be of further assistance please contact our office at 908-745-4350.

Sincerely,

Lorraine H. Mottola

Lorraine H. Mottola
Sr. Environmental Health Specialist

lhm
Enclosure

State of New Jersey
Department of Environmental Protection

Christine Todd Whitman
Governor

Robert C. Shinn, Jr.
Commissioner

NJ Division of Fish, Game & Wildlife
Bureau of Freshwater Fisheries
Box 394 - Cherry Street
Lebanon, NJ 08833
December 1, 1995

Mr. David Caro
Louis Berger & Associates, Inc.
100 Halstead Street
East Orange, NJ 07019

Dear Mr. Caro,

In response to your request, dated October 25, for information regarding freshwater fish found in New Market Pond please find enclosed a copy of a lake inventory report which was completed in 1987.

As for the Raritan River, in the area of Piscataway, the following species are found; American shad, alewife herring, blueback herring, striped bass, largemouth bass, pumpkinseed sunfish, bluegill sunfish, common sucker, brown bullhead, chain pickerel, American eel, common carp, rock bass, yellow perch, channel catfish, white perch, redbreast sunfish, black crappie, golden shiner, common shiner, and spottail shiner. Although none of the species listed are considered threatened or endangered the majority of the species, with the exception of the shiners, are recreationally sought after species. The Raritan River also serves as a migratory pathway for anadromous species, species which live in salt water and spawn in freshwater, such as the American shad, alewife herring and blueback herring. The Division has an on-going restoration project for these species for the Raritan. The project includes the breaching of existing dams and the construction of fish passage devices on any new impediments. Special timing restrictions are also incorporated into stream encroachment permits to protect these species during there spring spawning run.

If you have any additional questions I may be reached at (908) 236-2118.

Sincerely yours,

Lisa Barno

Lisa Barno
Senior Fisheries Biologist

APPENDIX D
MACROINVERTEBRATE SURVEY OF AMBROSE BROOK
Source: NJDEP

GREEN BROOK WATERSHED
MACROINVERTEBRATE STUDY
FEBRUARY 25-27, 1992

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY
OFFICE OF WATER MONITORING MANAGEMENT
BUREAU OF WATER MONITORING
BIOMONITORING UNIT

INTRODUCTION

At the request of the Toxic Analysis Unit in the NJDEPE Environmental Regulation branch, indigenous benthic fauna were assessed to ascertain their condition with regard to suspected toxic pollution in the Green Brook watershed.

METHODS

Macroinvertebrates were collected using a Surber sampler once at each of 13 sites from February 25-27, 1992. See Figure 1 for a map of the survey area with sampling locations. Field collections were performed according to the Rapid Bioassessment Protocol II described in USEPA 1989. A visual, qualitative observation was also made at each site concerning its potential to support indigenous fish populations. Samples were analyzed as described in both the NJDEP Standard Operating Procedures of the Biomonitoring Laboratory and USEPA 1989. The appendix contains the work/QA Plan. Criteria for the evaluation of stream biological condition are also included in the Appendix.

Explanation of the biometrics used in this study

The biometrics[1] used in the assessments are based on family level taxonomy: 1) Taxa Richness, a measure of community diversity; 2) FBI(modified), a measure of pollution tolerance utilizing the FBI (Family Biotic Index); 3) S/FCS (Scraper/Filterer Collector Score) which can reflect excessive nutrients and/or organic matter and/or siltation; 4) EPTC(modified), the proportion of Chironomidae (tolerant forms) to the intolerant forms (i.e., families of Ephemeroptera, Plecoptera, and Trichoptera); 5) %CDF(modified), (Contribution of the Dominant Family) expressed as a percentage; 6) EPT Index, the proportion of clean water organisms; 7) CLI (Community Loss Index), the loss of benthic taxa between a reference station and the station of comparison, thus gauging the severity of shifts in community composition; 8) S/TS (Shredder/Total Score) which detects possible toxicity and/or lack of riparian vegetation utilizing the STR (Shredder/Total Ratio). Noncomparative components, for reference site assessment, include #Taxa, FBI (which incorporates individual family pollution tolerance values[1]), %EPT, %CDF, and E+P+T. Functional feeding group designations (i.e. scrapers, filterers, shredders, etc.) in our analyses are determined using species rather than family level taxonomy. Biometric scoring criteria for Protocol II rating of

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[1] in USEPA (1989)

stream biological condition are included in the Appendix.

Reference sites are selected based on similar physical characteristics; if no reference site is given for a particular station, then the evaluation is considered noncomparative.

RESULTS AND DISCUSSION

Taxonomic data, statistical analyses and biological evaluations for each station are contained in the Appendix. Potential toxicity was indicated at seven (#2, 3, 5, 6, 7, 8 and 10) of the thirteen sites sampled. Section 7:9-4.5(a)2 of the Surface Water Quality Standards is not being met throughout the entire Green Brook watershed.

Green Brook

Station 1 (Apple Tree Rd., Watchung Twp.), at the headwaters of Green Brook, was rated severely impaired when contrasted with a non-impaired reference site on Primrose Brook. Excessive nutrients and/or organic matter and/or siltation were indicated. Diversity was low, clean water organisms were scarce, and Chironomidae overwhelmingly dominated. Nearby Interstate 78, and a swim club upstream that periodically discharges pool water into the brook, were likely contributing to the degradation. This site was presumed unfavorable for maintaining year round healthy fish populations.

Downstream at station 2 (New Providence Rd., Seeleys Mill), stream health was also impaired. RBP statistics are most reliable when analyzing a minimum of 100 organisms per sample, and this contained only 78. Excessive nutrients were evident in dense periphytic growth. Typical clean water organisms were scarce, and Chironomidae overwhelmingly dominated. The deficient sample size implied a possible toxicity problem. Although flow and gradient were good, the benthic fauna, with its capacity to support a healthy fish population, had evidently been retricted by pollution.

Conditions were worse further downstream at station 3 (Raymond Ave., Watchung Twp.), and our analysis revealed the stream rating as severely impaired. The sample collection contained just 10 organisms; this implied a possible toxicity problem. Diversity was low, and clean water organisms were scarce. Significant organic pollution was indicated. The surrounding vicinity is highly urbanized. Conditions were presumed unfavorable for maintaining a healthy fish population.

Station 6 (Park Dr., Green Brook Park) was tentatively rated as moderately impaired. Only 33 individuals were collected; this suggested a possible toxicity problem. There was a paucity of

clean water organisms. The presence of ciliated protozoans implied sewage pollution. Conditions were likely unfavorable for supporting a healthy fish community.

