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THE NEPONSET RIVER WATERSHED

1994 RESOURCE ASSESSMENT REPORT

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
OFFICE OF WATERSHED MANAGEMENT

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THE NEPONSET RIVER WATERSHED

1994 RESOURCE ASSESSMENT REPORT

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Department of Environmental Protection
Office of Watershed Management

in cooperation with:

The Department of Environmental Management
Office of Water Resources,

The Department of Fisheries, Wildlife,
and Environmental Law Enforcement Riverways Program,

MassGIS,

and

The Massachusetts Executive Office of Environmental Affairs

Resource Assessment Project Number 94-1

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OFFICE OF WATERSHED MANAGEMENT
NORTH GRAFTON AND BOSTON, MASSACHUSETTS

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DEDICATION

This Neponset River Watershed Project Resource Assessment Report is dedicated to a well-loved colleague, Mary Wheeler, who passed away on April 6, 1994, and who is sorely missed by all who knew her. The spirit of this project was her vision and is dedicated to her memory.

ACKNOWLEDGEMENTS

The Neponset River Basin Team also received support and guidance from the following federal environmental agencies: The U.S. Environmental Protection Agency's Region I, the U.S. Geological Survey's Water Resources Division, and the U.S. Natural Resources Conservation Service's Massachusetts Community Assistance Partnership Program. The Neponset River Watershed Association, the Massachusetts Water Resources Authority, and the Boston Water and Sewer Commission have all contributed to this report.

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It is impossible to thank everyone who contributed to this project: field, laboratory, data management, writing, editing, and graphics, as well as meetings, phone calls, and many e-mails. These contributions are very much appreciated.

EXECUTIVE SUMMARY
NEPONSET RIVER WATERSHED
1994 RESOURCE ASSESSMENT REPORT

MISSION STATEMENT:

Under the direction of the Secretary of Environmental Affairs, Massachusetts has adopted a watershed approach to managing water resources. The Neponset River Watershed is the pilot basin which is being used to demonstrate coordination of the programs of all agencies that comprise the Executive Office of Environmental Affairs (EOEA). These agencies include the Departments of Environmental Protection (DEP), Environmental Management (DEM), Fisheries, Wildlife and Environmental Law Enforcement (DFWELE), Food and Agriculture (DFA), the Metropolitan District Commission (MDC) and the Office of Coastal Zone Management (CZM). Through the combined efforts of these and selected federal environmental agencies, and in close association with the citizenry of the Neponset River Watershed, the mission of the Neponset River Watershed Project is simply to protect and enhance water resources so that the Neponset River and its contributing subwatersheds will be of sufficient quality and quantity to support their multiple uses.

PROJECT APPROACH:

The watershed approach, the centerpiece of the Department of Environmental Protection's "Clean Water Strategy", is being applied by the Department's Office of Watershed Management (OWM) for the Neponset River Watershed Project. Using the river basin as the fundamental planning unit for integrated water quality management, the following milestones represent the major elements of the implementation plan for the Neponset River Watershed Project:

• Basin targeted by Secretary of EOEA	April 1994
• Development of sampling plan/strategy	June 1994
• Resource assessment in the watershed	July-December 1994
• Resource assessment report	September 1995
• Watershed management plan	April 1996
• Basin-wide permitting	September 1996
• Water resource grant targeting	September 1996 - January 1999

RESOURCE ASSESSMENT:

Assessment of the existing water quality conditions is a key step to successful implementation of the watershed approach. This critical phase provides basic information for focusing resource protection and remediation activities to be executed later in the watershed management process. To this end, a wide array of monitoring and assessment techniques were used by several federal and state programs, to document water quality conditions in the Neponset River Watershed. Cooperating with the Office of Watershed Management were the Department's Division of Environmental Analysis (DEA), the Massachusetts Department of Environmental Management, the Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, U.S. Environmental Protection Agency's Environmental Services Division (ESD), the U.S. Geological Survey (USGS), and the U.S. Natural Resource Conservation Service's Massachusetts Community Assistance Partnership program (MassCAP).

Results of the assessment phase of the Neponset River Watershed Project are summarized in Figure 1. While many of the water resources in the watershed were found to be impacted, the adverse conditions encountered in many areas can be corrected through practical and feasible methods. Some of the remedies may be as simple as increasing public awareness of the consequences of their actions in the watershed. Already, the water resources have benefitted from the increasingly stronger commitment of concerned citizens working closely with the government agencies to achieve water quality goals.

SUMMARY OF CONDITIONS:

The Neponset River Watershed generally does not support its designated uses. Major causes of non-support include elevated bacteria counts, low dissolved oxygen content, high instream temperature, displeasing aesthetic and habitat quality, insufficient streamflow, nonpoint source pollution due to storm water runoff, illegal connections to storm drains, severe sediment contamination, imbalanced biological communities, elevated concentrations of contaminants in edible fillets of fish, severe eutrophication and/or infestations of non-native or nuisance aquatic vegetation in the ponds, lakes and impoundments.

MASSACHUSETTS SURFACE WATER QUALITY STANDARDS
CLASSIFICATION AND DESIGNATED USE SUPPORT DETERMINATIONS:

The Massachusetts Surface Water Quality Standards (SWQS, MA DEP 1995) designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected and prescribe the minimum water quality criteria required to sustain the designated uses. They also contain regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges. These standards have been adopted by DEP to meet the objectives of the 1972 Federal Clean Water Act, which are the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters.

Consistent with the National Goal Uses of "fishable and swimmable waters", the designated uses of the surface waters in the Neponset River Basin, according to the Massachusetts Surface Water Quality Standards, are Class B (freshwater) or SB (marine) which include the following:

- AQUATIC LIFE - suitable habitat for sustaining a native, naturally diverse, community of aquatic flora and fauna. Three subclasses of aquatic life are also designated in the standards; Cold Water Fishery - capable of sustaining a year-round population of cold water aquatic life such as trout, Warm Water Fishery - waters which are not capable of sustaining a year-round population of cold water aquatic life, and Marine Fishery - suitable for marine flora and fauna.

- FISH CONSUMPTION - pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption.

- PRIMARY CONTACT RECREATION - suitable for any recreation or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.

- SECONDARY CONTACT RECREATION - suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities.

- AESTHETICS - all surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

- AGRICULTURAL AND INDUSTRIAL - suitable for irrigation or other agricultural process water and for compatible industrial cooling and process water.

- SHELLFISH HARVESTING (in SB segments) - in approved areas, shellfish harvested with depuration (Restricted Shellfish Areas) shall be suitable for consumption.

A summary of the use support determinations for three defined stream segments along the mainstem Neponset River, and the East Branch Neponset River, as well as their contributing subwatersheds, is presented in Table 1. Causes and sources of impairment, when known, are noted in the narrative.

TABLE 1. 1994 NEPONSET RIVER BASIN SURVEY. Designated use support determination by subwatershed and river segment, where S = support, T = support but threatened, PS = partial support, NS = non-support, and NA = not assessed.

SUBWATERSHED/ SEGMENT	PRIMARY CONTACT RECREATION	SECONDARY CONTACT RECREATION	AQUATIC LIFE			FISH CONSUMPTION (Public Health)	AESTHETICS	OVERALL USE STATUS
			WATER QUALITY	SEDIMENT QUALITY	BIOLOGY			
SEGMENT 1/Upper Mainstem Neponset River	**NS**	**PS**	**NS**	**NS**	**NS**	**NS'**	**NS**	**NS**
HEADWATERS/SEGMENT 1	NS	NS	NS	NS	NA	NA	NS	NS
SCHOOL MEADOW BROOK/ SEGMENT 1	NA	NA	NA	NA	NA	NA	NA	NA
MILL/MINE BROOK/ SEGMENT 1	S	S	NS	NA	NS	NA	S	NS
SPRING BROOK/ SEGMENT 1	S	S	NS	NA	NA	NA	NS	NS
HAWES BROOK/ SEGMENT 1	PS	S	NS	NA	S	NA	S	PS
SEGMENT 2/Middle Mainstem Neponset River	**NS**	**S**	**NS**	**NS**	**NS**	**NS**	**PS**	**NS**
MEADOW BROOK/ SEGMENT 2	NS	NS	NS	NA	NA	NA	NS	NS
TRAPHOLE BROOK/ SEGMENT 2	NS	PS	NS	NA	S(T)	NA	S	NS
UNNAMED TRIBUTARY/ SEGMENT 2	S	S	S	NA	NA	NA	NA	S
PURGATORY BROOK/ SEGMENT 2	PS	S	PS	NA	NA	NA	NA	PS
PECUNIT BROOK/ SEGMENT 2	S	S	PS	NA	NA	NA	NA	PS
PONKAPOAG BROOK/ SEGMENT 2	PS	S	PS	NA	NA	NA	NA	PS
MOTHER BROOK/ SEGMENT 2	NS	PS	NS	NA	NA	NA	NS	NS

TABLE 1. (cont.)

SUBWATERSHED/ SEGMENT	PRIMARY CONTACT RECREATION	SECONDARY CONTACT RECREATION	AQUATIC LIFE			FISH CONSUMPTION (Public Health)	AESTHETICS	OVERALL USE STATUS
			WATER QUALITY	SEDIMENT QUALITY	BIOLOGY			
PINE TREE BROOK/ SEGMENT 2	NS	PS	NS	NA	NA	NA	NS	NS
SEGMENT 3/Neponset River Estuary**	**NS**	**NS**	**PS**	**NA**	**NA**	**NA**	**NA**	**NS**
UNQUITY BROOK/ GULLIVERS CREEK/ SEGMENT 3	NS	PS	PS	NA	NA	NA	NA	NS
SEGMENT 4/East Branch Neponset River	**PS**	**S**	**NS**	**NS**	**NS**	**NA**	**NS**	**NS**
MASSAPOAG BROOK/ SEGMENT 4	S	S	NS	NA	NS	NA	NS	NS
STEEP HILL BROOK/ SEGMENT 4	NS	NS	NA	NA	NA	NA	NS	NS
BEAVER MEADOW BROOK/ SEGMENT 4	NS	PS	PS	NA	NA	NA	NA	PS
PEQUID BROOK/ SEGMENT 4	PS	S	NS	NA	NA	NA	NA	PS

* Public Health advisory (elevated PCB concentrations in brown bullheads) issued for the Neponset River between Hollingsworth & Vose Dam in Walpole and Tileston Dam in Boston (Hyde Park).

** Segment 3 would also be classified as Non-support for Restricted Shellfishing.

SEGMENT 1 UPPER MAINSTEM NEPONSET RIVER (10.4 river miles)
The outlet of Crackrock Pond, Foxborough to Pleasant St. Bridge, Norwood

Segment Summary: The mainstem Neponset River begins at the outlet of Crackrock Pond, in Foxborough. This segment of the river, which extends downstream to the Pleasant Street bridge in Norwood, is characterized by a moderate gradient (loss in elevation of approximately 24 feet/mile), and a riffle-run-pool habitat. A multitude of pollution problems impact the river in this segment. In its headwater impoundments, Neponset Reservoir and Crackrock Pond, severe eutrophication problems exist. Both impoundments have been impacted to a great extent by the past discharge of treated process wastewater from the Foxborough Company, resulting in the contamination of the Neponset Reservoir sediments with heavy metals (particularly cadmium) and nutrients. Crackrock Pond also receives a small, treated municipal wastewater discharge from an elderly housing complex, which will be tied into the Mansfield wastewater treatment facility in the near future. If this connection is not complete prior to September 1996, a NPDES permit will be issued by the DEP.

Water quality problems in these headwater impoundments are manifested by excess turbidity and the proliferation of non-native aquatic plants that lead to impacts in the mainstem Neponset River such as the lack of a sufficient quantity of oxygen in the water column and turbidity. Exceedences of recommended instream concentrations of metals and nutrients were also measured. In addition, while the physical habitat of the majority of the stream channel would sustain a diverse biological community, the quality of the sediments in this segment of the river are severely degraded, as evidenced by elevated concentrations of nutrients and heavy metals, the presence of whole-sediment toxicity, and the bioaccumulation potential of cadmium, chromium, copper, and zinc.

From the outlet of Crackrock Pond, the Neponset River flows through culverts under the Foxboro Park Raceway. While the manure handling practices of the Raceway (a potential source of pollution to the river) are excellent, the storm water runoff from the areas of the track and practice track contribute significant loadings of stone dust directly to the Neponset River through the culvert system situated underneath the Raceway grounds. This has resulted in excessive sedimentation and degradation of the impoundments along the river in Walpole, and excessive turbidity in the water column after storm events, which severely degrades the aesthetic quality of the river. The NRCS Mass CAP program has provided the town of Foxborough, and the owners of the Foxboro Park Raceway, with an excellent set of options to correct the runoff problems from their facility. With the elimination of the nonpoint source pollution impacts from the Raceway, a wetland/habitat restoration project is highly recommended for the Neponset River and its impoundments in this segment.

Elevated fecal coliform bacteria concentrations were measured in the Neponset River near Summer Street in Walpole. Attempts to identify the source of bacterial contamination were unsuccessful; however, several homes and streets in the area adjacent to the river are not served by the MWRA sewer system. These impacts are most likely the result of failing septic systems, which are being addressed by the Walpole Board of Health and the homeowners.

The mainstem Neponset River receives one small discharge of non-contact cooling water and storm water runoff from the Bird Machine Company in South Walpole. Additionally, a small volume of effluent from a contaminated groundwater treatment system at a Mobil Service Station in Walpole is also discharged to the Neponset River. Neither of these point source discharges appear to be causing any obvious detrimental impacts to the river; however, no sampling of the discharges was performed in 1994. At the lower end of this segment, the Hollingsworth and Vose Company currently discharges circulating screen backwash water from its water intake structure. Process wastewater is currently discharged to the MWRA sewer system; however, the company has been issued a NPDES permit which authorizes the discharge of treated process wastewater to the mainstem Neponset River.

The Bird Roofing Company also discharges its non-contact cooling and treated (settling lagoon) process wastewater to the mainstem Neponset River at the lower end of this segment. While the discharge is in compliance with current permit limits, the effluent was a milky-white, turbid discharge which resulted in a visible plume in the river. This issue, as well as storm water management options, will be addressed through the NPDES permit process.

SCHOOL MEADOW BROOK was not assessed. Several wells in the subbasin contribute to the public water supply for the town of Walpole. One minor NPDES discharge from Senior Flexonics, Inc. in Sharon discharges cooling and process wastewater from an electroplating operation to a tributary of School Meadow Brook. The facility is also a confirmed waste site due to the chlorinated hydrocarbon contamination of soil and groundwater caused by a previous owner, Parker Hannifin, Corp. As a result of the groundwater contamination, and its subsequent migration off site, a remediation system has been installed at the town of Walpole Washington Well #6.

MILL/MINE BROOK: Comprised of Tubwreck, Mill and Mine Brooks, this small subwatershed contains municipal water supply wells in the towns of Dover, Medfield and Walpole. The total withdrawal from this subbasin was 1.4 million gallons per day (MGD) in 1994. The only discharge to the subbasin, other than the return of wastewater through a small number of septic systems, is the filter backwash water from the Harold E. Willis Water Treatment Plant in Walpole, which discharges into a wetland area adjacent to Mine Brook. This subbasin is experiencing considerable development in the form of single family home subdivisions. Storm water controls to prevent construction impacts such as erosion and sedimentation from subdivisions in Medfield were improperly installed and presumed ineffective. While documented as supporting a cold-water fishery as recently as 1987 (based upon the records of the DFWELE), no salmonids (i.e., trout) were found during OWM's 1994 biological monitoring effort. Furthermore, the water temperature was higher than expected (26°C).

While the tributary supports primary and secondary contact recreational uses, the aquatic life use support determination was non-support. An intensive water conservation outreach and education program is highly recommended for the communities which are receiving their water from this subbasin. A flow-optimization study, or the identification and use of alternate sources of water is also recommended to alleviate the stress on this small subwatershed during critical conditions.

SPRING BROOK: The Spring Brook/Diamond Brook system in Walpole is highly eutrophic. The Walpole Country Club, located in the headwaters of this watershed, withdrew approximately 0.14 MGD in 1994. The sources and magnitude of pollutant contributions to this system are currently unassessed. The impoundments, Clarks Pond and Diamond Pond, are impaired by non-native and nuisance aquatic vegetation, and do not support their designated uses. The presence of one non-native plant in particular, *Trapa natans* or water chestnut, was documented in Clarks Pond in Walpole. Because of its explosive growth, it threatens not only Clarks Pond, but the downstream and adjacent waterbodies as well. The isolated infestation of water chestnut in Clarks Pond was carefully removed by hand during the Fall of 1994, and again in Spring, 1995. Careful, repeated collections of this non-native aquatic vegetation over the next decade (based on the dormant period of the nutlet seed) should be utilized to control (and potentially eliminate) the infestation.

HAWES BROOK: The Hawes Brook subwatershed consists of Bubbling and Mill brooks and several unnamed tributaries to Pettee and Willet pond, as well as Germany Brook which flows into Ellis Pond. Hawes Brook is the named stream from the outlet of Ellis Pond to its confluence with the Neponset River in Norwood. The fish consumption advisory (due to mercury contamination) in Willet Pond results in the non-support status for the designated Fish Consumption Use. Ellis Pond was found to be impaired with non-native aquatic plants. Elevated fecal coliform counts were documented in Germany and Hawes brooks, while some exceedences of the water quality standards for other variables were measured in Hawes Brook. On more than one occasion, an unidentified purgeable organic compound was detected at very low concentrations in the water column of Hawes Brook. While not an obvious pollution problem, it is recommended for future monitoring efforts to determine the source of this potential pollutant. Gibbs Service Station, on 469 Walpole Street in Norwood, which discharges treated groundwater into Hawes Brook, is one possible source of this unidentified compound. The biological community of Hawes Brook was considered relatively healthy and diverse. Trash and debris degraded the aesthetic quality.

Potential impacts from the Norwood landfill on Germany Brook are unassessed at this time.

SEGMENT 2. MIDDLE MAINSTEM NEPONSET RIVER (12.2 river miles)
Pleasant Street Bridge, Norwood to Baker Dam, Milton/Boston corporate boundary.