Further downstream at station 9 (off Mill Rd., Sebrings Mill) the stream biota was still moderately impaired. Clean water organisms were scarce, and significant organic pollution was indicated. The Middlesex Boro STP, situated 0.3 miles upstream, is probably contributing to the degradation at this site. Conditions were presumed unfavorable for maintaining a healthy fish population.

Stream health at station 13 (Main St., Bound Brook Boro) was also found to be moderately impaired. Clean water organisms were scarce. Sources contributing to this degraded water quality include the Bound Brook Boro STP, and a small hazardous waste site upstream, as well as general urbanization of the area. This site was presumed unfavorable for sustaining a healthy fish population.

Blue Brook

Blue Brook, wholly situated within the Watchung Reservation, was not subject to any obvious pollution sources. This stream should be capable of maintaining populations of small fish.

Stony Brook

Station 4 (Sunlit Dr., Watchung Boro) was moderately impaired as contrasted with Primrose Brook. There was a paucity of clean water organisms, and Chironomidae overwhelmingly dominated. Runoff from a golf course upstream was likely a contributing factor in this degradation. This site was presumed capable of maintaining small fish.

Stream health was deteriorated downstream at Station 5 (West End Ave., N. Plainfield). The rating was a tentative moderately impaired as only 58 organisms were recovered. This deficient sample population implied a possible toxicity problem. Typical clean water organisms were scarce. Silt observed in the stream was attributable to a quarry and channelization which were in progress upstream. Conditions appeared unfavorable for maintaining fish.

Cedar Brook

Station 7 (Cedarbrook Ave., S. Plainfield) received a tentative rating of moderately impaired when contrasted with a non-impaired reference site on a tributary to the Dead River. A deficient population, only 31 organisms, precluded reliable statistical analyses. The data indicated severe impairment and possible toxicity. Typical clean water organisms were scarce. RBP analyses pointed to excessive nutrients and/or organic matter

and/or siltation. The surrounding area is urbanized. Oil was observed along the stream banks. Conditions were presumed unfavorable for maintaining a diverse fish population.

Bound Brook

Station 8 (Bound Brook Rd., Middlesex Boro) received a tentative rating of moderately impaired. A deficient sample population of 85 individuals precluded a reliable RBP analyses. Typical clean water organisms were scarce, and the limited sample population implied a possible toxicity problem. The site has been seriously impacted by urban development. Accumulations of trash nearly concealed the water. Conditions were presumed unfavorable for maintaining a healthy fish population.

Ambrose Brook

Station 10 (School St., N. Stelton) was moderately impaired as contrasted with a non-impaired reference site on a tributary to the Dead River. There was a paucity of typical clean water organisms. RBP analyses indicated excessive nutrients and/or organic matter and/or siltation, and possible toxicity and/or lack of riparian vegetation. Vicinities upstream are urbanized and industrialized. This site should be able to support a limited population of small fish.

Stream health was severely impaired downstream at Station 11 (Behmer Rd., Piscataway Twp.). There was a paucity of typical clean water organisms, and Chironomidae were overwhelmingly dominant. This site lies within an expanding industrial area. Conditions appeared favorable for maintaining small fish.

Further downstream, station 12 (Raritan Ave., Middlesex Boro) exhibited moderate impairment. Clean water organisms were scarce, and Gammaridae were dominant. Several stalked protozoans in the sample implied potential sewage pollution. An odor of oil was noted at the site. This site should be capable of supporting small fish.

REFERENCES

New Jersey Department of Environmental Protection (DEP). 1987. Field procedures manual for water data acquisition. Div. of Water Res. Trenton. 106pp. and appendices.

U.S. Environmental Protection Agency (EPA). 1989. Rapid bioassessment protocols for use in streams and rivers. EPA/4444/4-89-001. Assessment and Watershed Protection Division, Washington, D.C.

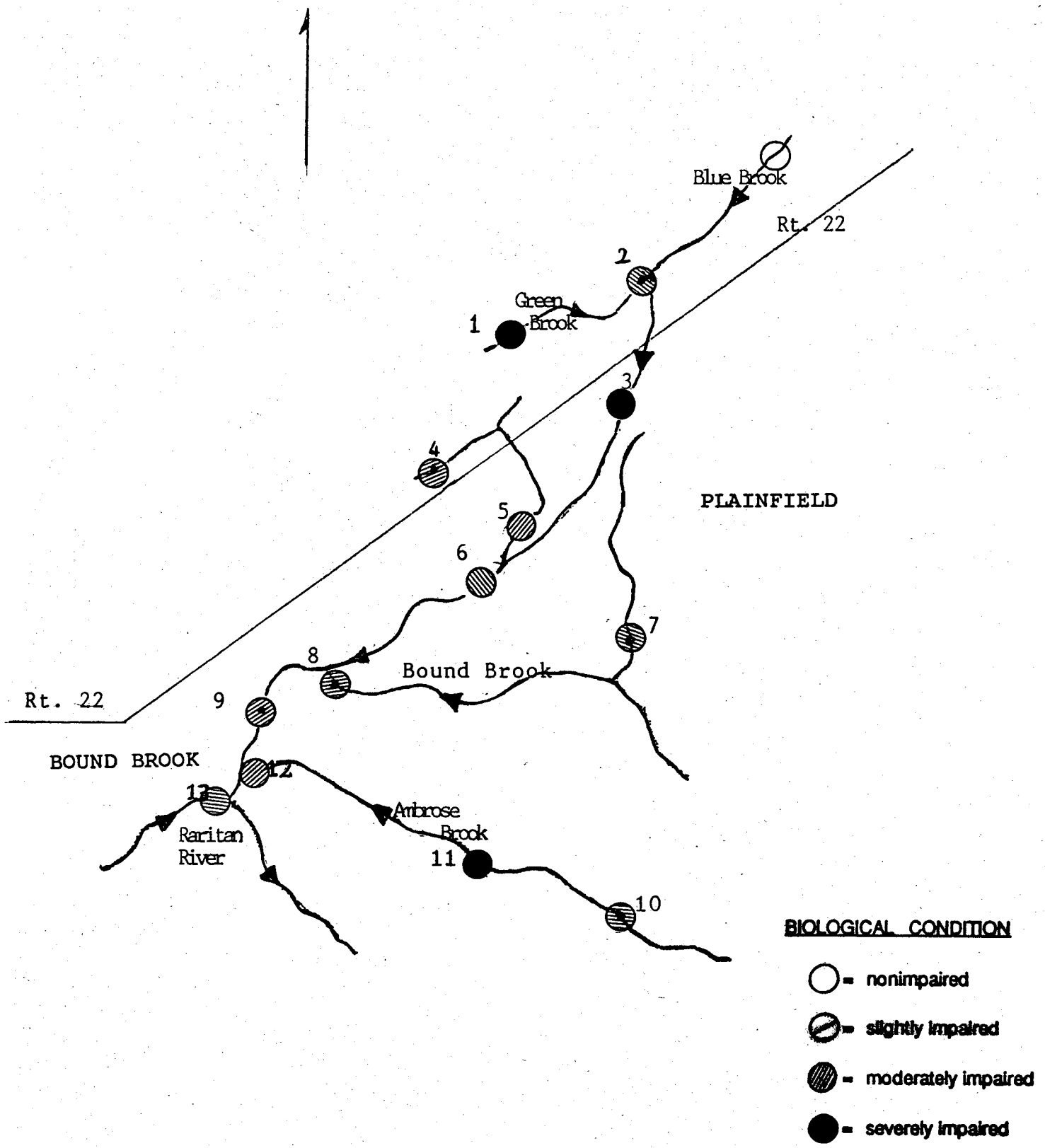

Figure 1. Map of Green Brook survey area. Numbers indicate sampling sites. White, shaded or black circles show the biological condition for each station based on the study.

Table 1. Summary of findings for the Green Brook watershed

Site	RBP II Impairment[a] Classification	Possible Toxicity	Nutrient Enrichment	Non-Point Impact	Channelized	Fishery Potential
1	Severe[b]	No	Yes	Yes	No	Poor
2	Moderate[c,d]	Yes	Yes	Yes	No	Poor
3	Severe[c]	Yes	Yes	Yes	No	Poor
4	Moderate[b]	No	No	Yes	No	Good
5	Moderate[c]	Yes	Yes	Yes	Yes	Poor
6	Moderate[c]	Yes	Yes	Yes	No	Poor
7	Moderate[c,e]	Yes	Yes	Yes	No	Poor
8	Moderate[c]	Yes	No	Yes	No	Poor
9	Moderate	No	Yes	Yes	No	Poor
10	Moderate[e]	Yes	Yes	Yes	No	Good
11	Severe	No	Yes	Yes	No	Good
12	Moderate	No	Yes	Yes	No	Good
13	Moderate	No	Yes	Yes	No	Poor

[a] Unless otherwise noted, degree of impairment is based on a noncomparative assessment.

[b] Primrose Brook in Jockey Hollow National Park was the comparison station.

[c] The statistical analyses was tentative due to inadequate sample size.

[d] Impairment was in reality severe.

[e] Tributary to Dead River near Liberty Corner was the comparison station.

APPENDIX

GREEN BROOK WATERSHED
MACROINVERTEBRATE STUDY
FEBRUARY 25-27, 1992

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY
OFFICE OF WATER MONITORING MANAGEMENT
BUREAU OF WATER MONITORING
BIOMONITORING UNIT

CRITERIA FOR CHARACTERIZATION OF BIOLOGICAL CONDITION

Comparative

Protocol II Biological Condition Scoring Criteria[1](f)

Metric	6	3	0
1. Taxa Richness[(a)]	>80%	40-80%	<40%
2. Family Biotic Index (modified)[(b)]	>85%	50-85%	<50%
3. Ratio of Scrapers/Filterer Collectors[(a,c)]	>50%	25-50%	<25%
4. Ratio of EPT and Chironomid Abundances[(a)]	>75%	25-75%	<25%
5. % Contribution of Dominant Family[(a)]	<30%	30-50%	>50%
6. EPT Index[(a)]	>90%	70-90%	<70%
7. Community Loss Index[(e)]	<0.5	0.5-4.0	>4.0
8. Ratio of Shredders/Total[(a,c)]	>50%	25-50%	<25%

(a) Score is a ratio of study site to reference site X 100.
(b) Score is a ratio of reference site to study site X 100.
(c) Determination of Functional Feeding Group is independent of taxonomic grouping.
(d) Scoring criteria evaluate actual percent contribution, not percent comparability to the reference station.
(e) Range of values obtained. A comparison to the reference station is incorporated in these indices.
(f) The final score is obtained by dividing the total score by 48 and then multiplying by 100.

% Comparison to Reference Score[(g)]	Biological Condition Category	Attributes
>79%	Non-impaired	Comparable to the best situation to be expected within an ecoregion. Balanced trophic structure. Optimum community structure (composition and dominance) for stream size and habitat quality.
29-72%	Moderately impaired	Fewer species due to loss of most intolerant forms. Reduction in EPT Index.
<21%	Severely impaired	Few species present. If high densities of organisms, then dominated by one or two taxa. Only tolerant organisms present.

(g) Percentage values obtained that are intermediate to the above ranges will require subjective judgement as to the correct placement. Use of the habitat assessment and physiochemical data may be necessary to aid in the decision process.

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Noncomparative

Biological Condition Scoring Criteria[2](h)

Metric	6	3	0
1. Taxa	>10	5-10	<5
2. Family Biotic Index (FBI)	<5	5-7	>7
3. E+P+T (Ephemeropter, Plecoptera, Trichoptera)	>5	3-5	<3
4. %EPT	>20	5-20	<5
5. % Contribution of Dominant Family (CDF)	<40	40-60	>60

(h) The final score is obtained by totaling the individual scores.

Final Score	Biological Condition Category
>24	Non-impaired
19-24	Slightly impaired
7-18	Moderately impaired
<7	Severely impaired

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[1] from USEPA, 1989
[2] from Jim Kurtenbach, USEPA

Site 1 - Green Brook at Appletree Road, Watchung Twp.