Segment Summary:
This segment of the mainstem Neponset River meanders through the extensive wetlands of Fowl Meadow which has been designated as part of the Ponkapoag Bog and Fowl Meadow Area of Critical Environmental Concern (ACEC), and continues to flow through the two impoundments created by the Tileston and Baker dams. The gradient in this section is quite low, thus altering the character of the river to that of a meandering, flat-water stream.

Resource assessment activities in this segment consisted of water column and sediment sampling, and fish toxics monitoring. Water column conditions were generally found to be non-supportive of the uses designated for this segment, although individual constituents varied with respect to their meeting water quality standards. Like the sediment quality exhibited in the upper Neponset River, severe degradation from elevated concentrations of heavy metals, and sediment toxicity resulted in the overall use support determination of "non-support".

While the Fowl Meadow wetland buffers much of the river from the impacts of development in this segment, the majority of this segment is unaffected by development, potential sources of pollution include storm water runoff from the major roads and highways which pass over the river in the Fowl Meadow, activities associated with the installation of new public water supply wells, and the New Neponset Valley Relief Sewer Project construction activities, which are scheduled for completion in January, 1996. Other projects being considered in this segment include the Route 128 AMTRAK/Commuter Rail Parking Lot, the Route 128 Transportation Improvement Project, the Northeast Corridor Electrification Improvement Project, and the potential realignment of the Route 128/Route 95 Interchange by the MA Highways Department.

In the lower portion of this segment the Fowl Meadow no longer provides a buffer for the river from the impact of urban runoff from the Boston and Milton areas. In 1992, the USEPA implemented the first phase of NPDES requirements for storm water discharges. Included in the first phase was the requirement that municipalities with populations of 100,000 and more, serviced by a separate storm/sanitary sewer system apply for an NPDES Storm Water Permit; in Massachusetts, the cities of Boston and Worcester are required to apply for a storm water permit. The Boston Water and Sewer Commission (BWSC) permit application is currently being reviewed, and in the interim, Boston has implemented a Storm Water Management Program, which should have a positive impact on the water quality of both segment 2 and segment 3 of the Neponset River.

Municipal water withdrawals in this segment of the river include the towns of Canton, and Dedham/Westwood suppliers which averaged approximately 5.51 MGD in 1994. Unreported withdrawals by the Spring Valley Country Club also occurred in this subwatershed. Discharges of wastewater in this segment include: Factory Mutual Engineering discharges of fire fighting safety equipment testing water (extremely small volumes); remediated groundwater discharges from several service stations and Shield Packaging Company; and truck wash water from the James Devaney Oil Company. Impacts from these discharges are believed to be negligible. There is concern about the potential for pollution from the James G. Grant Recycling Facility in Hyde Park. While the company has no NPDES permit, and has not applied for a storm water permit, the nature of the operation, combined with its proximity to the Neponset River, are of concern.

MEADOW BROOK: The Meadow Brook drainage system consists primarily of culverted streams which now underlie the town of Norwood's municipal sewer and storm drain systems. Leaking sewer lines, due to broken and/or crushed pipes, cause very severe impacts on the water quality of this tributary which surfaces approximately 1/4 river mile upstream from the confluence with the mainstem Neponset River. Fecal coliform levels as high as 240,000 colony forming units (cfu)/100 ml were measured. The town of Norwood Department of Public Works (DPW) responded to the discovery of the contamination problems through a series of efforts which included dye testing/TV camera monitoring combined with bacteriological monitoring by state and federal agencies, and the repair of eight sites which were identified as contributing to the bacterial contamination. Based on their efforts, the fecal coliform counts have been reduced to approximately 40,000 cfu/100 ml, a major improvement over the original condition, but still severely contaminated. The remaining drainage system has been tested by the DPW and two major problems have been identified. The MWRA has awarded Norwood money to remediate the major sources of contamination which still exist. The town of Norwood needs to accept the funding at a special town meeting in October, and the design for repair of all known sewer breaks needs to be completed. Pending the completion of these actions, construction is anticipated to begin in the spring of 1996.

In addition to fecal coliform bacteria, nutrients and heavy metals are discharged through Meadow Brook into the Neponset River. These pollutant problems are not the only cause of non-support in this tributary system. The previous owners of Grant Gear, Norwood (now a federal Superfund Site) were also responsible for contamination of subsoils, groundwater and ultimately the sediments of the lower section of Meadow Brook. PCBs have been documented in the sediments of Meadow Brook, as well as just below the confluence of Meadow Brook in the Neponset River (24 parts per million or ppm), although the extent and distribution of PCBs in the mainstem Neponset River is undetermined at this time.

TRAPHOLE BROOK: The Traphole Brook subwatershed drains portions of Sharon, Walpole, and Norwood, and is characterized by loose, easily eroded subsoils which limit habitat quality. However, this tributary was found to support a self-sustaining cold watery fishery, and the water temperature was the coolest documented in the basin. While these monitoring results look promising, other indications that water quality conditions may be threatened (high levels of chloride, and occasional elevated fecal coliform bacteria levels) were indicative of septic system failures. The bloom of the alga, *Mougeotia* sp., is also indicative of potential water quality problems.

It is strongly recommended that homeowners in this subwatershed follow a good septic system maintenance schedule, and, where called for, upgrade failing or inadequate systems. In addition, the presence of small man-made backyard ponds, combined with the presence of carp in this tributary, threaten the cold-water fishery in Traphole Brook. Outreach efforts aimed at educating citizens about the dangers of introducing exotic species into a waterbody could help to alleviate this kind of a threat in the future.

UNNAMED TRIBUTARY NEAR EDGE HILL ROAD, SHARON: This small tributary system joins the Neponset mainstem just downstream from Route I-95 in Canton. The majority of the watershed lies within the corporate boundary of Sharon. The limited monitoring of this tributary revealed full use-support for primary and secondary contact recreation.

PURGATORY BROOK: This subwatershed consists of Plantingfield and Purgatory brooks which join the mainstem Neponset River in the Fowl Meadow, just downstream from the Norwood Airport. During most of the field sampling season, Plantingfield Brook was dry. Elevated fecal coliform counts in Purgatory Brook impair its primary contact recreational use (partial support). The Lost Brook Golf Club in Norwood withdrew an average of 0.02 MGD in 1994 to irrigate its grounds. There are no NPDES discharges in this subwatershed, but several applications for storm water discharge permits have been received.

PECUNIT BROOK: Water quality sampling of this small subwatershed was limited; however, the system appears to be supporting both primary and secondary contact recreation, and dissolved oxygen concentrations were sufficient to support aquatic life. The Blue Hill Country Club in Canton withdrew an average of 0.23 MGD of water from this subwatershed in 1994. There are no NPDES permitted discharges in this subwatershed.

PONKAPOAG BROOK: Ponkapoag Pond (designated as part of the Fowl Meadow/Ponkapoag Pond ACEC - for its quaking bogs) is the headwaters of Ponkapoag Brook. The MDC Ponkapoag Golf Course is registered to withdraw 0.17 MGD of water from the pond to irrigate its golf course. Actual withdrawal volumes have not been reported. An infestation of the non-native aquatic plant, *Myriophyllum spicatum* or Eurasian milfoil, was found to have a deleterious impact on the beneficial use of this pond.

Water quality sampling of Ponkapoag Brook was limited; however, elevated fecal coliform levels in the lower portion of the subwatershed result in a partial-support determination for primary contact recreation. Secondary contact recreation, however, is fully-supported.

The Indian Line Farm hazardous waste (or 21E) site also lies within the Ponkapoag Brook subwatershed as well as the ACEC. This site was listed by DEP as a confirmed priority release site (#3-0283) under the State Superfund Law (M.G.L. Chapter 21E, enacted in 1983 and amended in July 1992) in January of 1987, due to a PCB release to the soil. The site is now being addressed under the federal Superfund program.

MOTHER BROOK: This tributary to the Neponset River, the first canal constructed in the United States, is capable of diverting streamflow from the Charles River Basin into the Neponset River Basin. The diversion is operated by the MDC which currently regulates the flow two seasons per year (spring and fall) and during all major storm events to prevent flooding in the lower Charles River Basin.

Water quality conditions documented in Mother Brook were poor, with elevated fecal coliform bacteria, and low dissolved oxygen concentration. Illegal discharges to storm drains have been identified in the brook, and are currently being eliminated by the Boston Water and Sewer Commission. A DEP Environmental Strike Force case was filed against the L.E. Mason Company, a 200-employee manufacturing firm caught discharging trichloroethylene (TCE) to Mother Brook. The company agreed to pay a $250,000 penalty, and to eliminate the use of TCE by converting to a water-based degreasing system. The company has also installed a closed-loop recirculating (cooling) system, thereby eliminating their water withdrawal from the Mother Brook subwatershed as well as their need for an NPDES permit.

PINE TREE BROOK: The Pine Tree Brook subwatershed begins at the outlet of the Blue Hills Reservoir in Quincy, and includes Balster, Trout and Pine Tree brooks which empty into the Neponset River just upstream from the Baker Dam in Milton. Water quality sampling in Pine Tree Brook revealed elevated levels of fecal coliform bacteria resulting in "non-support" for primary contact recreation, and only partial support of secondary contact recreational uses. The town of Milton maintains three sewerage pumping stations which tend to overflow during periods of high groundwater and/or storm events, particularly in the spring. Basement sump pump tie-ins are known to contribute inflow to the sewer lines in Milton, resulting in the exceedance of the line capacity, and subsequent sewer overflows to the brook. Elimination of these bypass overflows is strongly recommended.

In addition to the pollution problem described above, the aesthetic quality of the brook also suffers from cultural pollution. The trash and broken glass in Pine Tree Brook degrade the overall aesthetic quality and limit the quality of the available stream habitat. The biological monitoring conducted in Pine Tree Brook revealed conditions which were found not to support the aquatic life use.

Non-native aquatic plants in this subwatershed were documented in Blue Hills Reservoir, and in Russell, Popes, and Turners ponds. An infestation of curly leaf pondweed, *Potamogeton crispus*, was observed in Russell Pond. The presence of non-native plants in these waterbodies impair their designated uses. Pine Tree Pond was not assessed.

SEGMENT 3. NEPONSET RIVER ESTUARY (3.6 river miles)
Baker Dam, Milton/Boston corporate boundary to corporate boundary Quincy/Boston.

Segment Summary:
Segment 3 comprises the estuarine portion of the Neponset River, below Baker Dam at the Milton/Boston corporate boundary This segment has also been designated as an ACEC, and currently a management plan is being developed for this area. The Neponset River is tidally-influenced for three miles from Baker Dam to its confluence with Dorchester Bay. The estuarine wetlands in this area provide flood protection and buffer the upland from coastal storms.

This segment was assessed by the MWRA, and the reader is referred to the 1994 State of the Harbor Report for the complete resource assessment information. During the weeks of 10 July through 30 July, 1994, the MWRA collected surface grab samples in segment 3, and at one station located above Baker Dam, as part of their on-going harbor studies. MWRA provided their data to the Neponset team in order that the use support status of the estuary could be included in this report. The sample analyses included temperature, dissolved oxygen, conductivity, salinity, Secchi disc readings, and fecal coliform and enterococcus bacteria.

Water quality problems in this segment include bacteria levels which were determined to be non-supportive of restricted shellfishing and primary and secondary contact recreation. It should be noted that during the MWRA survey the highest fecal coliform counts were found at the station above Baker Dam, further support of the MWRA position that much of the bacterial problem in the Neponset estuary is due to problems in the upstream, freshwater segments. However, failing septic systems in the Forbes Hill section of Milton, as well as other elevated fecal coliform counts (Unquity Brook/Gulliver's Creek) also contribute to the water quality problems in the Neponset River Estuary. Dissolved oxygen concentrations in the estuary generally were determined to partially support the aquatic life use. The high bacteria levels and low DO concentrations in segment 3 resulted in the overall use support determination of "non-support".

The cities of Boston and Quincy comprise the lower porion of the Neponset River Basin. These communities are primarily urban-residential, with a wide variety of industrial, commercial and service-oriented interests. Both Boston and Quincy are serviced by the MWRA sanitary sewer system. The NPDES discharges located in segment 3 are: the US Army National Guard Armory in Dorchester, which discharges small quantities of truck wash water, and the Boston Water and Sewer Commission combined sewer overflows, BOS090, BOS093 and BOS095. The MWRA Final CSO Conceptual Plan and System Master Plan calls for complete sewer line separation in the contributing areas, resulting in elimination of all CSO discharges. In addition to the elimination of CSOs in segment 3, the BWSC NPDES Storm Water Permit and Storm Water Management Program, as described above, should have a positive impact on the water quality in this segment.

UNQUITY BROOK/GULLIVERS CREEK: This small subwatershed, tributary to the Neponset River Estuary, exhibits the same water quality problems as the Pine Tree Brook subwatershed. These include high fecal coliform counts and three additional pump station overflows currently permitted for the town of Milton.

SEGMENT 4. EAST BRANCH NEPONSET RIVER (2.6 river miles)
Outlet of Forge Pond, Canton to the confluence with the mainstem Neponset River.

Segment Summary: The East Branch Neponset River is the major tributary to the mainstem Neponset River, and therefore strongly influences downstream water quality conditions. The contributing watersheds to the East Branch Neponset River are comprised of tributary systems containing several lakes and impoundments.

The resource assessment efforts in the East Branch Neponset River revealed severely degraded conditions. While primary and secondary contact recreational activities are partially and fully supported, respectively, the aquatic life use-support determination was "non-support". Water temperature of this tributary was extremely high (31°C), posing a significant threat to the biota in both the East Branch and in the Neponset River downstream from the confluence. Biological monitoring revealed significant impacts, and the sediment quality conditions were as severely contaminated as those documented in Neponset Reservoir and Crackrock Pond.

The Plymouth Rubber Company utilizes the East Branch Neponset River as their source and discharge point for cooling water, both of which averaged approximately 2.42 MGD in 1994. The impacts of this discharge, as well as storm water runoff, needs further investigation.

MASSAPOAG BROOK: From its headwaters in Massapoag Lake - the largest lake in the Neponset River Watershed - Massapoag Brook flows through several small impoundments along its course to Forge Pond in Canton. The majority of this subwatershed lies in Sharon, which is served entirely by on-site septic systems. Primary and secondary contact recreational uses were fully supported in this system. However, the biological monitoring effort revealed a stressed biological community, and therefore the aquatic life use-support determination was found to be "non-support". Non-native aquatic vegetation in Massapoag Lake, and Billings St./East St. Pond, as well as the isolated infestation of pepperwort (*Marsilea quadrifoli*) in Mann's Pond, impair the designated uses of these waterbodies.

STEEP HILL BROOK: This small subwatershed is the source of the municipal water supply for the town of Stoughton. In 1994, the Stoughton Water Department withdrew an average of 1.17 MGD from wells in the vicinity of Pinewood, Muddy and Town ponds. Each of these ponds, as well as Bolivar and Farrington ponds, was infested with non-native and/or nuisance aquatic vegetation, which impair their designated uses.

BEAVER MEADOW BROOK: This subwatershed is the source of the municipal water supply for the Sharon Water Division and the A.A. Will Material Corporation in Stoughton. The combined withdrawal in 1994 averaged 0.83 MGD. Elevated fecal coliform bacteria levels in this segment led to its non-support of primary contact recreation and partial support of secondary contact recreation.

PEQUID BROOK: The Pequid Brook subwatershed in Canton, which includes Reservoir Pond, discharges into Forge Pond. The assessment of this subwatershed was limited. Monitoring results indicated that, while the primary contact recreational use of the brook is partially supported, secondary contact recreation is fully supported. Non-native aquatic vegetation impair the designated uses of Reservoir Pond.

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SECTION 1: INTRODUCTION

The Neponset River Watershed Project is a collaborative effort between state and federal environmental agencies, the citizens, groups, businesses and industries in the watershed, with a mission to improve water quality conditions, and to provide a framework under which the restoration and/or the protection of the basin's natural resources can be achieved.

Under the Executive Office of Environmental Affairs (EOEA), the Massachusetts Department of Environmental Protection's Office of Watershed Management (OWM) implemented a team approach to carry out the state's Clean Water Strategy in the Neponset River Basin. OWM's Neponset team is represented by a member from each of the four core programs (resource assessment, grants, water withdrawal permitting, and surface water discharge permitting). In addition to OWM's core team, active team participation for the Neponset River Watershed Project also extends to staff from the Department of Environmental Management's (DEM) Office of Water Resources, Department of Fisheries, Wildlife and Environmental Law Enforcement (DFWELE) Riverways Program, and EOEA. Federal support is also integral to the team effort and is provided by the Environmental Protection Agency's (EPA) Region I staff. The Neponset River Watershed Association (NepRWA), local town officials, and the citizenry in the Neponset River Basin also provided insight and input into the overall project.

Inherent in the ability to successfully implement the watershed approach, analytical capability is crucial. Field and analytical support for the Neponset River Watershed Project have been provided by staff of the Department's Division of Environmental Analysis at the Wall Experiment Station (WES), the Department of Fisheries, Wildlife, and Environmental Law Enforcement's Division of Fisheries and Wildlife Field Headquarters and Northeast District Offices, the EPA New England Regional Laboratory's Biology Section, and the United States Geological Survey's Water Resources Division. Their participation complements the efforts of the Neponset team, provides the information necessary to document water quality conditions, and provides the framework upon which remediation efforts can be defined.

This report presents the results of the sampling conducted in the Neponset River Basin between July and December 1994, and the ongoing efforts to address water quality problems in the basin. Components of the survey included:

- water and sediment quality sampling,
- stream discharge monitoring,
- biological monitoring of the periphyton, macroinvertebrates and fish communities in conjunction with an assessment of available habitat,
- fish toxics monitoring,
- synoptic surveys of the lakes and impoundments in the watershed in terms of the presence of non-native aquatic macrophytes, access and trophic status,
- a review of water withdrawal information and the five-year review of the Water Management Act (WMA) permits,
- site visits of National Pollutant Discharge Elimination System (NPDES) permittees prior to the reissuance of general and individual permits,
- an overview of projects addressing nonpoint sources of pollution, and
- an audit of the effectiveness of the newly implemented storm water program.

The results of these components of the survey will be utilized to determine the status of the designated uses of the surface waters, defined in the Massachusetts Surface Water Quality Standards (MA DEP 1995a), in the Neponset River Basin. These standards have been adopted by the Department of Environmental Protecton (DEP) to meet the objectives of the 1972 Federal Clean Water Act, which are to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.