Family	Number of Individuals	Family Tolerance Value (FTV)
Chironomidae	75	6
Simuliidae	15	6
Phryganeidae	1	4
Capniidae	4	1
Gastropoda	4	7
Sphaeriidae	1	8

Statistical Analysis[a]

Number of Taxa = 6
Taxa Richness = 28.57
Total Number of Individuals = 100
% Contribution of Dominant Family = 75.00
% Contribution of Dominant Family (modified) = 241.94
Family Biotic Index = 5.84
Family Biotic Index (modified) = 62.84
Scraper/Filterer Collector Ratio = 0.00
Scraper/Filterer Collector Score = 0.00
Shredder/Total Ratio = 0.04
Shredder/Total Score = 100.00
E+P+T* = 2 *(Ephemeroptera, Plecoptera and Trichoptera)
EPT Index = 18.18
%EPT = 5.00
EPT/C* = 0.07 *(Chironomidae)
EPTC (modified) = 4.31
Community Loss Index = 2.83
Comparative Rating = 25
Biological Condition = severely impaired
Deficiency(s): low diversity
excessive nutrients and/or organic matter
an/or siltation
Chironomidae disproportionate to intolerants
Chironimidae overwhelmingly dominant
paucity of clean water organisms

[a] Reference Site - Primrose Brook in Jockey Hollow National Park

Site 2 - Green Brook at New Providence Road, Seeleys Mill

Family	Number of Individuals	Family Tolerance Value (FTV)
Chironomidae	52	6
Hydropsychidae	13	4
Psephenidae	2	4
Naididae	4	7
Gastropoda	2	7
Turbellaria	1	4
Simuliidae	1	6
BloodRedChironomidae	2	8
Dytiscidae	1	4

Statistical Analysis

Number of Taxa = 9
Total Number of Individuals = 78
% Contribution of Dominant Family = 66.67
Family Biotic Index = 5.69
Scraper/Filterer Collector Ratio = 0.13
Shredder/Total Ratio = 0.26
E+P+T* = 1 *(Ephemeroptera, Plecoptera and Trichoptera)
%EPT = 16.67
EPT/C* = 0.24 *(Chironomidae)
Noncomparative Rating = 9
Biological Condition = moderately impaired
Deficiency(s): Chironomidae overwhelmingly dominant
paucity of clean water organisms

Site 3 - Green Brook at Raymond Avenue, Watchung Twp.

Family	Number of Individuals	Family Tolerance Value (FTV)
Lumbricidae	3	10
Chironomidae	2	6
Gastropoda	4	7
Hydropsychidae	1	4

Statistical Analysis

Number of Taxa = 4
Total Number of Individuals = 10
% Contribution of Dominant Family = 40.00
Family Biotic Index = 7.40
Scraper/Filterer Collector Ratio = 0.00
Shredder/Total Ratio = 0.00
E+P+T* = 1 *(Ephemeroptera, Plecoptera and Trichoptera)
%EPT = 10.00
EPT/C* = 0.50 *(Chironomidae)
Noncomparative Rating = 6
Biological Condition = severely impaired
Deficiency(s): low diversity
paucity of clean water organisms
significant organic pollution

Site 4 - Stony Brook at Sunlit Drive, Watchung Twp.

Family	Number of Individuals	Family Tolerance Value (FTV)
Chironomidae	56	6
Limnephilidae	4	4
Simuliidae	18	6
Sphaeriidae	3	8
Elmidae	4	4
Psephenidae	6	4
Tipulidae	2	3
Gammaridae	2	4
Nematoda	2	6
Asellidae	2	8
Heptageniidae	1	4

Statistical Analysis[a]

Number of Taxa = 11
Taxa Richness = 52.38
Total Number of Individuals = 100
% Contribution of Dominant Family = 56.00
% Contribution of Dominant Family (modified) = 180.65
Family Biotic Index = 5.70
Family Biotic Index (modified) = 64.39
Scraper/Filterer Collector Ratio = 0.48
Scraper/Filterer Collector Score = 27.57
Shredder/Total Ratio = 0.23
Shredder/Total Score = 57.50
E+P+T* = 2 *(Ephemeroptera, Plecoptera and Trichoptera)
EPT Index = 18.18
%EPT = 5.00
EPT/C* = 0.09 *(Chironomidae)
EPTC (modified) = 5.77
Community Loss Index = 1.45
Comparative Rating = 37.5
Biological Condition = moderately impaired
Deficiency(s): Chironomidae disproportionate to intolerants
Chironomidae overwhelmingly dominant
paucity of clean water organisms

[a] Reference Site - Primrose Brook in Jockey Hollow National Park

Site 5 - Stony Brook at West End Road, North Plainfield

Family	Number of Individuals	Family Tolerance Value (FTV)
Gammaridae	30	4
Tubificidae	12	10
Turbellaria	1	4
Tipulidae	1	3
Chironomidae	4	6
Hydropsychidae	5	4
Lumbricidae	3	10
Hirudinea	1	10
Elmidae	1	4

Statistical Analysis

Number of Taxa = 9
Total Number of Individuals = 58
% Contribution of Dominant Family = 51.72
Family Biotic Index = 5.78
Scraper/Filterer Collector Ratio = 0.00
Shredder/Total Ratio = 0.02
E+P+T* = 1 *(Ephemeroptera, Plecoptera and Trichoptera)
%EPT = 8.62
EPT/C* = 1.25 *(Chironomidae)
Noncomparative Rating = 12
Biological Condition = moderately impaired
Deficiency(s): paucity of clean water organisms

Site 6 - Green Brook at Park Drive, North Plainfield

Family	Number of Individuals	Family Tolerance Value (FTV)
Gammaridae	8	4
Hydropsychidae	17	4
Lumbricidae	2	10
Naididae	3	7
Tipulidae	2	3
Gastropoda	1	7

Statistical Analysis

Number of Taxa = 6
Total Number of Individuals = 33
% Contribution of Dominant Family = 51.52
Family Biotic Index = 4.67
Scraper/Filterer Collector Ratio = 0.00
Shredder/Total Ratio = 0.06
E+P+T* = 1 *(Ephemeroptera, Plecoptera and Trichoptera)
%EPT = 51.52
EPT/C* = 0.00 *(Chironomidae)
Noncomparative Rating = 18
Biological Condition = moderately impaired
Deficiency(s): paucity of clean water organisms

Site 7 - Cedar Brook at Cedar Brook Avenue

Family	Number of Individuals	Family Tolerance Value (FTV)
Lumbricidae	9	10
Naididae	2	7
Tipulidae	3	3
Tubificidae	13	10
Gastropoda	3	7
Dolichopodidae	1	4

Statistical Analysis[a]

Number of Taxa = 6
Taxa Richness = 40.00
Total Number of Individuals = 31
% Contribution of Dominant Family = 41.94
% Contribution of Dominant Family (modified) = 174.73
Family Biotic Index = 8.65
Family Biotic Index (modified) = 60.50
Scraper/Filterer Collector Ratio = 0.00
Scraper/Filterer Collector Score = 00.00
Shredder/Total Ratio = 0.10
Shredder/Total Score = 53.76
E+P+T* = 0 *(Ephemeroptera, Plecoptera and Trichoptera)
EPT Index = 00.00
%EPT = 00.00
EPT/C* = 0.00 *(Chironomidae)
EPTC (modified) = 0.00
Community Loss Index = 2.33
Comparative Rating = 31.25
Biological Condition = moderately impaired
Deficiency(s): excessive nutrients and/or organic matter and/or siltation
Chironomidae disproportionate to intolerants
Tubificidae overwhelmingly dominant
paucity of clean water organisms

[a] Reference Site - Tributary to Dead River near Liberty Corner

Site 8 - Bound Brook at Bound Brook Road, Middlesex Boro

Family	Number of Individuals	Family Tolerance Value (FTV)
Gammaridae	48	4
Asellidae	3	8
Tubificidae	14	10
Lumbricidae	6	10
Gastropoda	2	7
Nematoda	1	6
Chironomidae	2	6
Sphaeridae	9	8

Statistical Analysis

Number of Taxa = 8
Total Number of Individuals = 85
% Contribution of Dominant Family = 56.47
Family Biotic Index = 6.12
Scraper/Filterer Collector Ratio = 0.11
Shredder/Total Ratio = 0.00
E+P+T* = 0 *(Ephemeroptera, Plecoptera and Trichoptera)
%EPT = 0.00
EPT/C* = 0.00 *(Chironomidae)
Noncomparative Rating = 9
Biological Condition = moderately impaired
Deficiency(s): paucity of clean water organisms

Site 9 - Green Brook at Sebrings Mill, Green Brook Twp.

Family	Number of Individuals	Family Tolerance Value (FTV)
Tubificidae	53	10
Naididae	3	7
Gammaridae	17	4
Sphaeriidae	15	8
Gastropoda	1	7
Hydropsychidae	4	4
Lumbricidae	1	10
Chironomidae	2	6
Hirudinea	1	10
BloodRedChironomidae	2	8
Heptageniidae	1	4

Statistical Analysis

Number of Taxa = 11
Total Number of Individuals = 100
% Contribution of Dominant Family = 53.00
Family Biotic Index = 8.14
Scraper/Filterer Collector Ratio = 0.00
Shredder/Total Ratio = 0.00
E+P+T* = 2 *(Ephemeroptera, Plecoptera and Trichoptera)
%EPT = 5.00
EPT/C* = 1.25 *(Chironomidae)
Noncomparative Rating = 12
Biological Condition = moderately impaired
Deficiency(s): paucity of clean water organisms
significant organic pollution

Site 10 - Ambrose Brook at School Street, North Stelton

Family	Number of Individuals	Family Tolerance Value (FTV)
Hydropsychidae	37	4
Asellidae	2	8
Gammaridae	34	4
Turbellaria	1	4
Tubificidae	13	10
Naididae	2	7
Elmidae	5	4
Gastropoda	2	7
Psephenidae	2	4
Tipulidae	1	3
Chironomidae	1	6

Statistical Analysis[a]

Number of Taxa = 11
Taxa Richness = 73.33
Total Number of Individuals = 100
% Contribution of Dominant Family = 37.00
% Contribution of Dominant Family (modified) = 154.17
Family Biotic Index = 4.99
Family Biotic Index (modified) = 104.81
Scraper/Filterer Collector Ratio = 0.05
Scraper/Filterer Collector Score = 9.15
Shredder/Total Ratio = 0.01
Shredder/Total Score = 5.56
E+P+T* = 1 *(Ephemeroptera, Plecoptera and Trichoptera)
EPT Index = 12.50
%EPT = 37.00
EPT/C* = 37.00 *(Chironomidae)
EPTC (modified) = 2960.00
Community Loss Index = 1.00
Comparative Rating = 37.5
Biological Condition = moderately impaired
Deficiency(s): excessive nutrients and/or organic matter and/or siltation
Hydropsychidae overwhelmingly dominant
paucity of clean water organisms
possible toxicity and/or lack of riparian vegetation

[a] Reference Site - Tributary to Dead River near Liberty Corner

Site 11 - Ambrose Brook at Behmer Road, Piscataway Twp.

Family	Number of Individuals	Family Tolerance Value (FTV)
Chironomidae	65	6
Tubificidae	14	10
BloodRedChironomidae	5	8
Gammaridae	8	4
Naididae	3	7
Coenagrionidae	1	9
Hydropsychidae	2	4
Sialidae	1	4
Nematoda	1	6

Statistical Analysis

Number of Taxa = 9
Total Number of Individuals = 100
% Contribution of Dominant Family = 65.00
Family Biotic Index = 6.50
Scraper/Filterer Collector Ratio = 0.00
Shredder/Total Ratio = 0.11
E+P+T* = 1 *(Ephemeroptera, Plecoptera and Trichoptera)
%EPT = 2.00
EPT/C* = 0.03 *(Chironomidae)
Noncomparative Rating = 6
Biological Condition = severely impaired
Deficiency(s): Chironomidae overwhelmingly dominant
paucity of clean water organisms

Site 12 - Ambrose Brook at Raritan Avenue, Bound Brook

Family	Number of Individuals	Family Tolerance Value (FTV)
Gammaridae	56	4
Chironomidae	2	6
Hydropsychidae	16	4
Sphaeriidae	8	8
Tubificidae	12	10
Cambarinae	1	6
Turbellaria	2	4
Nematoda	1	6
Asellidae	1	8
Heptageniidae	1	4

Statistical Analysis

Number of Taxa = 10
Total Number of Individuals = 100
% Contribution of Dominant Family = 56.00
Family Biotic Index = 5.16
Scraper/Filterer Collector Ratio = 0.00
Shredder/Total Ratio = 0.00
E+P+T* = 2 *(Ephemeroptera, Plecoptera and Trichoptera)
%EPT = 17.00
EPT/C* = 8.50 *(Chironomidae)
Noncomparative Rating = 12
Biological Condition = moderately impaired
Deficiency(s): paucity of clean water organisms

Site 13 - Green Brook at Main Street, Bound Brook

Family	Number of Individuals	Family Tolerance Value (FTV)
Gammaridae	13	4
Hydropsychidae	38	4
Naididae	34	7
Chironomidae	11	6
Sphaeriidae	1	8
Elmidae	1	4
Simuliidae	2	6

Statistical Analysis

Number of Taxa = 7
Total Number of Individuals = 100
% Contribution of Dominant Family = 38.00
Family Biotic Index = 5.32
Scraper/Filterer Collector Ratio = 0.00
Shredder/Total Ratio = 0.00
E+P+T* = 1 *(Ephemeroptera, Plecoptera and Trichoptera)
%EPT = 38.00
EPT/C* = 3.45 *(Chironomidae)
Noncomparative Rating = 18
Biological Condition = moderately impaired
Deficiency(s): paucity of clean water organisms