The Massachusetts Surface Water Quality Standards (SWQS, MA DEP 1995a) designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected and prescribe the minimum water quality criteria required to sustain the designated uses. They also contain regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges.

Consistent with the National Goal Uses of "fishable and swimmable waters", the designated uses of the surface waters in the Neponset River Basin, according to the Massachusetts Surface Water Quality Standards, are Class B (freshwater) or SB (marine). These uses include the following:

- AQUATIC LIFE - suitable habitat for sustaining a native, naturally diverse, community of aquatic flora and fauna. Three subclasses of aquatic life are also designated in the standards; Cold Water Fishery - capable of sustaining a year-round population of cold water aquatic life such as trout, Warm Water Fishery - waters which are not capable of sustaining a year-round population of cold water aquatic life, and Marine Fishery - suitable for sustaining marine flora and fauna.

- FISH CONSUMPTION - pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption.

- PRIMARY CONTACT RECREATION - suitable for any recreation or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.

- SECONDARY CONTACT RECREATION - suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities.

- AESTHETICS - all surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

- AGRICULTURAL AND INDUSTRIAL - suitable for irrigation or other agricultural process water and for compatible industrial cooling and process water.

- SHELLFISH HARVESTING (in SB segments) - in approved areas, shellfish harvested with depuration (Restricted Shellfish Areas) shall be suitable for consumption.

Consistent with the designated use support determinations, the objectives of the 1994 Neponset River Basin survey were to:

1. update the Neponset River system database to reflect current water quality conditions and provide information concerning toxic pollutants in both the water column, sediment and biota at selected stations;

2. identify sources of bacterial contamination in the basin;

3. assess the biological integrity of the Neponset River and selected tributaries using the periphyton, macroinvertebrate, and fish community assemblages supplemented with an assessment of available habitat and measurements of streamflow;

4. update the list of water withdrawals in the basin; conduct the five-year review of the Water Management Act permits;

5. update the list of current NPDES discharges in the basin; conduct site inspections and provide information necessary to issue/reissue NPDES and general permits by 30 September 1996, and address the application for the new Hollingsworth & Vose Company discharge to the Neponset River;

6. identify priority nonpoint sources of pollution in the basin; work with communities, public interest groups, NepRWA, and others to develop remediation plans eligible for funding under the DEP's nonpoint source (s.319) program;

7. audit the current list of storm water permit applicants, conduct site visits and determine effectiveness of existing best management practices (BMPs) and pollution prevention plans (PPPs) aimed at reducing impacts from storm water discharges; conduct outreach/education seminars to target audiences if deemed necessary; and

8. integrate the components of the sampling plan into an overall assessment of the aquatic resources in the Neponset watershed; determine the designated use support status; and provide recommendations for a water quality management plan.

The report has been divided into nine sections. The executive summary provides an overall assessment of the condition of the Neponset River Watershed. Recommendations from the resource assessment report will be used to develop a water quality management plan for the Neponset River Basin.

NEPONSET RIVER BASIN DESCRIPTION*

The Neponset River Basin is located in eastern Massachusetts, within the metropolitan Boston area (see Figure 1.1). The basin encompasses portions of Boston, Quincy, Milton, Dedham, Westwood, Dover, Medfield, Walpole, Foxborough, Sharon, Stoughton, and Randolph, while the entire towns of Canton and Norwood are located within its boundaries. From the outlet of the Neponset Reservoir to its mouth in Dorchester Bay the Neponset River falls approximately 270 feet in elevation. The Neponset River is 29.5 miles in length and drains 117 square miles. The river is impounded by 12 dams and passes through several mills and private reservoirs. The basin is bordered on the north and west by the Charles River Basin, on the east by the South Shore coastal drainage system and on the south by the Taunton River Basin. The Neponset River subwatershed boundaries are illustrated in Figure 1.1.

The headwaters of the Neponset River originate in Foxborough at Neponset Reservoir, a manmade impoundment of 272 acres. Immediately downstream and easterly is Crackrock Pond. From Crackrock Pond, the river flows north, and is culverted under portions of the Foxboro Park Raceway before crossing into Walpole.

As it enters the town of Walpole, the river is impounded first at Smith Pond and then at Clark Pond and Ruckaduck Pond. From Ruckaduck Pond, the Neponset meanders northerly for approximately 2.5 miles through Cedar Swamp before flowing into Upper Blackburn Pond. Just above Upper Blackburn Pond the river is joined by School Meadow Brook. This brook drains portions of Sharon, Foxborough and Walpole. The Neponset continues northward through Walpole center, adding Mine and Diamond Brooks before entering Stetson Pond. Mine Brook drains portions of the towns of Dover, Medfield and Walpole. Diamond Brook is located primarily in Walpole, with a small portion of its drainage area in Sharon. Heading northeasterly, the Neponset empties into Plimpton and Bird Ponds. Both of these impoundments were created by the outlet structure at Bird Pond. Just below Bird Pond is the Hollingsworth and Vose Pond at Washington Street in Walpole.

[*Adapted from: Neponset River Basin - Flood Plain Management Study - Reconnaissance Report (Department of the Army, New England Division, Corps of Engineers, 1979)].

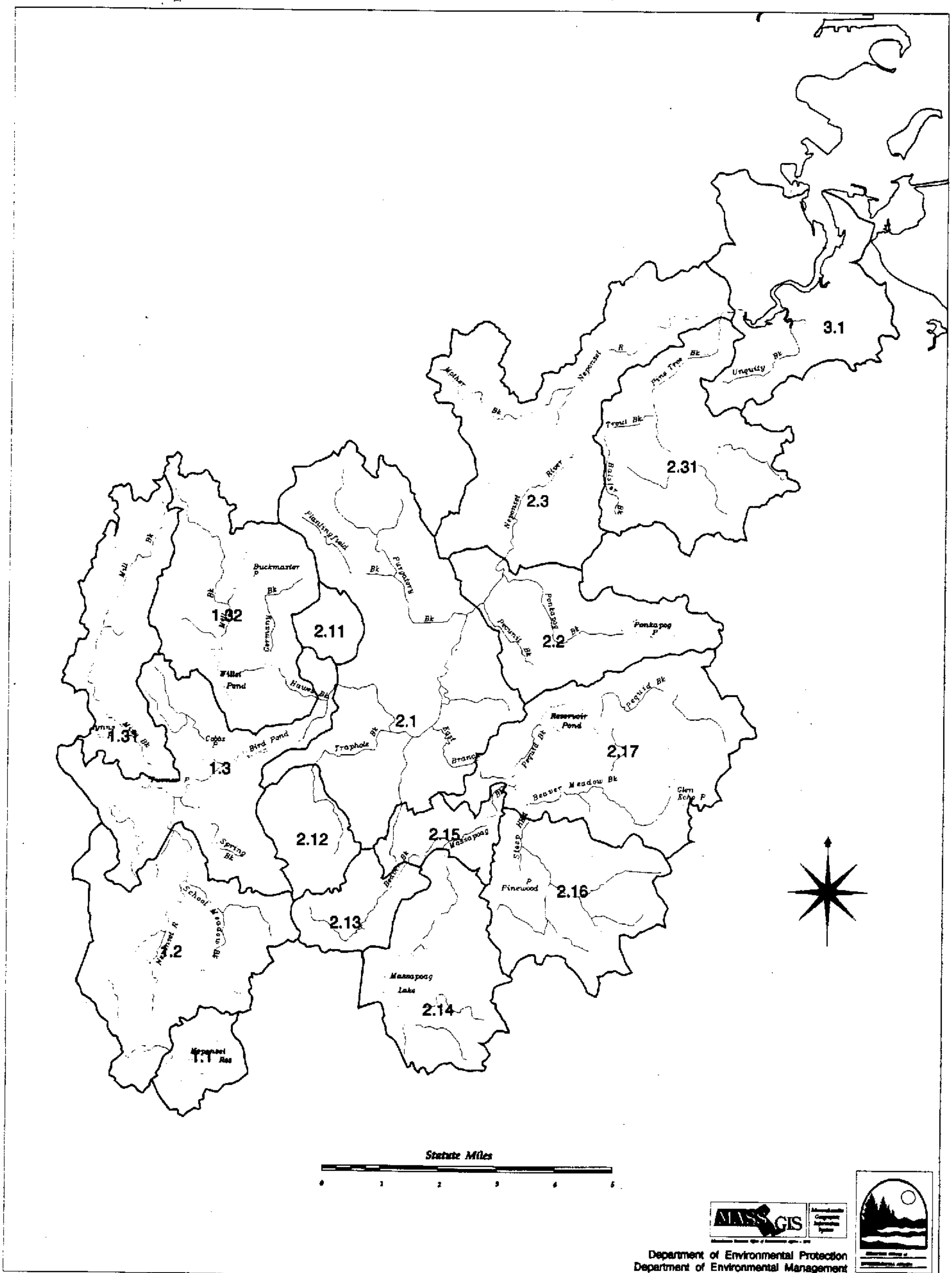


Fig. 1.1. 1994 NEPONSET RIVER BASIN SURVEY. Subwatershed boundaries in the Neponset River Basin.

From the outlet of the Hollingsworth and Vose impoundment, the Neponset River flows northeasterly for about one mile into Norwood, where it is met by Hawes Brook. The Hawes Brook system drains portions of Dover, Westwood and Walpole via a number of small ponds and tributaries to Willet Pond. Tributaries to Hawes Brook include Mill, Bubbling and Germany brooks. Like the Neponset Reservoir, Willet Pond is a large manmade impoundment. At the United States Geological Survey (USGS) gaging station at Pleasant Street, Norwood, the river turns eastward. Meadow Brook joins the Neponset River downstream from the USGS gaging station. Meadow Brook starts at the Norwood/Westwood town line and is culverted for almost its entire length, surfacing for a brief stretch before its confluence with the Neponset River. The Neponset River then turns south, passing beneath Route 1, before entering Fowl Meadow, a freshwater wetland area of approximately 2,360 acres.

In the Neponset River Basin, wetlands are an important feature that provide natural valley storage. Wetlands reduce the potential of flood damage by retaining flood waters and releasing them over an extended period of time, lowering peak runoff levels. Approximately 13% of land area in the basin is wetlands, and most of these wetlands are classified or zoned as floodplain. Wetlands are also important for fish and wildlife habitat, water quality enhancement and preservation, groundwater aquifer protection, recreational use, open space, buffer zones, and maintenance of streamflow during periods of low flow.

In 1992, the Fowl Meadow area and Ponkapoag Bog were designated by the Secretary of the Executive Office of Environmental Affairs as Areas of Critical Environmental Concern (ACEC). The purpose of the ACEC designation is to focus attention on the environmental sensitivity of the area, and to provide a greater degree of environmental scrutiny for projects located within the ACEC.

Traphole Brook, draining portions of Sharon, Walpole and Norwood, is the first tributary to join the Neponset River during its nine mile course through Fowl Meadow. The river enters Canton and flows northeasterly from Route I-95. At river mile 15.8, the East Branch Neponset River (also known as the Canton River) joins the mainstem Neponset River. The East Branch starts in the center of Canton at Forge Pond and has a drainage area of approximately 31.2 square miles. The East Branch drainage system is characterized by numerous small brooks and streams passing through swampy areas, including Massapoag, Beaver, Steep Hill, Beaver Meadow and Pequid Brooks.

The Neponset River continues in a northeasterly direction, crossing Route I-95 again, and forming the boundary between the towns of Norwood and Canton. Purgatory Brook joins the mainstem just upstream of the Norwood-Westwood-Canton corporate limit. This brook, along with its major tributary, Plantingfield Brook, drains portions of Westwood, Dedham and Norwood, and is channeled around the Norwood Municipal Airport, which is built on wetlands. Pecunit and Ponkapoag Brooks, which are located entirely within Canton, flow into the Neponset River just before the river crosses the junction of Westwood, Dedham and Canton, and Route 128.

After Route 128, the river continues to flow northeasterly acting as the boundary between Dedham and Canton. As the Neponset passes through the Hyde Park section of Boston it is joined by the Mother Brook Diversion. Mother Brook is a manmade channel that flows from the Charles River in Dedham to the Neponset River. The diversion is controlled by the Metropolitan District Commission (MDC), which currently regulates the flow twice per year, in the spring and fall. Mother Brook, the first canal constructed in the United States, began operation in 1640. Legislation adopted in 1831 provides that up to one-third of the Charles River can be diverted through Mother Brook to the Neponset River. One mile downstream from the confluence with Mother Brook, the Neponset River is impounded by the Tileston Dam, which is also controlled by the MDC.

Farther downstream, Pine Tree Brook joins the Neponset at Milton Village just before the Baker Dam. This brook drains portions of the Blue Hills Reservation in Quincy and Milton. The Neponset River is tidally-influenced for three miles from the Baker Dam to its confluence with Dorchester Bay in Boston Harbor. This section of the Neponset River was designated, on 29 March 1995, as the Neponset River Estuary Area of Critical Environmental Concern by the Secretary of Environmental Affairs. The estuarine wetlands in this area provide flood protection and buffer the upland from coastal storm damage. Unquity Brook, draining a small area of Milton, flows into Gulliver Creek, one of a half-dozen tidal creeks sectioning the estuary.

There are three USGS flow gaging stations located in the Neponset River Basin. One is located in Norwood on the mainstem of the Neponset River (gage 01105000). This gage has a drainage area of 34.7 square miles. Over a period of 46 years, the average recorded flow at this gage is calculated as 54.4 cubic feet per second (cfs), with a maximum flow of 1,490 cfs, a minimum of 1.4 cfs, and a 7Q10 (seven day-ten year low flow) of 4.5 cfs. Another gage is located on the East Branch Neponset River in Canton (gage 01105500). The drainage area for this gage is 27.2 square miles, with an average recorded flow of 51.5 cfs over 33 years of record and a maximum flow of 1,790 cfs, a minimum flow of 0.60 cfs, and a 7Q10 of 3.6 cfs. Another gage measures the flow in Mother Brook in Dedham (gage 01104000). Since Mother Brook is a diversion from the Charles River, there is no drainage area and thus no 7Q10 flow associated with this gage. Over 54 years of operation, the average discharge at Mother Brook was 78.4 cfs, with a range of 1,040 cfs to 0 cfs (no flow). Since streamflow has been identified as a critical issue in the Neponset River Basin (due to the net loss of water through the Massachusetts Water Resource Authority (MWRA) sewer system, MA DEM 1991) estimates of monthly streamflow at 14 locations (water quality and/or biological monitoring station locations) were generated using a drainage area ratio methodology, with 7Q10 flow estimates ranging from 0 to 8.8 cfs (Appendix B, Table 1.1B).

There are 64 lakes and ponds in the Neponset River watershed, which have a total area of 1,935 acres. The largest lake in the basin is Massapoag Lake in Sharon, which is 353 acres.

Several types of communities lie in the Neponset Watershed, ranging from urban-residential Boston to the rural-residential community of Sharon. Because of its location, the Neponset Watershed has always been, and will continue to be, impacted by rapid growth due to urbanization.

Boston, Quincy, Dedham and Milton comprise the lower basin. These communities are primarily urbanized and contain a wide variety of industrial, commercial and service-oriented interests. The middle portion of the basin - Westwood, Norwood and Canton - has a variety of industry. Development in Westwood and Norwood is heavy along Routes 1 and 1A, including both manufacturing and wholesale/retail trade. There is a concentration of industrial/commercial usage in Canton along Route 138 and the East Branch Neponset River. The Stoughton/Randolph drainage areas are comprised of residential and commercial development. Most of the industrial development in the upper watershed is in Walpole, concentrated along the Routes 1-1A corridor. The area of Foxborough located within the watershed is primarily residential, however, two facilities, the Foxboro Company and the Foxborough State Hospital, discharge wastewater to the Neponset Reservoir and Crackrock Pond, respectively. The other towns in the basin, Dover, Medfield and Sharon, are largely residential in character.

A summary of the station locations sampled during the 1994 survey and the types of samples collected at each station are presented in Table 1.1. Specific sampling information is contained in the next 8 sections of this report.

TABLE 1.1. 1994 NEPONSET RIVER BASIN SURVEY. Monitoring station locations in the Neponset River Basin and sampling conducted at each station including bacteriological monitoring (Bac), water quality sampling (WQ), stream discharge measurements (Q), sediment quality sampling (S), biological monitoring (B), and fish toxics monitoring (FT).

STATION[1]	LOCATION[1]	SAMPLE TYPE
NE01	Neponset Reservoir, Foxborough	S
NE02	Neponset River, outlet of Crackrock Pond, Foxborough	WQ, S
NE02A	Neponset River, Route 1, Foxborough	Bac
NE03	Neponset River, Summer Street, Walpole	Bac
NE04	Neponset River, South Street, Walpole	WQ, B
2B02	Mine Brook, Mill Pond Road, Walpole	Bac
2B01	Mine Brook, Elm Street, Medfield	Bac
2B0B	Mill Brook, Route 109, Medfield	B
6B01	Spring Brook, Off Route 27, near playground, Walpole	Bac
6B02	Spring Brook, Washington Street, Walpole	Bac
NE05	Neponset River, Bird Pond, East Walpole	S
NE09	Hawes Brook, Washington Street, Norwood	WQ, Q, B
4B01	Germany Brook, Inlet Ellis Pond, Nichol Street, Norwood	Bac
1B02	Mill Brook, inlet Pettee Pond off Clearwater Drive, Brook Street, Westwood, and Willet Pond, Westwood/Norwood/Walpole	Bac, FT

TABLE 1.1 (cont.)

STATION[1]	LOCATION[1]	SAMPLE TYPE
NE10	Neponset River, Pleasant Street Bridge, Norwood	WQ, S, B
1B01	Meadow Brook, off Meadow Brook Road/Pleasant Street, Norwood	WQ, Q
NE11	Neponset River, Fowl Meadow ACEC, Neponset Street, Norwood	S, FT
5B01	Traphole Brook, Cooney Street, Walpole	WQ, B
12B01	unnamed Traphole trib., Union Street & Edge Hill Road, Sharon	Bac
13B01	unnamed Traphole trib., Union Street, Walpole	Bac
5B0B	Traphole Brook, High Plain Street, Sharon	B
11B01	unnamed Neponset trib., Edge Hill Road, Sharon	Bac
NE12	East Branch Neponset River, Neponset Street, Canton	WQ, S, B
9B02	Massapoag Brook, Walnut Street off Washington Street, Canton	Bac
10B01	Beaver Brook, Upland Road, Sharon	Bac
9B0B	Massapoag Brook, Deb Sampson Street, Sharon	B
9B01	Massapoag Brook, outlet of Massapoag Lake, Sharon (Cedar, East & Massapoag Streets)	Bac
7B02	Pequid Brook, Sherman Street, Canton	Bac

TABLE 1.1 (cont.)

STATION[1]	LOCATION[1]	SAMPLE TYPE
7B01	Pequid Brook, York Street, Canton	Bac
8B02	Beaver Meadow Brook, Pine Street, Canton	Bac
8B01	Beaver Meadow Brook, Route 138, Canton	Bac
3B01	Purgatory Brook, Route 1 near Everett Street, Norwood	Bac
NE12A*	Neponset River, Dedham Street Bridge, Canton	WQ, Q
18B01	Pecunit Brook, Elm Street, Canton	Bac
17B02	Ponkapoag Brook, Elm Street, Canton	Bac
17B01	Ponkapoag Brook, Washington Street, Canton	Bac
NE13	Neponset River, Fowl Meadow ACEC, Green Lodge Street, Norwood	S
16B02*	Mother Brook, Hyde Park Avenue, Hyde Park	Bac
16B01	Mother Brook, Washington Street, Dedham	Bac
NE14	Neponset River, Fowl Meadow ACEC, upstream of Truman Highway, Hyde Park/Milton	S
14B04	Pine Tree Brook, Central Avenue, Milton Village	WQ
14B03B	Pine Tree Brook, Ruggles Lane/School Street, Milton	B

TABLE 1.1 (cont.)

STATION[1]	LOCATION[1]	SAMPLE TYPE
14B03	Pine Tree Brook, Central Avenue, Milton	Bac
14B02P	pipe discharging to Pine Tree Brook, Blue Hills Parkway, Milton	Bac
14B02	Pine Tree Brook, Blue Hills Parkway, Milton	Bac
14B01	Pine Tree Brook, Unquity Road & Harland Street, Milton	Bac
NE16*	Neponset River, Baker Dam, Milton/Boston	WQ, S, Q
15B04	Gulliver Creek, Christopher Ave, Milton	Bac
15B03	Unquity Brook, Adams Street, Milton	Bac
15B02	Unquity Brook, Brook Road, Milton	Bac
15B01	Unquity Brook, Gun Hill Street Off Randolph Avenue, Milton	Bac

[1] stations and locations are ordered according to stream hierarchy and classification system (Halliwell et al. 1982) where tributaries are indented under their main stem stations.

* - WQ sample taken with bucket

Conventional pollution problems in the Neponset River drainage system have been documented by the DEP since the early 1970s. Low dissolved oxygen (DO), high fecal coliform counts, total solids, biochemical oxygen demand (BOD), ammonia, nitrate, and phosphorus concentrations have all contributed to the degraded water quality of the Neponset River (MA DEP 1973a, 1973b, 1978, and 1987).

Major efforts are currently underway by the MWRA to expand and repair the sewer system which conveys 70% of the wastewater generated within the basin. This project, known as the New Neponset Valley Relief Sewer, is scheduled for completion in January 1996, and will alleviate hydraulic overloads in this sewer system.

This report will serve as a reference to the conditions of the Neponset River prior to the completion of the New Neponset Valley Relief Sewer project. The MWRA is also eliminating the Combined Sewer Overflows (CSOs) which discharge at two permitted locations in the Neponset River estuary. The sewer separation will be implemented by the Boston Water and Sewer Commission. The tentative schedule for this project includes the completion of a project design by January 1996 with implementation of sewer separation completed sometime in 1998.

Concurrently, the results of the 1994 sampling have been utilized, as they have become available, to initiate several remedial actions. This type of action is a result of the watershed project--a vested interest by the citizens, regulatees and regulators to improve the condition of the natural resources in the Neponset River Basin.

SECTION 2: WATER CHEMISTRY

INTRODUCTION

A typical assessment of water quality begins with a characterization of two types of pollutants in the water column: conventional and toxic. The Massachusetts Surface Water Quality Standards (MA DEP 1995a) were promulgated to protect the surface waters of the Commonwealth from the impacts of both conventional and toxic pollutants. Under these standards, the Neponset River and its tributaries are designated Class B warm water fishery from the headwaters at Neponset Reservoir to Baker Dam (or Milton Lower Falls Dam) at the Milton/Boston line, and Class SB in the estuary portion of the basin below Baker Dam. Class B and SB waterbodies are suitable for supporting fish and other aquatic life, wildlife, primary and secondary contact recreation, and must have good aesthetic quality. The water quality criteria, designed to protect these designated uses, are specified in the standards.

Water chemistry data collected during the 1994 Neponset River Basin Survey were compared to the Class B standards (MA DEP 1995a). In addition to conventional pollutants, the revised standards (MA DEP 1995a) have adopted EPA-recommended water quality criteria for toxic pollutants. Together these criteria were used to determine whether or not the Neponset River system was supporting, at the time of the surveys, its designated uses for aquatic life, primary and secondary contact recreation and aesthetics as defined in Table 2.1. The use support determinations are summarized below in the Discussion subsection.

Conventional pollutants include such variables as oxygen demand, solids, nutrients, and bacteria. Waters which are adversely impacted by conventional pollutants exhibit problems such as oxygen depletion, high turbidity and excessive algal growth, and tend to have poor aesthetic qualities.

The dissolved oxygen content of a stream refers to the amount of uncombined oxygen held in solution which is available to aquatic organisms for respiration. The solubility of oxygen is dependent upon both atmospheric partial pressure and water temperature, and can be expressed in terms of percent saturation. The minimum water quality criteria for a Class B warm water fishery is 5.0 mg/l (milligrams per liter) DO and 60% saturation. In addition, surface waters with percent saturation of 100% to 110% would be considered threatened, while waters with percent saturation of greater than 110% would be considered impaired. To protect freshwater and marine aquatic life, the total dissolved gas concentrations in water should not exceed 110% of the saturation value for gases at existing atmospheric and hydrostatic pressures (EPA 1976).

Diel fluctuations of DO are typically observed in very productive surface waters. Photosynthetic activity of autotrophs increases the DO concentration during daylight hours, often resulting in supersaturated conditions (above 100%), while DO is consumed by the respiration of both autotrophs and heterotrophs during the night (Hynes 1970) resulting in lower DO concentrations.

Water quality is also affected by solids concentrations which vary considerably in natural waters. Suspended solids can settle on the streambed resulting in the alteration of benthic habitats and fish spawning areas. In addition, solids in suspension increase turbidity and ultimately reduce light penetration which can restrict the photosynthetic activity of plants and the vision of animals (Warren 1971).

In aquatic habitats, algae and macrophytes rely on dissolved nitrogen and phosphorus compounds for growth and reproduction. Although these substances are not harmful at low concentrations, excess nutrient loadings to a water body can be detrimental.

Nitrification is a fixed sequence of reactions through which ammonia, nitrite,

TABLE 2.1. 1994 NEPONSET RIVER BASIN. Use support determinations for the Neponset River and Tributaries.

USE	SUPPORT	PARTIAL SUPPORT	NON SUPPORT
AQUATIC LIFE dissolved oxygen	>5.0 mg/l $\geq$60% to $\leq$100% saturation	4.0 to 4.9 mg/l 50% to 59% saturation 100% to 110% saturation	<4.0 mg/l <50% saturation >110% saturation
temperature	<28.3°C		>28.3°C delta T >3.6°C from mean
pH	6.0 to 8.3 SU	5.0 to 6.0 SU	<5.0 SU >9.0 SU
NH_3-N	<aquatic life criterion (0.21 mg/l conservative)		>aquatic life criterion (0.21 mg/l conservative)
toxic units*	<1.0 Criterion Unit (CU)	1.0 CU	>1.0 CU
1° CONTACT RECREATION fecal coliform bacteria	$\leq$200/100 ml	>200/100 ml or geo mean <400/100ml or less than 10% $\geq$400/100 ml	geo mean >400/100 ml or greater than 10% >400/100 ml
2° CONTACT RECREATION fecal coliform bacteria	$\leq$1000/100 ml	>1000/ 100 ml or geo mean $\leq$2000/100ml or less than 10% $\geq$2000/100 ml	geo mean >2000/100 ml or greater than 10% >2000/100 ml
AESTHETICS suspended solids	<25 mg/l	25-80 mg/l	>80 mg/l
turbidity	5 NTU (or mean)	delta 5 NTU	>5 NTU above mean
total phosphorous	0.[illegible] mg/l in flowing streams		>0.1 mg/l in flowing streams
RESTRICTED SHELLFISHING fecal coliform bacteria	median or geo mean MPN $\leq$88/100 ml nor more than 10% MPN >260/100 ml		median or geo mean MPN >88/100 ml

* defined as $\frac{\text{concentration}}{\text{criterion}}$ (listed in Appendix B, Table 2.5B)

and ultimately nitrate are produced from the oxidation of organic nitrogen by bacteria. Nitrogen compounds therefore exist in water in a variety of forms. Ammonia, the initial byproduct of the decomposition of organic nitrogen, exerts a high oxygen demand and is also toxic to many aquatic organisms. Background concentrations in natural surface and groundwater are usually less than 0.01 mg/l. Nitrates, on the other hand, generally occur in trace quantities in surface water but may attain high levels in some groundwater (Greenberg et al. 1985). Hynes (1970) notes that the main sources of nitrate in streams are rainfall and surface runoff.

In freshwater, phosphorus usually exists in smaller quantities than nitrogen, and, therefore, often becomes the nutrient which limits the primary productivity. According to Wetzel (1975), total phosphorus concentrations of most uncontaminated surface waters are between 0.01 and 0.05 mg/l.

Fecal coliform bacteria are found in the intestinal tract of warm-blooded animals and their presence in surface water is an indication of sewage contamination. For primary contact recreation (swimming), the Class B water quality standards require a geometric mean of fecal coliform equal to or less than 200 organisms per 100 ml. (milliliters); for secondary contact recreation (boating, fishing), a geometric mean of fecal coliform equal to or less than 1000 organisms per 100 milliliters is required. Where waters are approved for shellfish harvesting with depuration (Restricted Shellfish Areas), such as the Neponset estuary, Class SB fecal coliform standards are more stringent to protect this designated use. The standards for these waters require a fecal coliform median or geometric mean MPN (most probable number) equal to or less than 88 organisms per 100 milliliters.

Toxic pollutants generally have less visible effects than conventional pollutants. Although the appearance of the water column may be good, toxic contaminants such as ammonia-nitrogen, heavy metals and synthetic organics can have a negative impact on the growth and survival of organisms inhabiting the waterbody.

The standard for ammonia-nitrogen (NH_3-N) is dependent upon both pH and temperature; increases in both variables result in an increase in the concentration of unionized ammonia (the toxic fraction). In order to assess the potential for any instream toxicity due to ammonia, the ammonia-nitrogen data were compared to the conservative value of 0.21 mg/l. This value was calculated from the Ambient Water Quality Criteria for Ammonia (EPA 1985a) using both the highest pH, 8.5 standard units (SU) and temperature, 29°C measured at a full water quality sampling station (station 6B01, Spring Brook, Walpole) during the three surveys, and was used to screen the ammonia concentrations for potential criteria exceedences.

The results of metals analyses were compared to the EPA Criteria Continuous Concentration (CCC) (EPA "Goldbook" - Quality Criteria for Water, 1986a) to determine if water quality standards were being met at the times of the surveys, and if there is potential for instream metal-related toxicity to aquatic life. Since the toxicity of several of the metals has been determined by the EPA to vary with hardness, the criteria were calculated and adjusted, where appropriate, using a conservative hardness of 25 mg/l as $CaCO_3$ (as recommended in the U.S. Government Printing Office Federal Register [Vol. 57; No. 246], December 22, 1992). A hardness of 25 mg/l represents the more susceptible conditions measured during the three water quality surveys. A summary of individual metal criteria are contained in Appendix B, Table 2.5B.

Water quantity is also a significant factor affecting water quality; however, the relationship between water quality and quantity may be difficult to assess. The Massachusetts Surface Water Quality Standards (MA DEP 1995a) are designed to protect water quality conditions to the lowest flow which occurs at the frequency of once every ten years over a consecutive seven day period (7Q10). Generally, 7Q10 stream flow is exceeded 99% of the time (or Q99).

FIELD AND LABORATORY METHODS

Sampling for both conventional and toxic pollutants was conducted during the 1994 Neponset River Watershed Project to determine if the designated uses of the Neponset River and its tributaries were supported. Sampling stations and types of samples collected at each station are listed in Table 2.2; Figures 2.1 and 2.2 indicate the location of each station. Methodology for selecting sampling stations is discussed in Section 1, Introduction. It should be noted that only the freshwater portions of the basin were sampled during the 1994 synoptic water quality surveys. During the weeks of 10 July through 30 July, 1994 the Massachusetts Water Resources Authority collected surface grab samples in the estuarine portion of the Neponset River as part of their on-going harbor studies.

The MWRA collected samples from one location in the freshwater portion of the Neponset River, above Baker Dam at the Milton/Boston line, and five stations in the estuary, including: at Granite Avenue, adjacent to the combine sewer overflow, BOS095; near the Mass Transit Bridge; at the mid-point of Tenean Beach; at Commercial Point, adjacent to the combined sewer overflow, BOS090, and at the

TABLE 2.2. 1994 NEPONSET RIVER BASIN SURVEY. Location of water quality sampling stations and types of samples collected. Where, WQ = water quality samples (physico-chemical analyses, nutrients, bacteria, total metals and VOCs), DO = early morning dissolved oxygen sampling (time, temperature, dissolved oxygen), FC = fecal coliform bacteria, and Q = streamflow.

STATION	STATION LOCATION	SAMPLE TYPE
NE02	Neponset River, outlet of Crackrock Pond, Foxborough	WQ, DO
NE02A	Neponset River, Route 1, Foxborough	DO, FC
NE03	Neponset River, Summer Street, Walpole	DO, FC
NE04	Neponset River, South Street, Walpole	WQ, DO
NE05	Neponset River, West Street bridge at Kendall Company, Walpole	DO
2B02	Mine Brook, Mill Pond Road, Walpole	DO, FC
2B01	Mine Brook, Elm Street, Medfield	DO, FC
6B01	Spring Brook, Off Route 27, near playground, Walpole	WQ, DO, Q
6B02	Spring Brook, Washington Street, Walpole	DO, FC
NE07	Neponset River, Outlet Bird Pond, Washington Street, Walpole	DO
NE08	Neponset River, Footbridge below Hollingsworth and Vose, East Walpole	DO
NE09	Hawes Brook, Washington Street, Norwood	WQ, Q, DO
4B01	Germany Brook, Inlet Ellis Pond, Nichol Street, Norwood	DO, FC
1B02	Mill Brook, inlet Pettee Pond off Clearwater Drive, Brook Street, Westwood	DO, FC
NE10	Neponset River, Pleasant Street Bridge, Norwood	WQ, DO
1B01	Meadow Brook, off Meadow Brook Road/Pleasant Street, Norwood	WQ, Q, DO, FC
5B03	Traphole Brook, Sumner Street, Norwood	DO
5B01	Traphole Brook, Cooney Street, Walpole	WQ
12B01	Unnamed Traphole tributary, Union Street and Edge Hill Road, Sharon	DO, FC
13B01	Unnamed Traphole tributary, Union Street, Walpole	DO, FC
11B01	Unnamed Neponset tributary, Edge Hill Road, Sharon	DO, FC
NE12	East Branch Neponset River, Neponset Street, Canton	WQ, DO
9B02	Massapoag Brook, Walnut Street off Washington Street, Canton	DO, FC
10B01	Beaver Brook, Upland Road, Sharon	DO, FC

TABLE 2.2 *(cont.)*

STATION	STATION LOCATION	SAMPLE TYPE
9B01	Massapoag Brook, outlet of Massapoag Lake, Sharon (Cedar, East & Massapoag Streets)	DO, FC
7B02	Pequid Brook, Sherman Street, Canton	DO, FC
7B01	Pequid Brook, York Street, Canton	DO, FC
8B02	Beaver Meadow Brook, Pine Street, Canton	DO, FC
8B01	Beaver Meadow Brook, Route 138, Canton	DO, FC
3B01	Purgatory Brook, Route 1 near Everett Street, Norwood	DO, FC
NE12A*	Neponset River, Dedham Street Bridge, Canton	WQ, Q, DO
18B01	Pecunit Brook, Elm Street, Canton	DO, FC
17B02	Ponkapoag Brook, Elm Street, Canton	DO, FC
17B01	Ponkapoag Brook, Washington Street, Canton	DO, FC
NE12B	Neponset River, Green Lodge Street, Canton	DO
16B02*	Mother Brook, Hyde Park Avenue, Hyde Park	DO, FC
16B01	Mother Brook, Washington Street, Dedham	DO, FC
NE13	Neponset River, Truman Highway, Milton	DO
NE14	Neponset River, Dana Avenue, Hyde Park	DO
14B04	Pine Tree Brook, Central Avenue, Milton Village	WQ
14B03	Pine Tree Brook, Central Avenue, Milton	DO, FC
14B02	Pine Tree Brook, Blue Hills Parkway, Milton	DO, FC
14B01	Pine Tree Brook, Unquity Road and Harland Street, Milton	DO, FC
NE16*	Neponset River, downstream of Baker Dam, Adams Street, Milton/Boston line	WQ, Q, DO
15B04	Gulliver Creek, Christopher Avenue, Milton	DO, FC
15B03	Unquity Brook, Adams Street, Milton	DO, FC
15B02	Unquity Brook, Brook Road, Milton	DO, FC
15B01	Unquity Brook, Gun Hill Street Off Randolph Avenue, Milton	DO, FC