Site - Primrose Brook in Jockey Hollow National Park

Family	Number of Individuals	Family Tolerance Value (FTV)
Capniidae	4	1
Limnephilidae	7	4
Chironomidae	31	6
Ephemerellidae	25	1
Hydropsychidae	2	4
Naididae	1	7
Molannidae	1	6
Lepidostomatidae	4	1
Simuliidae	7	6
Tubificidae	1	10
Gomphidae	1	1
Tipulidae	6	3
Siphlonuridae	1	7
Nematoda	1	6
Perlidae	1	1
Pteronarcyidae	1	0
Rhyacophilidae	1	0
Dixidae	1	3
Gastropoda	1	7
Peltoperlidae	2	1
Leptophlebiidae	1	2

Statistical Analysis

Number of Taxa = 21
Total Number of Individuals = 100
% Contribution of Dominant Family = 31
Family Biotic Index = 3.67
Scraper/Filterer Collector Ratio = 1.73
Shredder/Total Ratio = 0.40
E+P+T* = 11 *(Ephemeroptera, Plecoptera and Trichoptera)
%EPT = 48.00
EPT/C* = 1.55 *(Chironomidae)
Noncomparative Rating = 30
Biological Condition = non-impaired
Deficiency(s): none

Site - Tributary to Dead River near Liberty Corner

Family	Number of Individuals	Family Tolerance Value (FTV)
Sphaeriidae	3	8
Odontoceridae	10	0
Tubificidae	17	10
Elmidae	4	4
Chironomidae	24	6
Helicopsychidae	1	3
Psephenidae	2	4
Limnephilidae	5	4
Simuliidae	19	6
Ephemerellidae	2	1
Heptageniidae	1	4
Capniidae	8	1
Sialidae	1	4
Nemouridae	2	2
Leptophlebiidae	1	2

Statistical Analysis

Number of Taxa = 15
Total Number of Individuals = 100
% Contribution of Dominant Family = 24
Family Biotic Index = 5.23
Scraper/Filterer Collector Ratio = 0.59
Shredder/Total Ratio = 0.18
E+P+T* = 8 *(Ephemeroptera, Plecoptera and Trichoptera)
%EPT = 30.00
EPT/C* = 1.25 *(Chironomidae)
Noncomparative Rating = 27
Biological Condition = non-impaired
Deficiency(s): none

APPENDIX E
NEW MARKET POND REPORT (1987)
Source: NJDEP

New Market Pond

New Market Pond (Figure I) is an urban on-channel (Bound Brook) impoundment located in the town of New Market, Piscataway Township, Middlesex County. It was built in the early 1800's to provide water power to operate a mill, with the earliest recorded owner being the Middlesex Milling Company. The pond was apparently purchased by the Elizabethtown Water Company during the mid-1900's, and served as a supplemental water supply until the late 70's, early 80's when it was purchased (Green Acres) by Piscataway Township for recreational purposes (Columbus Park). The township subsequently undertook a lake rehabilitation program (hydraulic dredging) including construction of recreational facilities, fishing being a major anticipated use.

The entire watershed and area adjacent to the park is developed (residential and light industry), consequently, the pond receives large quantities of nutrient laden "urban runoff", and as a result, is highly eutrophic.

The geology of the New Market Pond Watershed (20.6 sq. miles) is of the Piedmont physiographic province and is underlain, for the most part, by soft red shale of the Newark group of Triassic age. A terminal moraine, which is a ridge composed of accumulations of cobbles and boulders of clay, silt, sand and gravel that marks the southernmost advance of the last glaciers, is along a line from Perth Amboy to South Plainfield, Glacial outwash, in the form of stratified sand and gravel, is immediately to the west of the terminal moraine.

The soils of the watershed are of the Dunellen-Ellington Variants, which are urban land and nearly level to gently sloping, which are urban land and nearly level to gently sloping, deep, well-drained and moderately well drained soils that have a loamy subsoil on uplands.

Because of the urban nature of the watershed, and eutrophic state of the pond, extensive plankton blooms routinely occur resulting in extreme diurnal fluctuation in both dissolved oxygen and pH (historical data). Rooted aquatic vegetation is limited to the immediate margin of the pond, with the exception at the inlet where it extends out to a depth of approximately two feet.

Physical-Chemical Water Characteristics

Selected physical-chemical water characteristics of New Market Pond are presented in Table I. At the time checked this lake was homothermal, however, due to its shallowness (maximum depth of 5 feet), this condition would essentially prevail at all times of year.

Aquatic Vegetation

Rooted aquatic vegetation, as previously noted, is relatively limited and essentially located along the shoreline. The following species was noted:

spatterdock *Nuphar advena*

Fish

Table II presents a checklist of New Market Pond fish species. Table III provides information on the composition of "young-of-the-year" and "older" fish captured by shoreline seining. Successful reproduction of the three major centrarchid species (pumpkinseed and bluegill sunfish and largemouth bass) present in the impoundment is documented.

Tables IV and V provide information on the composition of fish species as determined by shoreline electrofishing and gill netting, respectively. It is quite obvious that crap and goldfish dominate the fish population, both in number and total weight.

The problem with carp and goldfish is that they are members of the minnow family and feed at a very low trophic level. In other words, they are competing with every other species for food and space and, because of their rapid growth rate, quickly become too large to be preyed upon by most predator species (largemouth bass). Since the only way to control them effectively is through use of a fish toxicant (rotenone) and the cost of reclaiming the entire watershed above the lake would be prohibitive, management of the fishery must be built around these species. Carp and larger goldfish can be caught on hook and line and as such, provide sporting opportunity for those willing to learn the technique of catching them. Also, since largemouth bass along with the pumpkinseed and bluegill are successfully reproducing, they can provide additional fishing opportunity.

Table VI provides limited growth data on pumpkinseed sunfish, bluegill sunfish and largemouth bass in New Market Pond. All three species exhibit below average growth rate when compared to the average for North Jersey lakes (Stewart, 1971). This is adjudged the result of severe competition with carp and goldfish.

Fisheries Management Recommendations

1. New Market Pond should be managed for warmwater fish species with the existing population providing most of the fishery.
2. In addition, catchable catfish (>7") and sunfish (>5") should be stocked periodically to provide additional fishing opportunity for the many local children who utilize the pond.

Literature Cited

Stewart, Robert W. 1971 — Studies of the Standing Crops of Fish in New Jersey Lakes and Ponds. New Jersey Division of Fish, Game and Wildlife, Miscellaneous Report No. 34.

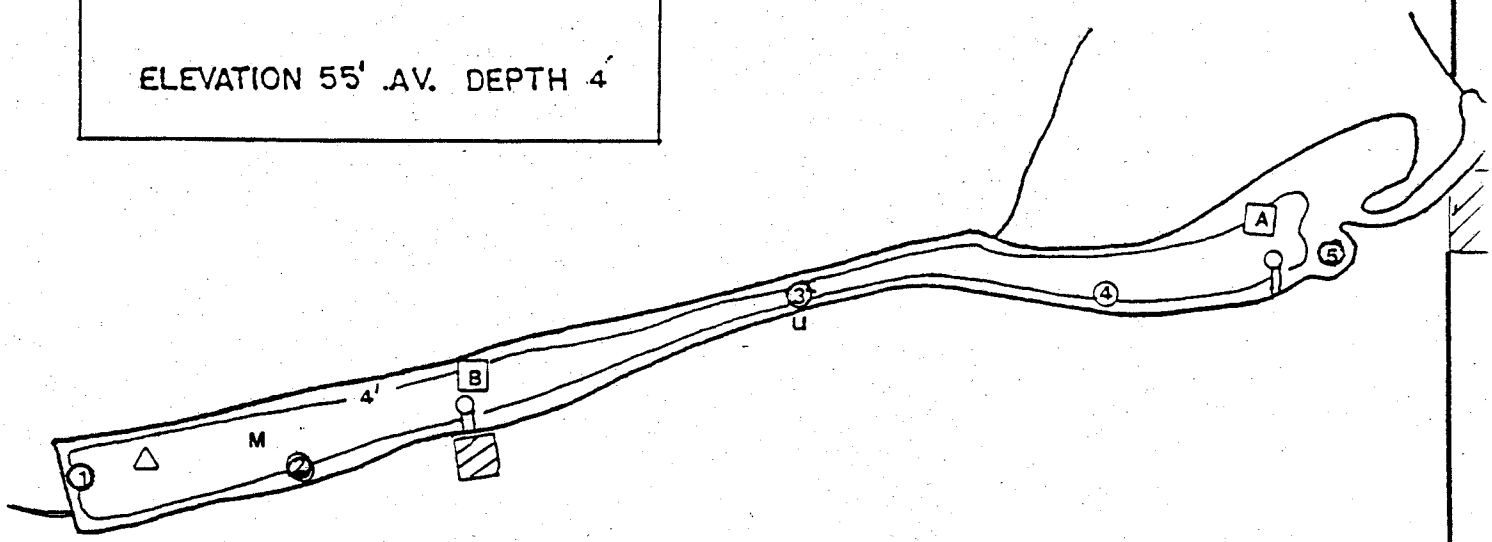
Figure I

NEW MARKET POND

MIDDLESEX COUNTY

25 ACRES MAX. DEPTH 6'+

ELEVATION 55' AV. DEPTH 4'



KEY:

SAMPLING SITES

- ○ SHORELINE SEINING
- ▽ WATER CHEMISTRY
- □ ORGANIC NITROGEN AND PHOSPHORUS

FACILITIES

- FISHING PIER
- PARKING

Table I. Selected physical-chemical water characteristics of New Market Pond, July 30, 1987

Depth in Ft.	Temperature (F) Water	Air	Dissolved Oxygen (ppm)	Alkalinity (ppm) pH-th	Total	pH	Specific Conductance 1/	Turbidity (inches)
0	75	86	11.2	0	65	7.5	320	12 2/
5	75		4.0	-	-	-	295	

1/ Micromohos at standard temperature.
2/ Heavy plankton bloom.

Table II. Organic nitrogen (Total Kjeldahl) and phosphorus content of bottom sediments and surface and bottom water samples at New Market Pond.

Sample Location 1/	Nitrogen(ppm) Total Kjeldahl	Total Phosphorus (ppm)		Nitrogen(ppm) Total Kjeldahl	Phosphorus (ppm)
A	1900	680	Surface	0.65	0.218
			Bottom	0.64	0.223
B	914	349	Surface	0.69	0.254
			Bottom	0.68	0.281

1/ See Figure I for sampling locations.

Table III. Checklist of fish species captured in New Market Pond during 1987.

Order: Cypriniformes		
Family: Cyprinidae - minnows		
	Carp	*Cyprinus carpio*
	Goldfish	*Carassius auratus*
	Golden shiner	*Notemigonus crysoleucas*
Family: Catostomidae - suckers		
	White sucker	*Catostomus commersoni*
Family: Ictaluridae - catfishes		
	Brown bullhead	*Ictalurus nebulosus*
Order: Perciformes		
Family: Centrarchidae - sunfishes		
	Pumpkinseed	*Lepomis gibbosus*
	Bluegill	*Lepomis macrochirus*
	Largemouth bass	*Micropterus salmoides*

Table IV. Composition of young-of-the-year and older fish captured by shoreline seining 1/ at New Market Pond (August 25, 1987.

Species	Young-of-the-Year			Older		
	Location 2/	No.	% of No. Captured	Location 2/	No.	% of No. Captured
Pumpkinseed	5	1	10			
Bluegill	All	6	60	1	1	100
Largemouth bass	1	3	30			
Totals		10	100		1	100

1/ Due to a steeply sloping shoreline resulting from recent dredging of the pond in combination with a very soft bottom made seining extremely difficult.

2/ See Figure I for sampling locations.

Table V. Composition of fish species as determined by electrofishing 1/ the littoral zone in New Market Pond (July 30, 1987)

Species	No.	Weight (lbs)	% of Population by weight	Harvestable 2/		
				No.	Weight (lbs)	% of Total Weight
Carp	65	140*	27.8	65	140.0*	27.8
Goldfish	400	340*	67.5	400	340.0*	67.5
Golden shiner	75	5	1.0			
White sucker	38	14.3	2.8			
Pumpkinseed	4	0.4	0.1	1	0.2	0.1
Bluegill	8	0.3	0.1			
Largemouth bass	6	3.7	0.7	4	3.2	0.7
Totals	596	503.7	100.0%	470	483.4	96.1

1/ Entire perimeter of the pond.

2/ See Appendix Table I.

* Estimated weight.