• - WQ sample taken with bucket

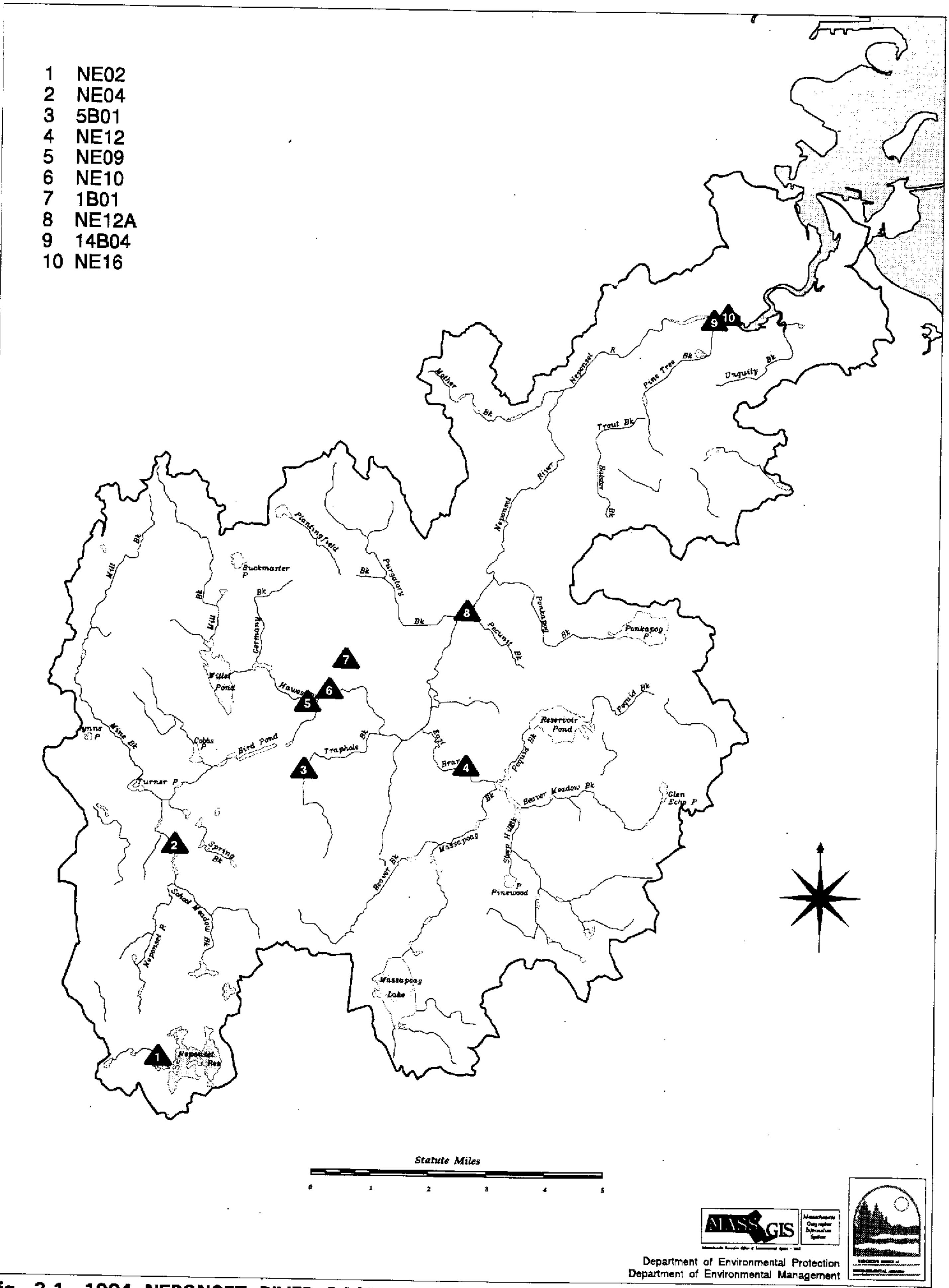


Fig. 2.1. 1994 NEPONSET RIVER BASIN SURVEY. Water quality monitoring station locations.

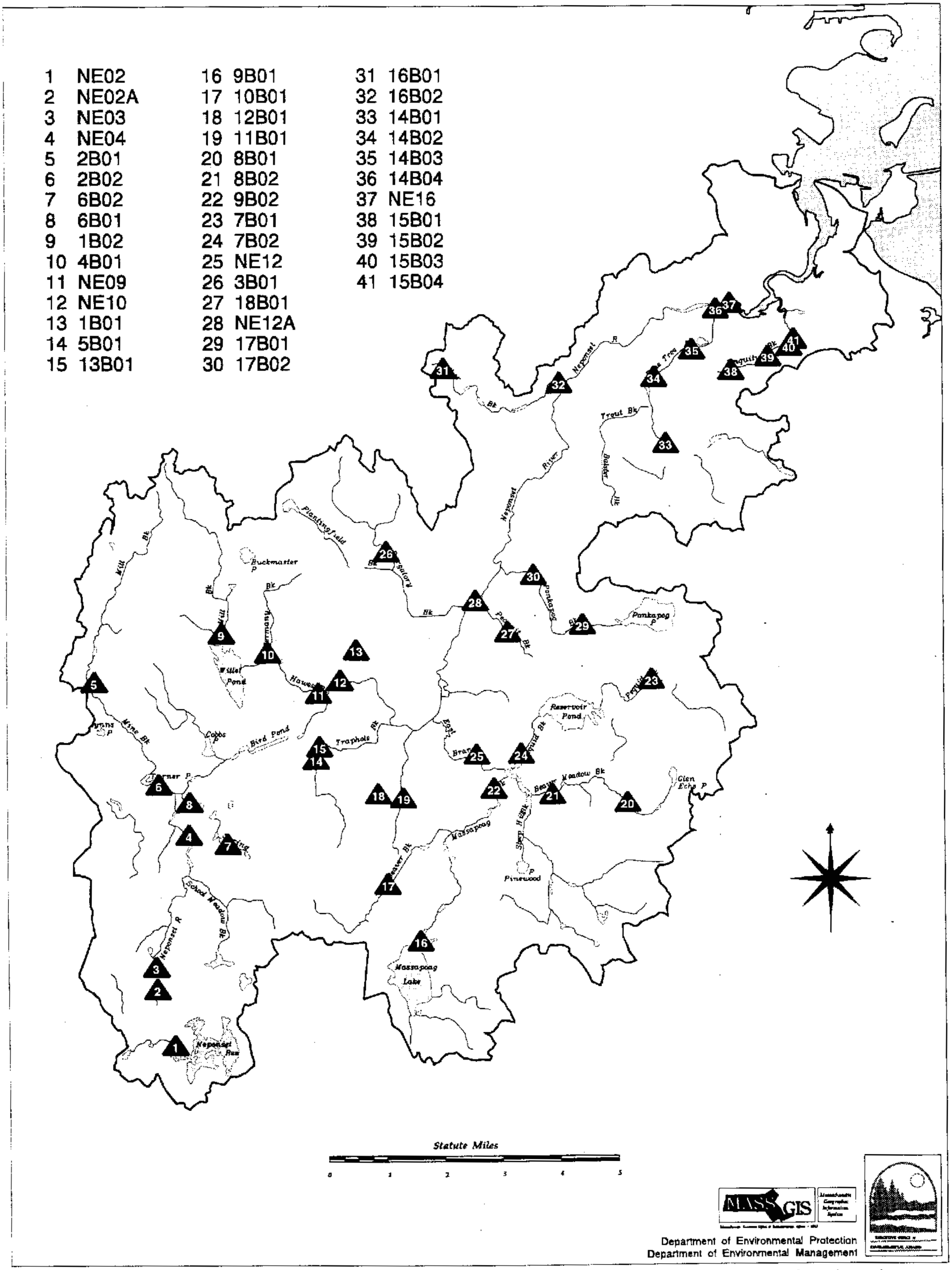


Fig. 2.2. 1994 NEPONSET RIVER BASIN SURVEY. Bacteriological monitoring station locations.

Old Colony Yacht Club in Dorchester. The sample analyses included temperature, dissolved oxygen, conductivity, salinity, Secchi disc readings, and fecal coliform and enterococcus bacteria. MWRA provided their data to the Neponset team in order that the use support status of the estuary can be included in this report. The results of the MWRA sampling also will be included in a five year (1989 - 1994) study report currently being prepared by the MWRA.

Prior to initiating water chemistry sampling, a plan was developed to address the objectives of the 1994 Neponset River Basin survey. This sampling plan called for basin wide coverage for the critical variables, DO, pH, temperature and bacteria. DO surveys can provide valuable data to determine use support status at a large number of stations, where sampling for a wide range of variables is cost-prohibitive. Historic survey data identifies bacteria as a primary cause of non-support in the mainstem Neponset River; the purpose of the 1994 bacteria surveys was to pinpoint sources of bacterial contamination in the basin. In addition, synoptic surveys were planned to provide an in-depth analysis of water quality conditions at 11 stations. Station locations were selected after reviewing the historical data, location of discharges and tributaries, proximity to land use activities which may produce nonpoint pollution, as well as the response by the "stakeholders" who provided comments on the draft sampling plan.

Samples were collected during early morning hours at a total of 49 stations, identified in Table 2.2, for DO, pH and water temperature; in addition, DO, pH and temperature samples were collected during each synoptic survey. Samples were collected on various dates at a total of 41 stations for fecal coliform bacteria.

The synoptic water quality surveys were conducted on 19 July, 16 August, and 18 October, 1994. These surveys involved the collection of instream grab samples at stations NE02, NE04, 6B01, NE09, NE10, 1B01, 5B01, NE12, NE12A, 14B04, and NE16 for: physico-chemical analyses (alkalinity, hardness, total and suspended solids, turbidity, and chlorides), nutrients (organic nitrogen, ammonia, nitrate and total phosphorus), bacteria (fecal coliform), total metals (aluminum, cadmium, chromium, copper, iron, lead, mercury, nickel, silver, and zinc), and volatile organic compounds (VOCs). (Note: water quality samples were collected at station 6B01 on 19 July only and at 1B01 on 16 August and 18 October only.)

Procedures used for sampling technique and sample handling are outlined in the Basin Program Standard Operating Procedures (TSB 1989). The Wall Experiment Station, the Department's analytical laboratory, supplied bottles and field preservatives for all sampling. Bottles were precleaned and prepared according to the draft WES standard operating procedures (SOP), Laboratory Quality Assurance Plan and Standard Operating Procedures (DEP 1994). Samples were preserved in the field as necessary, transported on ice to WES, and analyzed according the WES SOP. Quality control samples (field blanks, trip blanks, and split samples) were prepared and submitted to the laboratory on each sampling day. Water temperature, dissolved oxygen and pH measurements were made in situ at each station. These variables were measured with the equipment available at the OWM North Grafton office, which include: hand-held thermometers, a Markson Digital Model 88 or an Orion Model 201 pH meter, YSI Model 518, 54A or 54ABP DO meter, or the Scout 2 Hydrolab.

Conditions prior to each synoptic survey were characterized by analyzing precipitation and streamflow data. Three weather station precipitation gages were used to determine precipitation and weather conditions for several days prior to the sampling dates: Walpole Station 731, Foxborough Station 732, and Blue Hill National Weather Service (NWS); data for these stations were provided by the DEM Office of Water Resources. Discharge (hereinafter referred to as streamflow) and duration data were obtained from the two continuous USGS stream gages in the basin, Neponset River at Norwood (01105000) and East Branch Neponset River at Canton (01105500). The data from these gages are used to calculate streamflow characteristics for the period of record. These statistical analyses can be found in Water Resources Data Massachusetts and Rhode Island, Water Year

1993 (USGS 1994) and the Gazetteer of Hyrologic Characteristics of Streams in Massachusetts--Coastal River Basins of the North Shore and Massachusetts Bay (Wandle 1984). The period of record for the Neponset River gage is water years (October through September) 1940 through 1993. For the East Branch gage, the period of record is water years 1953 through 1993.

In addition to the gage data, streamflow was measured by USGS personnel on 19 July, 16 August, and 18 October, 1994 at two mainstem stations, NE12A (Dedham Street, Canton) and NE16 (Adams Street, Milton), and one tributary station, NE09 (Hawes Brook, Norwood) using a wading rod and Price pygmy meter. Meadow Brook, Norwood (1B01) streamflow was measured during the August and October surveys, while Spring Brook, Walpole (6B01) was measured during the July survey.

RESULTS

Precipitation and Streamflow

Precipitation data are presented in the following text; streamflow data are presented in Appendix B, Table 1.16B.

July 19, 1994 - Precipitation data indicate that a moderate intensity 24-hour duration rain event occurred four days prior (14-15 July) to sampling, amounting to 0.3-0.4 inches of rain. Following this rainfall the days were mild (70's°F) with cloudy skies, while the days prior to the precipitation were warm and clear. Total precipitation in the Neponset Basin for the month of July ranged from 3.0 inches at the headwaters of the basin to 2.0 inches in the majority the basin. Normal (historic average conditions) July rainfall for the southeast region of Massachusetts is 3.38 inches. Rainfall for the preceding month (June) was significantly below normal.

For at least seven days prior to sampling, streamflow at the two USGS gage sites was well below the July monthly mean for the period of record (hereinafter referred to as the monthly mean) of 20.7 cfs (cubic feet per second) at the Norwood River gage and 17.6 cfs at the Canton gage. Streamflow at both gages responded to the precipitation event on the 14th and 15th for a few hours before returning to pre-event levels. The flows recorded on 19 July approach the 70th percentile of flow. The term percentile of flow refers to a flow which is exceeded a certain percent of the time, e.g., the 70th percentile of flow is the flow which is exceeded 70% of the time.

August 16, 1994 - Significant rainfall occurred two days prior to sampling; one to two inches of rain fell over approximately 36 hours. Prior to this event the weather had been sunny, dry and warm for six to seven days. Precipitation in the basin for the month of August (6.0 to 7.0 inches) was well above the regional August normal (4.11 inches), however, much of the month's rainfall occurred after the 16th.

On 16 August, streamflow at the two USGS gages was well below the August monthly mean of 24.2 cfs at Norwood and 22.7 cfs at Canton. Streamflow at the Norwood gage increased from 3.0 to 4.0 cfs prior to the rain event to an hourly maximum of 36 cfs on the 14th, and then decreased to approximately 13 cfs on the 16th. A similar trend occurred at the East Branch Neponset gage. The measured flows on this date at the two gages fell in the 80-85th percentile range of flow. Streamflow measured at stations NE12A (Dedham Street, Canton), NE16 (Adams Street, Milton), NE09 (Hawes Brook, Norwood) and 1B01 (Meadow Brook, Norwood) may vary from this percentile of exceedence.

Streamflow at the downstream location NE16 was less (16.7 cfs) than the streamflow at the upstream site, NE12A (32.6 cfs); this flow anomaly also has been observed during previous basin surveys. It is theorized that the Fowl Meadow wetland system retards transport of significant volumes of water from a rain event preceded by several days of dry weather conditions. In conjunction with urbanization in the lower reaches of the basin, where runoff is rapidly discharged into the river following a storm event, wetland flow retardation may alter the timing of stream discharge peaks. In effect, the peak flow at the Adams Street site may have already occurred when high flows are just beginning to be released from the wetlands upstream.

October 18, 1994 - The month of October was very dry with all three precipitation stations recording less than 0.5 inches; normal regional rainfall for October is 3.30 inches. Throughout most of the basin, not more than 0.10 inches of rain had fallen before the 18th, and there was no measurable rainfall for at least ten days prior to sampling. It did rain on 18 October, however, after samples had been collected. The previous month (September) was in the normal to above normal range for precipitation.

Streamflow throughout the early part of the month dropped gradually, yet continually, reaching 7.3 cfs at the Norwood gage and 7.0 cfs at the Canton gage on the 18th. These streamflows are both in the low 90th percentile of flow exceedence, well below the October monthly means of 27.3 cfs at Norwood and 29.6 cfs at Canton.

Physicochemical

Analytical data for the water quality surveys are presented in Appendix B, Tables 2.1B through 2.4B.

During the 1994 Neponset River Watershed Project, 181 measurements were taken for DO and temperature at a total of 49 stations. Measurements taken in conjunction with the water quality surveys on 19 July, 16 August and 18 October were collected during daylight hours. The remaining DO measurements were taken during early morning hours to document the lowest DO concentrations and saturations. Of the 181 measurements, 35, or 19%, did not meet the minimum DO/percent saturation standard. In addition, seven DO measurements (4%) exceeded 100% saturation.

The outlet of Crackrock Pond, Foxborough (NE02) exhibited supersaturated conditions on 19 July, and did not meet the minimum saturation standard on 1 and 9 September. Although diel samples (daytime and nighttime) were not collected during the survey, such data indicate a productive waterbody; the abundant aquatic vegetation observed in this impoundment confirms this assessment. At its headwaters, the Neponset River partially supports the Class B standard for DO.

No violations of the DO standard were documented in the mainstem Neponset River between Route 1, Foxborough (NE02A) and Pleasant Street, Norwood (NE10). Two tributaries to the mainstem Neponset River between these stations did not meet the DO standard. The Mill/Mine Brook system (stations 2B01 and 2B02) in Medfield/Walpole had low DO concentrations during the July survey, and Spring Brook (6B01) in Walpole exhibited supersaturated conditions, including the only saturation above 110% during the entire survey (111.8% on 19 July). The other tributaries to the mainstem Neponset River in this segment met the DO standard.

Downstream from NE10, the mainstem Neponset River begins its meandering journey through the Fowl Meadow wetland. Meadow Brook (1B01) joins the mainstem at the headwaters of the Fowl Meadow; this tributary frequently did not meet the saturation standard. The East Branch Neponset River (NE12), the major tributary to the mainstem Neponset River, consistently met the DO standard. Several East Branch tributaries, however, were found to violate the DO standards during the October survey (Beaver Brook in Sharon 10B01, Pequid Brook in Canton 7B01 and 7B02, and Beaver Meadow Brook in Canton, 8B01). Supersaturated conditions were found at Purgatory Brook, Norwood (3B01) during the October survey. Station NE12A on the mainstem Neponset River at Dedham Street in Canton did not meet the instream standard on 19 July and 18 October. Potential causes of this violation in the mainstem Neponset River include the impact from Meadow Brook, background conditions due to wetland influence, and/or low flow conditions.

The tributaries to the Neponset River between stations NE12A (Green Lodge St., Canton) and NE16 (Adams Street Bridge, Milton) were found to violate the recommended instream standard for DO. These tributaries include Pecunit Brook (18B01) and Ponkapoag Brook (17B02), both in Canton, Mother Brook (stations 16B01 and 16B02) in Dedham and Boston as well as Pine Tree Brook (14B01 -14B04) in Milton. Violations of the dissolved oxygen standard were also documented in the mainstem Neponset River within this segment at stations NE13 and NE14.

The only tributary to the Neponset River Estuary sampled during the 1994 survey was Unquity Brook/Gulliver Creek in Milton. Low percent saturation occurred at the headwater sampling station (15B01). This sampling station was dry during the first two surveys and, during the October survey, the stream was a small trickle draining a wetland. Since the stream drains a wetland, the low oxygen saturation (49.8%) is considered to be due to natural conditions. The slightly supersaturated conditions documented in Unquity Brook at Brook Road (15B02) during the July survey are also considered to be the result of natural conditions. No DO violations were documented in the lower portion of this subwatershed during the survey.

Temperatures measured during the water chemistry surveys met the Class B warm water fishery standard of 28.3°C, with the exception of Spring Brook, Walpole (6B01) which had a temperature of 29°C on 19 July. The highest mean temperatures occurred during the July survey, with means of 22.7°C in the mainstem and 22.1°C in the tributaries. The temperature of several tributaries, Mine Brook, Walpole (2B02), Spring Brook, Walpole (6B02), East Branch Neponset River, Canton (NE12), and Massapoag Brook, Sharon (9B01), exceeded the July mean by more than 3.6°C, and, therefore, are considered non-support for aquatic life. In addition, the temperature of the East Branch Neponset River measured during the biological survey was 31°C on 21 July, a significant exceedence of the recommended instream standard for the protection of aquatic life. These temperature violations need further investigation to identify possible remediation measures.

Total alkalinity in the Neponset River and its major tributaries ranged between 16 and 33 mg/l (as $CaCO_3$), while hardness generally was higher, between 16 and 89 mg/l. The lowest alkalinity was in the mainstem Neponset River at the outlet of Crackrock Pond (NE02), two days after heavy thundershowers in the southwest portion of the watershed. The alkalinity of Traphole Brook (5B01) was also very low (average 19 mg/l).

The pH of the mainstem Neponset River ranged between 5.6 and 7.3 standard units (SU); the water quality standard for pH for Class B warm water fisheries is 6.5 to 8.3 SU. Out of a total of 93 pH measurements taken during the survey, 33% of the tributary readings and 7% of the mainstem readings were below 6.5 SU. Under certain circumstances, such as wetland influences, the natural pH may be lower (Suurballe 1992), which may account for the lower pH measurements in the Neponset River basin. The Neponset watershed contains significant wetland areas, therefore, for the purpose of this assessment, pH measurements above 6.0 SU are considered as supporting the aquatic life use. The 18 October pH measurements in the upper portion of the mainstem to station NE10 were between 5.5 and 6.0 SU; no pH measurements of less than 5.5 SU were found in the mainstem. Of 11 tributary pH measurements below 6.0 SU, 10 readings were between 5.5 and 6.0 SU. Only one pH reading during the entire 1994 survey was less than 5.0 SU; on 19 July a pH of 4.8 was measured at Mill Brook in Westwood (1B02), a tributary to Willet Pond in the Hawes Brook subwatershed.

Three pH measurements were in excess of the upper pH range, two from Spring Brook, Walpole (6B01) and the third from Mother Brook, Dedham (16B01). The loss of carbon dioxide in the water column during daylight hours, due to photosynthetic uptake, generally results in an increase in pH of the water (Hynes 1970). Although diel monitoring of pH in Spring Brook was not conducted, the two elevated pH measurements (8.4 and 8.5 SU) corresponded to supersaturation of oxygen in the water column (106.9% and 103.7%, respectively). The reason for the high pH measurement (10 SU) in Mother Brook is unknown.

In general, when assessing all three surveys, the suspended solids concentrations measured at the outlet of Crackrock Pond (NE02) were elevated in comparison to the other water quality sampling stations, with the exception of the 18 October sample from the mainstem at Pleasant St., Norwood (NE10). The significance of the high concentration (31mg/l) measured at NE10 is unknown, and may be the result of field technique or handling procedures. If this is not a valid value, then the Neponset River watershed did meet the full use support determination for suspended solids. Thirty-three percent of all the water quality samples had suspended solids concentrations less than the analytical detection limit of 2.5 mg/l, and 85% of the tributary concentrations were less than the detection limit.

Like the suspended solids concentrations, turbidity readings at the outlet of Crackrock Pond (NE02) during the July and August surveys were elevated (12 and 27 Nephelometric Turbidity Units (NTU), respectively) and do not support aesthetic use. The water column was considerably less turbid at the next downstream station (South Street, Walpole, NE04) during both surveys (0.8 and 12 NTU, respectively); however, the August reading still did not support aesthetic use. The range of turbidity in the mainstem downstream from South Street was 1.7 to 8.1 NTU, meeting full or partial use support determinations for turbidity. The turbidity range in the tributaries was between 0.4 to 5.3 NTUs, all of which fully support aesthetic use.

Nutrients

Only two locations, the outlet of Crackrock Pond (NE02) and Meadow Brook (1B01) were found to have ammonia-nitrogen concentrations which exceeded the conservative ammonia-nitrogen criterion of 0.21 mg/l (calculated using the both the highest pH and temperature measured at a full water quality sampling station during the three surveys). The actual ammonia-nitrogen criteria are calculated to be 1.21 mg/l for Crackrock Pond on 19 July, and for Meadow Brook, 1.7 mg/l on 16 August and 1.8 mg/l on 18 October, when the pH and temperature measurements from NE02 and 1B01 are used. The 0.37 mg/l concentration of ammonia-nitrogen found at Crackrock Pond on 19 July did not exceed the 1.21 mg/l criterion, while the Meadow Brook (1B01) concentrations were found to exceed the recommended instream ammonia-nitrogen criteria by factors of 1.6 and 2.4 during the August and October sampling surveys, respectively.

In freshwater, phosphorus usually exists in smaller quantities than nitrogen, and, therefore, often becomes the nutrient which limits primary productivity. According to Wetzel (1975), total phosphorus concentrations of most uncontaminated surface waters are between 0.01 and 0.05 mg/l. Seventy percent (70%) of the total phosphorus measurements were at or below 0.05 mg/l. Phosphorus concentrations at the outlet of Crackrock Pond (NE02) were elevated in comparison to the other sampling results, with the exception of Meadow Brook, and were in excess supply to support the very productive aquatic community.

The highest total phosphorus concentrations were measured at Meadow Brook (1B01) during the August and October surveys (0.65 and 0.68 mg/l, respectively). This brook is severely impacted from leaking sewer lines, as evidenced by the concentrations of the conventional pollutant variables (organic nitrogen, ammonia-nitrogen (NH_3-N), nitrate-nitrogen (NO_3-N), total phosphorous (TP), and fecal coliform bacteria).

Fecal Coliform Bacteria

Fecal coliform contamination is recognized as a major problem throughout the basin. In the mainstem Neponset River, the standard for primary contact recreation is not met at Summer Street, Walpole (NE03), and then in the river reach from Pleasant Street, Norwood (NE10) through Adams Street, Dorchester (NE16); the standard for secondary contact recreation is not met at both the Summer and Pleasant Street stations. Numerous tributaries did not meet the standard for primary contact recreation, including, Germany Brook (4B01), Meadow Brook (1B01), Traphole Brook (5B01), Beaver Meadow Brook (10B01), Mother Brook (16B01), and the lower portions of Pine Tree Brook (14B03 and 14B04) and Unquity Brook (15B02, 15B03 and 15B04). In addition, the standard for secondary contact recreation is not met in Meadow Brook, Mother Brook and the lower portion of Pine Tree Brook.

Partial use support for primary contact recreation and full use support for secondary contact recreation were documented for the following tributaries in the Neponset River Basin: two unnamed tributaries to Traphole Brook (12B01 and 13B01), the East Branch Neponset River (NE12), the lower segment of Pequid Brook (7B02), Purgatory Brook (3B01), Ponkapoag Brook (17B01 and 17B02), and the upper segment of Pine Tree Brook (14B01 and 14B02). The remaining stream segments surveyed were found to be fully supporting both primary and secondary contact recreation.

Total Metals

Using approved EPA methodologies for total recoverable metals, thirty seven percent of the samples analyzed for metals had detectable concentrations. Only 13% (41 out of 307 analyses) of the metals concentrations were found to exceed one CU or criterion unit (calculated by dividing the concentration of a metal by the water quality criterion for that metal). The range in CUs for all metals analyzed was found to be between 1 and 483.

Silver (Ag) was not detected in any of the water samples from the July 19 survey and, for this reason, was subsequently eliminated from the sampling plan.

Aluminum (Al) is a very abundant metal in the earth's crust and its presence in natural waters is common. Only one of 30 aluminum results exceeded the criterion, 1.1 CU at station NE12A on 16 August, and is not considered to pose a significant threat to the biota based upon this data set.

Cadmium (Cd) is a highly toxic carcinogenic heavy metal and a known contaminant in the Neponset Reservoir sediments (Section 4, Sediments). Only one of the 20 water samples submitted for cadmium analysis had a calculated CU greater than 1, 1.1 CU at NE02 on 16 August. It should be noted that results of the cadmium analyses for 18 October were not included in this evaluation because the results of field quality assurance/quality control samples did not meet OWM data quality objectives (Appendix A, QA/QC).

Chromium (Cr) is an abundant element in the earth's crust and occurs in several oxidation states; only the trivalent and hexavalent forms, however, are of biological significance (Claassen et al. 1986). The EPA "Goldbook" (EPA 1986a) has criteria for both Cr(III) and Cr(VI). Since the results presented in the data table are for total chromium, it is conservative to compare these results to the Cr(III) and Cr(VI) criteria. None of the total chromium results exceeded the Cr(III) criterion. Two of the 30 results exceeded the Cr(VI) criterion, 2.7 CU at station 5B01 and 6.4 CU at station 14B01 on July 19.

A review of the copper (Cu) data indicates 14 of the 29 results (42%) exceeding the water quality criterion with CUs ranging from 1 to 23.8. It should be noted that the field quality assurance quality control sample results indicate marginal data quality with respect to the OWM data quality objectives (Appendix A, QA/QC). This presents a problem when comparing results that are close to the criterion, however, relatively high concentrations of copper were measured on 16 August at Pine Tree Brook (14B04), 23.8 CU and in the mainstem at Adams St, Milton (NE16), 11.7 CU.

Four of the 30 iron (Fe) results (12%) were greater than the iron criterion (1.0 mg/l) with calculated CUs ranging between 1.0 and 1.4. These exceedences are not of concern given the abundance of iron in the earth's crust; it also is commonly associated with the wetland characteristics found in the Neponset River watershed.

Lead (Pb) concentrations were found to exceed the Pb criterion in 24% of the water samples analyzed, however, the CUs were generally low, between 1.7 and 3.8. Lead concentrations ranged from <0.002 to 0.008mg/l. It should be noted that the range of lead reported is close to the analytical detection limit as well as the water quality criterion.

Mercury (Hg) was detected in eight of the 30 water samples (27%) analyzed, with all eight exceeding the freshwater criterion (between 16.7 and 483 CU). The freshwater criterion for mercury is very conservative (0.000012 mg/l) due to its ability to bioconcentrate in the food web (EPA 1985b), and its presence in the water column is of concern.

None of the samples analyzed for nickel (Ni) or zinc (Zn) had concentrations exceeding their respective criterion.

Volatile Organic Compounds

Volatile organic compounds, also referred to as purgeable organic compounds, were not detected in the water column at any of the stations sampled on 19 July, with the exception of Hawes Brook, Norwood (NE09), where an unidentified compound was detected. This site needs further investigation.

DISCUSSION

The goal of the water chemistry sampling was to quantify selected conventional and toxic pollutant concentrations in the freshwater portion of the Neponset River and its tributaries. The observed concentrations were compared to the Massachusetts Water Quality Standards (MA DEP 1995a) to determine if the surface waters of the Neponset Basin are supporting their designated uses. It should be noted here that the synoptic surveys conducted on the 19 July, 16 August and 18 October were not designed to quantify pollutant loads from specific point and nonpoint sources under varying weather and flow conditions. The results of this assessment can be used to:

- highlight sections of the river that will need further monitoring to identify sources of contamination;
- identify sites for potential remediation actions, and
- help focus pre- and post-implementation monitoring to measure changes in water quality as management measures are adopted.

As stated above, water quantity is a significant factor affecting water quality, however, the relationship between water quality and quantity may be difficult to assess. Streamflow is a critical issue in the Neponset River Basin. Forty-four percent of the public water supply is withdrawn from the basin, however, only 18% of the flow was returned to the basin via septic systems in 1993 (MA DEM 1995). Most of the water withdrawn in the basin is transferred out of basin via the MWRA Sewer System. As sewer lines are extended within the Neponset River Basin, out of basin transfer can only increase. To address the complex relationship between streamflow and water uses in the basin, a detailed inflow/outflow analysis was conducted of the Mine Brook subwatershed by the DEM Office of Water Resources; the results of this analysis are contained in Section 9. It should be also noted here that the return of water to the basin was a major factor in permitting the Hollingsworth & Vose proposed discharge of 0.7 MGD (million gallons per day) of treated process wastewater (Section 7, Wastewater Discharges).

While direct correlations between low flow and poor water quality are difficult to make, low streamflow, in general, can result in loss of habitat, higher instream temperatures, lower dissolved oxygen concentrations, and lower capacity to assimilate wastes.

The Massachusetts Surface Water Quality Standards (MA DEP 1995a) specify the most severe hydrologic conditions at which water quality criteria must be met. For rivers and streams, the lowest flow condition at which criteria must be met is the 7Q10. Streamflow at the two continuous gaging stations in the Neponset Basin was below the monthly means, yet above 7Q10, during all three synoptic surveys. 7Q10 for the Neponset River at Norwood is 4.5 cfs; the survey low flow was 4.9 cfs on 19 July. Likewise, 7Q10 flow for the East Branch Neponset River at Canton is 3.6 cfs, and the survey low flow was 6.9 cfs on 19 July. Since streamflow exceeded 7Q10 during the surveys, the comparison of instream solute concentrations with applicable criteria does not necessarily represent worst-case conditions. Pollutant concentrations measured during the 1994 survey might have been higher had 7Q10 conditions occurred. On the other hand, since wet weather surveys were not conducted, pollutant loadings from storm water have not been quantified, so it cannot be determined whether worst-case conditions occur during periods of low flow or during wet weather conditions.

The representativeness of the data, as described above, must be considered when reviewing the 1994 water quality survey results. These data can be used for the purposes identified above; these data cannot be used to quantify pollutant loadings that may occur during conditions of flow or climate that differ from those that occurred at the time of sampling.

Use support status for the Neponset River Basin segments is presented in Table 2.3 (the use support status from the water column monitoring at each sampling station can be found in Appendix B, Table 2.6B); support status was determined by comparing the values contained in the data table to the use support determinations listed in Table 2.2. Overall, the three segments that were assessed during the 1994 survey, Segment 1 - Mainstem, Outlet of Crackrock Pond to Pleasant Street, Norwood, Segment 2 - Mainstem, Pleasant Street, Norwood to Baker Dam, Boston/Milton line and Segment 4 - East Branch, Forge Pond to Confluence, failed to meet the designated uses for Class B waters.

The 1994 water chemistry survey data provide sufficient variables to make a complete evaluation of support status (i.e., a complete comparison to Table 2.2) at eleven stations in the Neponset River Basin. At the remaining 38 stations the use support status is based on the variables available. Aesthetic use was not assessed at these 38 stations, because the purpose of the sampling plan did not call for the collection of suspended solids, turbidity and total phosphorus samples at these stations, and the Aquatic Life use determination is based on DO, temperature and pH data at these stations. This fact should be kept in mind when looking at full or partial support status for these uses.

As can be seen from Table 2.3, bacterial contamination is a major problem throughout the basin. Only 13 of 41 stations sampled for fecal coliform met the support status for primary contact recreation, and two stations are non-support for secondary recreation (NE03 in Segment 1 and 1B01 in Segment 2). On 19 July and 18 October, the sources of bacterial contamination most likely were leaking sewer lines and failed septic systems, while on 16 August, storm water runoff from the heavy rain which occurred two days prior to sampling also may have contributed to the bacterial loading. The purpose of the sampling was to identify areas of bacterial contamination and prioritize these areas according to the level of contamination. This prioritization is shown on Figure 1 in the Executive Summary of this report.

Some management actions have been initiated to address the bacterial problems. It was obvious from the bacteria data, as well as the water quality data, that Meadow Brook was a significant source of pollutant loading to the Neponset River,

TABLE 2.3. 1994 NEPONSET RIVER BASIN SURVEY. Designated Use Support Determination by Subwatershed and River Segment. Where S = support, PS = partial support, NS = non-support, and NA = not assessed.

SUBWATERSHED/SEGMENT	1° CONTACT RECREATION	2° CONTACT RECREATION	AQUATIC LIFE	AESTHETICS	OVERALL USE STATUS
MAINSTEM/SEGMENT 1	NS	PS	NS	NS	NS
SCHOOL MEADOW BROOK/SEGMENT 1	NA	NA	NA	NA	NA
MILL/MINE BROOK/SEGMENT 1	S	S	NS	S	NS
HAWES BROOK/SEGMENT 1	PS	S	NS	S	PS
SPRING BROOK/SEGMENT 1	S	S	NS	NS	NS
MAINSTEM/SEGMENT 2	NS	S	NS	PS	NS
MEADOW BROOK/SEGMENT 2	NS	NS	NS	NS	NS
TRAPHOLE BROOK/SEGMENT 2	NS	PS	NS	S	NS
UNNAMED TRIBUTARY/SEGMENT 2	S	S	S	NA	S
PURGATORY BROOK/SEGMENT 2	PS	S	PS	NA	PS
PECUNIT BROOK/SEGMENT 2	S	S	PS	NA	PS
PONKAPOAG BROOK/SEGMENT 2	PS	S	PS	NA	PS
MOTHER BROOK/SEGMENT 2	NS	PS	NS	NS	NS
PINE TREE BROOK/SEGMENT 2	NS	PS	NS	NS	NS
ESTUARY/SEGMENT 3*	NS	NS	PS	NA*	NS
UNQUITY BROOK/SEGMENT 3	NS	PS	PS	NA	NS
EAST BRANCH/SEGMENT 4	PS	S	NS	S	NS
MASSAPOG BROOK/SEGMENT 4	S	S	NS	NS	NS
STEEP HILL BROOK/SEGMENT 4	NA	NA	NA	NA	NA
BEAVER MEADOW BROOK/ SEGMENT 4	NS	PS	PS	NA	PS
PEQUID BROOK/SEGMENT 4	PS	S	NS	NA	PS

* - Segment 3 would also be classified as Non-support for Restricted Shellfishing.

as well as a potential public health problem. Investigations by the town of Norwood revealed crushed sewer lines discharging raw sewage to the brook. Once this problem was identified, the town immediately implemented remediation actions. Although bacterial counts in Meadow Brook continue to indicate problems, the town of Norwood is continuing to investigate and remediate this problem.