Table VI. Composition of fish species as determined by overnight gill netting 1/at New Market Pond (August 25-26, 1987)

Species	No.	Weight (lbs)	% of Population By Weight	Harvestable 2/		
				No.	Weight (lbs)	% of Total Weight
Carp	1	1.3	7.2	1	1.3	7.2
Goldfish	22	13.7	76.2	22	13.7	76.2
Golden shiner	23	1.8	10.0			
White sucker	3	0.8	4.4			
Brown bullhead	1	0.4	2.2	1	0.4	2.2
Totals	50	18.0	100.0	24	15.4	85.6

1/ One 125' x 6' experimental gillnet, containing 25 feet each of 1 1/1", 2", 2 1/2", 3 ", and 3 1/2" stretched mesh netting (see Figure I for sampling locations).

2/ See Appendix Table I.

Table VII. Growth 1/ of pumpkinseed sunfish, bluegill sunfish and largemouth bass in New Market Pond.

Species	Age	Year Class	No.	Average Length * at Annuli (inches)	Range (inches)
Pumpkinseed	II	1985	5	3.1	2.9 - 3.3
	III	1984	1	4.1	-
	IV	1983	1	5.1	-
Bluegill	II	1985	4	3.5	3.1 - 4.0
Largemouth bass	I	1986	1	4.5	-
	II	1985	2	6.8	6.5 - 6.9
	III	1984	2	10.1	9.9 - 10.1
	IV	1983	1	12.3	-

1/ Age classes were determined by projecting the enlarged image of the scale on a screen and lengths at the last annuli only back-calculated by the Van Oosten method.

* Total length.

APPENDIX

Table 1. New Jersey standardized criteria for harvestable sizes.

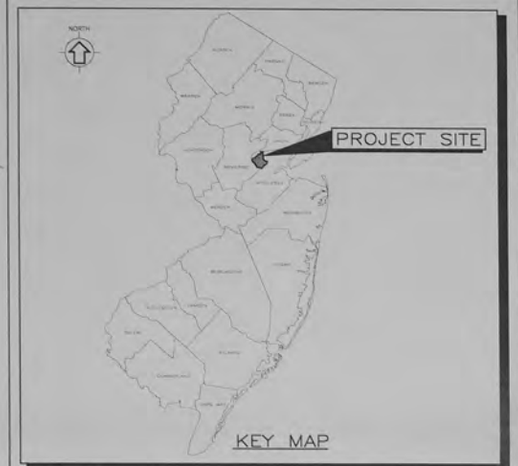
Species	Total length in inches
Trout (brook, brown, rainbow)	All
Tiger muskie - muskellunge	>30
Northern pike	>24
Pickerel (chain, redfin)	>12
Bass (largemouth, smallmouth)	>9
Perch (yellow and white)	>7
Catfish (all species except madtom)	>7
Rock bass	>5
Sunfish (all species)	>5
Crappie (black, white)	>5
Striped bass	>33
Striped bass x white bass hybrid	>18
Walleye	>15

APPENDIX F
NEW MARKET POND MONITORING (1976-1988)
Source: NJDEP

TABLE 1

NEW MARKET ND

STATION	DATE	TEMP. (Top)	D.O. (Top)	TEMP. (Bot)	D.O. (Bot)	F.COLI (MPN)	F.STREP (MPN)	FC/FS	pH	Alk (mg/L)	TOT. P (mg/L)	SECCHI (M)	Chl a (mg/M3)	DIVERSITY	DOMINANT SPECIE
INLET	06/02/76	17.2	4.9			9200	>2400	<3.8	6.9	49	0.652				
INLET	10/11/77	12.0	7.6			330	170	1.9	7.1	103	0.114				
INLET	09/10/81	21.0	6.6			1700	>2400	<0.7	7.0		0.270				
INLET#2	06/28/88	20.5	8.0			270	11	24.5	7.1	129	0.151				
INLET#2	09/29/88	17.0	5.0			<20	49	<0.4	7.9	243	0.110				
UPPER	04/27/88	17.5	10.0	14.0	11.4	230	8	28.7	7.6	137	0.183	.76	10.66		
UPPER	06/28/88	22.5	7.2	22.0	6.8	1100	22	50	7.5	135	0.117	.61	41.24	HIGH	FLAGELLATES
UPPER	09/28/88	17.0	6.0	16.0	5.5	80	15	5.3	8.3	131	0.140	.46	74.96	HIGH	CHLOROPHYTES
LOWER	04/27/88	15.0	12.0	14.0	11.4	20	<2		8.0	129	0.139	.76	29.25	HIGH	FLAGELLATES,DIA
LOWER	06/28/88	23.5	9.0	23.0	8.8				8.5	146	0.107	.37	68.10	HIGH	CHLOROPHYTES
LOWER	09/29/88	18.5	8.1	18.0	7.6				8.4	123	0.054	.37	70.04	HIGH	CHLORPHYTES
OUTLET	06/02/76	17.8	3.2			5400	>2400	<2.2	7.0	92	0.152				
OUTLET	10/11/77	13.5	5.2			170	540	.3	7.1	67	0.114				
OUTLET	09/10/81	22.0	2.9			460	>2400	<0.2	6.5		0.231				



LEGEND

- ROADWAY
- STREAM
- TOWNSHIP/BORO BOUNDARY
- COUNTY BOUNDARY
- STREAM FLOW DIRECTION
- TIDAL FLOW DIRECTION
- NEW MARKET POND SEGMENTS (SEE TEXT) — SEGMENT II
- EXISTING DAM

SOURCES:

PISCATAWAY TOWNSHIP NATURAL RESOURCES INVENTORY BASE MAP, 1993.
DIGITIZED PISCATAWAY BOARD OF EDUCATION TRANSPORTATION MAP, 1992.

NOTES:

1. THIS MAP WAS DEVELOPED, IN PART, USING NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION GEOGRAPHIC INFORMATION SYSTEM DIGITAL DATA, IN CONJUNCTION WITH THE TOWNSHIP OF PISCATAWAY'S WORK, BUT THIS SECONDARY PRODUCT HAS NOT BEEN VERIFIED BY NJDEP AND IS NOT STATE-AUTHORIZED.
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TOWNSHIP OF PISCATAWAY
Middlesex County, New Jersey

LOUIS BERGER & ASSOCIATES, INC.
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East Orange, New Jersey

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DRAWN BY: / DATE:	RAH, zV / CEM/JH/JD
CHECKED BY: / DATE:	DE/MZ
REVISED BY: / DATE:	RAH

NATURAL RESOURCE INVENTORY
STREAM FLOW CHARACTERISTICS

RECOMMENDED FOR APPROVAL BY: / DATE:	DATE: 12/15/95	DRAWING NO.
	REVISION NO.	
APPROVED BY: / DATE:	SHEET NO.	FILE NO. PISCNRI.DWG