Additional sampling is required to further identify and prioritize sources of the bacterial contamination, and to measure the success of the abatement measures that continue to be implemented.

Of 49 stations sampled for dissolved oxygen, 23 stations exhibited impairment; five of the of 14 mainstem stations sampled and 18 of the 35 tributary stations did not meet the support determination for dissolved oxygen. It should be noted, however, that 81% of the total number of samples met water quality standards. In addition, none of the 49 stations had consistently low dissolved oxygen concentrations, and only two stations exhibited % saturation levels that would be considered indicative of diel fluctuations. Given the predominant morphology of the river (wide, shallow, gently sloping streambed), the low flow, high water temperatures, the number of impoundments, and the fact that the headwaters originate in a productive impoundment, it is surprising that more DO violations were not measured during the survey.

The high instream temperatures documented during the survey are of concern and pose a threat to aquatic life. Temperature in the East Branch Neponset River is a major concern, considering that streamflow was above 7Q10 in this segment during the 1994 survey.

Nutrient related impairment (dense to very dense coverage of aquatic vegetation) occurred at the outlet of Crackrock Pond (NE02), where elevated concentrations of total phosphorus were measured. Crackrock Pond is a productive impoundment, with abundant aquatic vegetation. This pond receives the only remaining direct discharge of sanitary sewage in the basin; wastewater from an elderly housing unit is discharged to the pond via the treatment plant at the now closed Foxborough State Hospital. Crackrock Pond is downstream from Foxborough Reservoir, where 1994 sediment analyses (Section 3) showed high concentrations of phosphorus. The Foxboro Company previously discharged treated process wastewater containing phosphorus to the reservoir. In addition, land use around the reservoir and pond is primarily residential, which potentially could contribute significant phosphorus loadings via septic systems and fertilizer use.

Nutrient related problems at station 1B01, Meadow Brook, (high phosphorus concentrations and potential ammonia-nitrogen toxicity) are attributed to the discharge of untreated sewage from leaking sewer lines. This station had the only concentrations of ammonia-nitrogen which exceeded the water quality criterion.

Although Spring Brook at Route 27, Walpole did not exhibit high nutrient concentrations, the DO data suggests diel fluctuations that are indicative of productive streams. This brook should be considered as "threatened", and warrants further investigation.

The metals data indicate numerous criteria exceedences throughout the basin. These metals concentrations are not attributed to point sources; the survey of wastewater discharges in the Neponset River Basin (Section 8) indicates a significant decline in point source discharges over the past 20 years. Currently, only one company, Senior Flexonics Inc., is discharging a small volume of treated metal processing wastewater into a tributary of School Meadow Brook. The sediment data (Section 3) show high metals concentrations, which may be a source of the water column metals. Other sources of metals in the water column include storm water runoff, atmospheric deposition (especially with regards to mercury) and, potentially, sewage discharges from leaking sewer lines.

The Massachusetts Water Resources Authority sampled the Neponset River Estuary, and therefore their data must be used to determine the water quality conditions as well as the use support status determinations of Segment 3 of the Neponset River.

MWRA Data

Fecal coliform counts at the MWRA sampling stations ranged from <5 colonies/100 ml to 57,500 colonies/100 ml during the course of the survey. Bacteria levels at all estuary sampling stations were determined to be non-supportive of restricted shellfishing, and non-supportive of primary contact recreation at all six stations. Partial use support for secondary contact recreation was documented at the stations located at Granite Avenue, near the Mass Transit Bridge, and at Tenean Beach; the other three stations were determined to be non-supportive of the secondary contact recreation use. It should be noted that during the MWRA survey the highest fecal coliform counts were found at the station above Baker Dam, in the freshwater portion of the river. On 19 July, the MWRA fecal coliform count was 1100 colonies/100 ml above Baker Dam, while the DEP fecal coliform count was 900 colonies/100 ml at NE16, below Baker Dam, indicating good correlation between the two data sets on that date.

pH values ranged from 6.7 SU to 7.91 SU, all of these values are within the pH range for full support of aquatic life. Temperatures ranged from 18.8°C to 27°C; one station, Tenean Beach, had two temperature readings >3.6° above the mean, and did not meet the full use support determination for aquatic life. DO concentrations ranged from 4.1 to 10.6 mg/l at the six stations. The sampling station at the Old Colony Yacht Club in Dorchester was determined to be fully supportive of aquatic life, while partial use support for aquatic life was documented at the other five stations.

CONCLUSIONS

Although Table 2.3 indicates non-support for designated uses in all of the river segments, water quality in the Neponset River during the 1994 survey can be ranked as "fair". Based on this survey data, the major water quality concerns in the basin are bacteria, metals, high instream temperatures, and low flow. The primary cause of non-support is fecal coliform bacteria.

Although DO is cited frequently as a cause of non-support, the 1994 survey did not find consistent violations at the majority of stations. Nutrient enrichment was noted at only two isolated locations, Crackrock Pond and Meadow Brook, while a third stream, Spring Brook, is considered threatened.

The primary sources of bacteria appear to be leaking sewer lines and failing septic systems. A number of ongoing projects in the basin should help to alleviate this problem. The MWRA currently is upgrading many of the sewer interceptors in the basin, and is providing funding for Inflow/Infiltration studies and sewer line repairs to member communities. The new Title 5 regulations should, ultimately, ameliorate septic system failures. To assist communities in implementing these new regulations, a Section 319 Nonpoint Source Competitive Grant proposal recommended for federal fiscal year 1996 funding will provide Boards of Health in the Neponset River Basin with a computer database that tracks inspections, repairs and replacements of Title 5 systems, and will provide technical assistance to these Boards for the implementation of this database.

It will be much more difficult to address source of metals in the basin, since it appears that the instream metal concentrations are related to storm water runoff and nonpoint sources of pollution. Models can be used to predict the storm water contribution of metals to surface waters based on landuse data (Section 8 - Storm Water). Currently, the Metropolitan Area Planning Council

(MAPC) is using the P-8 runoff model to predict storm water pollutant loadings in three Neponset subwatersheds. Results from this modeling and the 1994 water quality survey data can be used to prioritize subwatersheds contributing metals loadings. Based on this prioritization, further assessment work could lead to the identification of remediation measures in these subwatersheds (such as issuing and enforcing of NPDES Storm Water Permits). Contribution of metals to the water column from sediments is also difficult to assess. A task force has been established at the Southeast Regional Office (SERO) to address the Neponset Reservoir issues, including contaminated sediments.

A project proposal addressing high water temperatures in the East Branch and tributaries was submitted to the Water Resources Commission for funding under the Army Corps of Engineers (ACOE) Section 22 Program. This proposal calls for the review of existing conditions to formulate restoration recommendations.

The issue of low flow in the basin is addressed in Section 9, Water Use and Streamflow.

Another project which the Neponset River Watershed Modeling Project developed by DEP for funding under the federal 104(b)(3) grant program involves the development of computer modeling capability and user guidance necessary for implementation of the Statewide Watershed Management initiative in Massachusetts. A suite of models will be identified and evaluated for use in developing relationships between land use, point and nonpoint source pollution, water withdrawal and water quality in rivers and estuaries throughout the state. The models will be used to predict changes in water quality from different pollution control strategies, allowing targeting of those efforts which promise the greatest environmental benefit and economic return. To demonstrate this, modeling will be specifically applied in the Neponset River Basin to quantify pollution source and assess in-stream impacts and assist in evaluating various best management control options.

RECOMMENDATIONS

1. Bacterial contamination is the major water quality problem in the basin. Additional sampling is required to further identify and prioritize sources of the bacterial contamination. As sources are identified, the Neponset Team will continue to work with public and private entities to implement remediation measures.

2. High temperatures documented in the East Branch Neponset River need further investigation to identify possible remediation measures. The Neponset Team will work with the ACOE on this project.

3. The reason for the high pH measurement (10 SU) in Mother Brook is unknown. If further sampling indicates that this was a valid measurement, then potential sources of the high pH need to be investigated.

4. Hawes Brook in Norwood, where an unidentified VOC compound was detected, needs further sampling and investigation.

5. Additional sampling of Spring Brook at Route 27, Walpole is warranted to determine if the diel fluctuations in DO are the result of high nutrient concentrations.

6. The results of the MAPC P-8 modeling and the Neponset River Watershed Modeling Project should be utilized to show communities how increasing development impacts water quality within a subwatershed and the Basin as a whole.

7. Results from the modeling projects and the 1994 water quality survey data can be used to prioritize subwatersheds contributing metals loadings. Based on this prioritization, further assessment work could lead to the identification of

remediation measures in these subwatersheds (such as issuing and enforcing of NPDES Storm Water Permits).

8. The Neponset Team will oversee the grant projects which have been funded to date in the basin, and additional opportunities for grant funding of remediation/education projects should be investigated.

9. Wet weather sampling should be conducted in the future to assess pollutant loadings from storm water runoff.

SECTION 3: SEDIMENTS

INTRODUCTION

Streambed sediments are quite often the ultimate sink for a wide variety of environmental pollutants. Such sediment contaminants can include, but are not limited to, nutrients, heavy metals, and organic compounds (e.g., polycyclic aromatic hydrocarbons (PAH) and polychlorinated biphenyls (PCB)). Many of these contaminants are ubiquitous in nature and can be the result of such natural processes as forest fires, volcanic activity and microbial synthesis (Eisler 1987), however, anthropogenic activities mobilize these substances, often causing them to become enriched or concentrated above natural or baseline levels. Anthropogenic sources of these contaminants include both industrial and municipal point sources and nonpoint sources which are primarily determined by surrounding land-use characteristics. Surface runoff has been noted as a significant source of sediment contamination in virtually all urbanized areas (Lyman et al. 1987). The Neponset River Watershed is highly developed with many urbanized areas and thus subject to this source of pollution. Other nonpoint sources of sediment contamination include atmospheric deposition, the burning of fossil fuels (e.g., motor vehicles, coal generated power plants), and accidental spills (e.g., petroleum products).

Sediment quality sampling in the Neponset River basin was designed to address concerns expressed by NepRWA and others as to the extent of the contamination of the streambed and lake sediments with heavy metals and elevated nutrients from both point and nonpoint sources. The sampling was also designed to answer questions regarding wasteload allocation model assumptions for a new NPDES discharge. Within the means of the available resources, nine sites were selected based on accessibility and to provide coverage of the entire length of the freshwater mainstem Neponset River, as well as its major tributary, the East Branch Neponset River. The sampling plan was designed to screen the sediment quality condition utilizing chemical and biological characterization techniques. Since national sediment quality criteria have not yet been established, a sediment quality ranking system (SQR) was developed to provide a relative scale (good to poor) of the sediment quality condition. The sediment quality data were also incorporated into the overall assessment of the Neponset River Watershed through the aquatic life use support determination. Actual fate and transport of sediments, as well as the distribution of potential contaminants within each sampling location (i.e., replicate or transect sampling), was beyond the scope of the study. Impacts from other pollution sources which are known to exist in the Neponset River Watershed (i.e., PCB contamination from the Grant Gear Superfund Site, Norwood) were also beyond the scope of the survey.

Whether originating from human activities or from natural sources, organic matter suspended in the water column will settle to the stream bottom in impounded or slowly-flowing stream reaches. If these deposits are not subjected to scouring during periods of high streamflow, they accumulate and become thicker over time, as new material constantly sinks to the bottom. The decomposition of these organic deposits involves both anaerobic and aerobic microbiological processes. Aerobic decomposition occurs primarily at the sediment-water interface, and is effected by microorganisms that rely on a supply of dissolved oxygen in the overlying water. As the organic matter in this upper layer of sediment is oxidized, deoxygenation of the water column will occur unless offset by stream reaeration or photosynthetic oxygen production. The quantity of oxygen consumed during the sediment decomposition process, or sediment oxygen demand (SOD), can play a major role in defining the dissolved oxygen relationships in stream and lake water.

A predictive water quality model (Qual2E) was developed for the Neponset River by Hollingsworth & Vose, Inc. to forecast the effects on instream dissolved oxygen concentrations of varying waste loads from their proposed discharge. While water-column biochemical oxygen demand data and measured dissolved oxygen profiles from DEP surveys in 1986 and 1991 were available for model development, information pertaining to the extent and character of sediment deposits was unavailable. Therefore, the benthal deoxygenation rates were repeatedly adjusted until the dissolved oxygen profiles predicted by the model simulated the actual measured survey conditions.

METHODS

Between 7 November and 5 December 1994, sediment from nine stations (Table 3.1) was sampled. The following analyses were conducted: sediment oxygen demand, with the single exception of station SNE01 (the Neponset Reservoir), metals (Al, Ag, As, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, and Zn), nutrients (TKN and TP), and total organic carbon (TOC). Sediment toxicity testing using two invertebrate species, *Chironomus tentans* (a midge) and *Hyallela azteca* (an amphipod) was also conducted. Bioaccumulation method development using *Lumbriculus variegatus* (an aquatic earthworm) and trial tests were also conducted by the Biology Section of EPA Region I Environmental Services Division (ESD) at five of the nine stations (also noted in Table 3.1). Sediment collected from Saw Mill Brook, Concord, in the Charles River Basin, served as the reference. Saw Mill Brook sediment is routinely used by EPA as a far-field reference for several reasons: 1) it has demonstrated good performance in testing the amphipod and chironomid species, 2) it met the highest number of selection criteria compared to other ponds and brooks selected and tested as potential reference sediment, 3) it has known chemical constituents which closely match pristine conditions, and 4) it is located within conservation land (away from human perturbation). A brief description of the sediment sampling locations is contained in Table 3.1 and depicted graphically in Figure 3.1.

Sediment quality was assessed for a total of 25.2 river miles along the mainstem and the East Branch of the Neponset River in terms of providing suitable quality of habitat to ensure survival and reproduction for the indigenous species of aquatic life (fish, shellfish, benthos, etc.) inhabiting the sediment. For the purpose of this evaluation, sediment quality conditions were assessed for three segments:

1. the upper mainstem Neponset River at sampling stations SNE01, SNE02, SNE05, and SNE10 (outlet of Crackrock Pond to the Pleasant Street bridge in Norwood, also including the headwater impoundments of the Neponset Reservoir and Crackrock Pond),

2. the middle mainstem Neponset River, at sampling stations SNE11, SNE13, SNE14, and SNE16 (Pleasant Street bridge in Norwood to Baker Dam in Milton), and

3. the East Branch Neponset River at sampling station SNE12 (outlet of Forge Pond, Canton to the confluence with the mainstem Neponset River).

<u>Collection</u>

Samples for SOD were collected in a soft, depositional area if present, with a gravity corer (WILDCO No. 2404) equipped with a plunger and a suction flap for use in deep water. Each acrylic core cylinder is 50.5 cm in height and 5.1 cm in diameter. The cylinder was removed from the corer and stopped at both ends after the sediment sample was retrieved to provide an undisturbed profile of benthic sediments and overlying water. In shallow water, an acrylic core cylinder from the Wildco corer was inserted directly into the sediment to an estimated maximum depth of 15.2 cm (six inches). The tube was stopped on top, which created suction and allowed the sediment core to be raised intact until the bottom of the tube could be stopped underwater.

TABLE 3.1. 1994 NEPONSET RIVER BASIN SURVEY. Sediment quality monitoring stations and sampling conducted at each station including chemical characterization (C), sediment oxygen demand analysis (O), toxicity testing with *Chironomus tentans* and *Hyallela azteca* (T), and bioaccumulation test studies with *Lumbriculus variegatus* (B).

STATION[1]	RIVER MILE[2]	STATION LOCATION[1]	SAMPLING CONDUCTED
SNE01	N/A[3]	Neponset Reservoir, Foxborough	C, T, B
SNE02	26.2	Neponset River, outlet of Crackrock Pond, Foxborough	C, O, T, B
SNE05	17.5	Neponset River, Bird Pond, East Walpole	C, O, T, B
SNE10	15.8	Neponset River, downstream from Pleasant Street Bridge, behind Industrial Park, Norwood	C, O, T
SNE11	12.6	Neponset River, Fowl Meadow ACEC, Neponset Street, MWRA Construction Yard, Canton	C, O, T
SNE12	13.4, 1.8	East Branch Neponset River, Factory Pond, Neponset Street, Canton	C, O, T
SNE13	8.6	Neponset River, Fowl Meadow ACEC, Green Lodge Street, Canton/Norwood	C, O, T, B
SNE14	9.0	Neponset River, Fowl Meadow ACEC, upstream of Truman Highway, Hyde Park/Milton	C, O, T, B
SNE16	3.6	Neponset River, upstream of Baker Dam, Milton	C, O, T
SMR	EPA Far-field Reference Station	Sawmill Brook, Concord Conservation Land, Concord (Charles River Basin)	C, T, B

[1] stations and locations are ordered according to stream hierarchy and classification system (Halliwell et al. 1982) where tributaries are indented under their main stem stations.
[2] from the mouth of Neponset River as defined as the corporate boundary between Boston and Quincy (at Commercial and Squantum Points), upstream tributary confluence
[3] not applicable

Since the corer penetration varied depending upon the substrate composition, both the sediment and water column contained within the core was precisely measured. Sediment surface is always constant within the core cylinder. In cases of soft or unconsolidated sediment, where the corer may penetrate the sediment entirely, the sediment was carefully bled from the bottom of the cylinder. Overlying water was then added to fill the cylinder. The water column depth over the sediment was adjusted to a minimum of 35 cm. Overlying water was also collected using a three liter (L) Kemmerer sampler. Six 300 ml BOD bottles were filled at each sample location with the overlying water. Half were fixed in the field with manganous sulfate solution, alkali-iodide-azide and sulfuric acid. Five replicate cores were collected at each sample location. Sediment samples for the remaining analytical testing were collected using a pre-cleaned, stainless steel, petit Ponar dredge from a boat or while wading, depending on the location.

Sediments were collected from the upper six inches of aquatic substrate and were emptied from the dredge into a pre-cleaned, plastic bucket. Multiple dredge samples were collected at each station until a total of five liters was obtained. Any surface water obtained with the samples was poured off. The sediments were then well mixed with a new, disposable, plastic shovel. Samples were then split

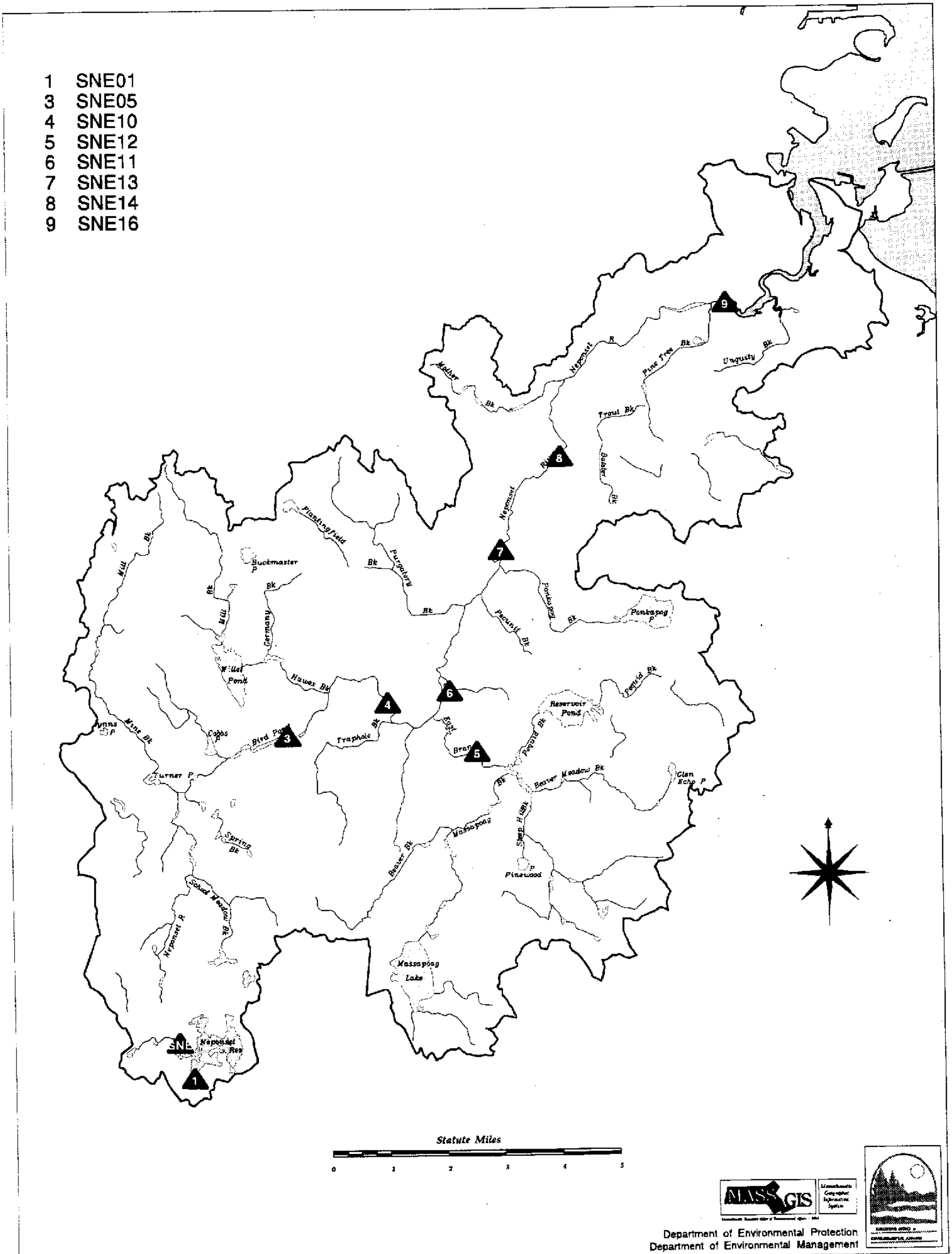


Fig. 3.1. 1994 NEPONSET RIVER BASIN SURVEY. Sediment quality monitoring station locations.

into the appropriate pre-washed, acid-rinsed clear glass bottles for the metals analysis, brown glass bottles for the nutrient analysis, and plastic liter bottles for the toxicity and bioaccumulation tests. Nutrient and metals samples were iced after collection, and kept refrigerated in the laboratory trailer at the OWM office in North Grafton until all samples were collected. These samples were then delivered to the Wall Experiment Station in Lawrence for analysis. The samples collected for TOC, sediment toxicity and bioaccumulation testing were delivered immediately after collection to the Biology Laboratory at EPA Environmental Services Division (ESD) in Lexington, MA where they were held and refrigerated, until sampling was completed at all of the stations.

SOD Analysis

Water column respiration or production through the SOD test was evaluated as follows: Three of the acidified DO samples were titrated in the laboratory according to the Winkler method (Standard Method No. 4500). This established an "initial blank" value. The remaining bottles were incubated in a shaded water bath for the duration of the SOD test. Upon completion, these shaded bottles were also titrated and the average of the three values established the "final blank" value. Any measured difference between the "initial" and "final" values were attributed to water column respiration or production and the SOD rates were adjusted accordingly.

The water column height was measured and the cylinder was placed in a temperature controlled water bath. DO was monitored simultaneously using an Orbisphere five channel DO meter (Model 2601) in each of the core cylinders. The five probes were calibrated daily against a Winkler standard. The core tops were modified to accept the DO probes. A self-contained stirring apparatus on each probe insured adequate flow past the sensing head and provided continuous mixing within the cylinder. DO concentrations within the cylinder were monitored and recorded every 30 minutes over the course of three to four hours. This period also included a one-half to one hour period of temperature stabilization within the cylinder, when necessary. The water temperature maintained in the water bath during the analyses of the Neponset River sediments was 20 $\pm$ 2°C.

Oxygen depletion was plotted against time, and the portion of each graph where oxygen consumption was constant over time was used in the calculation of the SOD rate. SOD was calculated using the equation:

$$\text{SOD gms } O_2/M^2\text{-day} = \frac{((O_i - O_f) - (B_i - B_f))(V)}{(SA)(T)}$$

where:

O_i = initial DO (mg/l)
O_f = final DO (mg/l)
B_i = initial DO in bottle (mg/l)
B_f = final DO in bottle (mg/l)
V = volume of confined water (M^3)
SA = sediment surface area (M^2)
T = time (days)

Whole Sediment Toxicity Testing Procedure

The day prior to the initiation of the toxicity testing, each sediment sample (both test and reference) was mixed and a 50 ml aliquot was added to each test chamber. The sediment in each chamber was smoothed using a plastic spoon or spatula. To minimize resuspension, a petri dish was laid on top of the sediment and reconstituted laboratory water was carefully poured to overlay the sediment. The petri dish was then removed. Sediments were allowed to settle for a period of 12 - 24 hours before the test organisms were added.

The one liter test chamber beakers were covered with petri dishes to prevent evaporation. Aeration was provided to each test chamber through a 1-ml glass pipet which extended through the petri dish lid to a depth not closer than 2 cm from the sediment surface. Air was bubbled into the test chambers at a rate that did not cause turbulence or disturb the sediment surface. The *Chironomus tentans* and *Hyallela azteca* tests were conducted for 10 days.

The DO in each test chamber was measured in at least one test chamber in each treatment daily during the test period. DO concentrations were maintained between >40% and <100% saturation. Temperature and pH were measured daily.

The test chambers with sediment were set into an environmental chamber at the initiation of the test. The temperature of the environmental chamber was 25°C. Overlying water was partially replenished by pouring off 50% and adding new culture water. Additional test methodologies follow those of EPA Draft Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates (June 1994).

The sediment toxicity test results were obtained by comparing the survival (*H. azteca* and *C. tentans*) and growth (*C. tentans*) of the test organisms against the response of the reference site sample. Samples that were determined to be significantly different from the reference site were noted. The sediment test employed four replicates of 15 organisms per test chamber for *H. azteca* and five organisms per test chamber for *C. tentans*. The reference station (Saw Mill Brook sediments) was used to test the performance of the test organisms, overlying water and environmental chamber used in these tests.

The endpoints for the toxicity tests included the mean survival at each station for each test organism as well as an unpaired t-test comparing the test results to the reference sediment of Saw Mill Brook to determine statistically significant toxicity (STATVIEW MAC, a computer software package).

Bioaccumulation Test Study

A methods development and trial test run for measuring the toxicity and bioaccumulation of Neponset Reservoir and river sediment-associated contaminants to the worm, *Lumbriculus variegatus*, was conducted by EPA ESD Biology Section staff. The procedures in general, followed those outlined in EPA Draft Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates (June 1994). Although five replicates are recommended for routine testing in the protocol, only two replicates were tested due to a limit of sufficient sample volume and the amount of available test organisms. These test stations were the Saw Mill Brook reference station and Crackrock Pond, Bird Pond, Neponset River near Green Lodge Street, and the Neponset River upstream of Truman Highway (SMR, SNE02, SNE05, SNE13 and SNE14, respectively). Four replicates were tested for the Neponset Reservoir sediment sample (SNE01).

Approximately seven grams of *L. variegatus* were introduced into each 4 L test vessel which contained one L of sediment, and three L of laboratory reconstituted water (60mg $CaCO_3$/L), which had been allowed to settle overnight. Initial chemistry measurements were performed on the overlying water which included pH, conductivity, hardness, temperature, and dissolved oxygen. Dissolved oxygen, pH, and temperature were monitored daily. A 50% overlying water renewal was conducted every 72 hours for the duration of the 28 day test. The test organisms were not fed.

Recovery of the test organisms was accomplished over a three day period (over 70 person hours) and entailed sieving the sediments and removing any external debris from the organisms before weighing. The preferred method of collection was to pour small amounts of sediment into a #35 sieve (or some combination of sieves) and to rinse the sieves with large volumes of water. This effectively washed away much of the fine particles, which made the collection easier. Any residual sediment or other matter was removed from the organisms prior to weighing in order to prevent any additional contamination.

The reference method listed above suggests a 24-hour period of depuration at the conclusion of the test. Since the purpose of this bioaccumulation test was to determine what concentration of metals might pass up the food chain should the worms be ingested, a depuration period was deemed unnecessary. Therefore sediment in the gut as well as in the worm tissue was analyzed. A minimum of two grams of worms per replicate were recovered. The sample preparation and analytical methods are included in Appendix A.

To determine the potential uptake of metals in the sediments of the Neponset Reservoir and Neponset River, ratios of tissue and gut concentration to sediment concentration were calculated, after a blank correction (the subtraction of the concentration of metals in the culture test organisms from the tissue concentration) was also performed. These bioaccumulation factors (BAFs) give a rough estimate of potential transfer of metals up the food chain. They were calculated using both the mean concentration and the highest concentrations of tissue and sediment contamination at each station for estimates of average and worst-case bioaccumulation potential.

Chemical Analysis

The analysis of the nutrients, metals, and TOC in the Neponset River Basin sediment samples followed the methods outlined in Appendix A. Quality control data are also contained in Appendix A. The data obtained were compared with the "Lowest and Severe Effect Levels" published by Persaud et al. (1992). The guidelines established in this document provided the background and methods used to determine two threshold levels (based on contaminant and biological monitoring in the freshwater environment); the Lowest Effect Level (L-EL) indicating the level of sediment contamination at which the majority of the benthic organisms were found to be unaffected; and the Severe Effect Level (S-EL) where the level of sediment contamination would be expected to cause severe detrimental impacts to the biota (Persaud et al. 1992). Additionally, the data were compared to a summary of sediment data collected for Massachusetts lakes and ponds (Rojko 1990) to provide a reference for the condition of the Neponset River Basin sediments in relation to contaminant levels in the state.

The sediment data were also normalized to the Al and Fe content and average earth crustal values (Schropp and Windom 1988) to calculate Enrichment Ratios (ERs), which provides a method to look at the difference between test and average or expected concentrations. Because of their natural abundance in the earth's crust, and the relatively small inputs from anthropogenic sources, the metals concentrations were divided by the Al (and also Fe) concentration for each sample. This quotient, or ratio, was then divided by the crustal ratio (Schropp and Windom 1988) to calculate an Enrichment Ratio, defined as follows using Al as the example:

$$E_x = (X/Al)_{sediment} / (X/Al)_{crust}$$

where E_x = enrichment factor for metal X
$(X/Al)_{sediment}$ = weight ratio in sediment
$(X/Al)_{crust}$ = weight ratio in average crustal material

Sediment Quality Rank

To evaluate and compare results from the different types of sediment data that were collected, a system was developed to illustrate the relative ranking among stations, tests and analytes. In this ranking system, values from "1" to "4" (good to poor, respectively) are assigned based on the scoring criteria in Table 3.2 for the following categories: concentrations of individual metals, concentration of total metals, concentration of nutrients (each of which is

TABLE 3.2. 1994 NEPONSET RIVER BASIN SURVEY. Overview of the sediment quality rank (SQR) assignment based on the various categories of analysis including comparison to Persaud et al. (1992) low and severe effect threshold levels (L-EL and S-EL, respectively) for bulk concentration of individual and total metals and nutrients (expressed in mg/kg dry weight), sediment toxicity test results, bioaccumulation test results, enrichment ratios based on *normalization to Al or Fe*.

Sediment Quality Rank (SQR)	[Individual Metal]	[Total Metal]	[Nutrients]	Toxicity Testing Per Test or Station* (% Survival)	Bioaccumulation Factor	Normalization to Al or Fe
1 (low or no degradation)	Metal is at or within L-EL	All metals at station are at or within L-EL	Nutrient is at or within L-EL	100 - >75	Bioaccumulation not apparent	Enrichment Ratio $\leq$ 1
2 (moderate degradation)	Metal is between L-EL and S-EL	At least one metal at station is between L-EL and S-EL	*Nutrient is between* L-EL and S-EL	$\leq$75 - >50	--	Enrichment Ratio >1 but <10
3 (severe degradation)	Metal is at or exceeds S-EL	At least one metal at station is at or exceeds S-EL	Nutrient is at or exceeds S-EL	$\leq$50 - >25	Bioaccumulation apparent	Enrichment Ratio $\geq$10 but <100
4 (very severe degradation)	Metal is twice S-EL	At least one metal at station is twice S-EL	Nutrient is twice S-EL	$\leq$25 - 0	--	Enrichment Ratio $\geq$100

*Station ranking is based on the results of the most sensitive test organism.

compared to a threshold level in Persaud et al. 1992), sediment toxicity testing results (using the most sensitive test organism), bioaccumulation study results, and ER calculations by normalization to either Al or Fe. The ranking by the ER was assigned by considering the order of magnitude difference between ratio values. Generally, ratios above one are interpreted to mean that chemicals are present above natural levels and are therefore contaminants, while ratios less than one are usually attributed to imprecision in establishing a baseline ratio (Dasdalakis et al. 1995). The determination of natural ratios would require collecting data from selected uncontaminated sites. Sufficient data of this nature were unavailable for this study. Instead, the approach of assuming a metal to Al or Fe ratio based on values in the literature for average crustal abundance was used to estimate the natural component of As, Cr, Cu, Ni, Pb and Zn.

RESULTS

Sediment Oxygen Demand

The results of the SOD rates are provided in Appendix B, Table 3.1B. The SOD rates for the Neponset River system, from Crackrock Pond (SNE02) to Baker Dam impoundment in Milton (SNE16), ranged from a low of 1.249 g/m^2-d in the Neponset River just downstream from Route 1, Norwood (SNE10) to a high of 2.397 g/m^2-d in the Baker Dam impoundment, Milton (SNE16).

Whole Sediment Toxicity Analysis

The results of the whole sediment toxicity analyses are presented in Appendix B, Table 3.2B, and illustrated in Figures 3.2 and 3.3. The mean survival of the test organisms, *H. azteca* and *C. tentans*, was adversely affected (less than 50% survival) in 67% of the sediment samples collected from the Neponset Reservoir (SNE01), Crackrock Pond (SNE02), Bird Pond (SNE05), Neponset River behind the Industrial Park (just downstream from Route 1, Norwood--SNE10), Factory Pond in the East Branch (SNE12), and the Baker Dam (SNE16) impoundment. Statistically significant toxicity occurred to the amphipod species at stations SNE01, SNE05, SNE12, SNE13, and SNE16 ($P \leq 0.05$), while significant toxicity to the chironomid species occurred at two other stations, SNE02 and SNE10. Although not significantly different due to variability between replicates (p-value 0.1012), reduced *H. azteca* survival in the sediments of the Neponset River at Neponset Street in Canton (SNE11) was observed. No significant toxicity to either test organism was detected in the Neponset River sediment collected near Truman Highway in Hyde Park/Milton (SNE14).

Bioaccumulation Test Study

The results of the bioaccumulation test studies (Appendix B, Table 3.3B) indicate bioaccumulation of four heavy metals (Cd, Cr, Cu, and Zn) in *L. variegatus* exposed to Neponset Reservoir sediment. The BAFs ranged from 0 to 0.581. Two metals, Cd and Cu, were found to bioaccumulate in the worms exposed to Crackrock Pond sediment. Copper was observed to bioaccumulate in worm tissues when exposed to sediment from the Neponset River at Green Lodge St. and Truman Highway (BAF of 0.039 and 0.341, respectively).

Chemical Analysis

The results of the chemical analyses are presented in Appendix B, Table 3.4B. The concentration of the heavy metals and the nutrients in the Neponset Reservoir sediments, comprised of only 10.9% solids, were found to exceed the S-EL for the following: TP, TKN, Cd, Cr, Cu, Ni, Pb, and Hg. Arsenic, Fe, and Mn concentrations were $\leq$ L-EL levels. It should be noted that the concentration of Cd was greater than 72 times the S-EL threshold value of 10 ppm, while Cu and Cr exceeded their S-EL thresholds by factors of approximately 18 and 8, respectively.

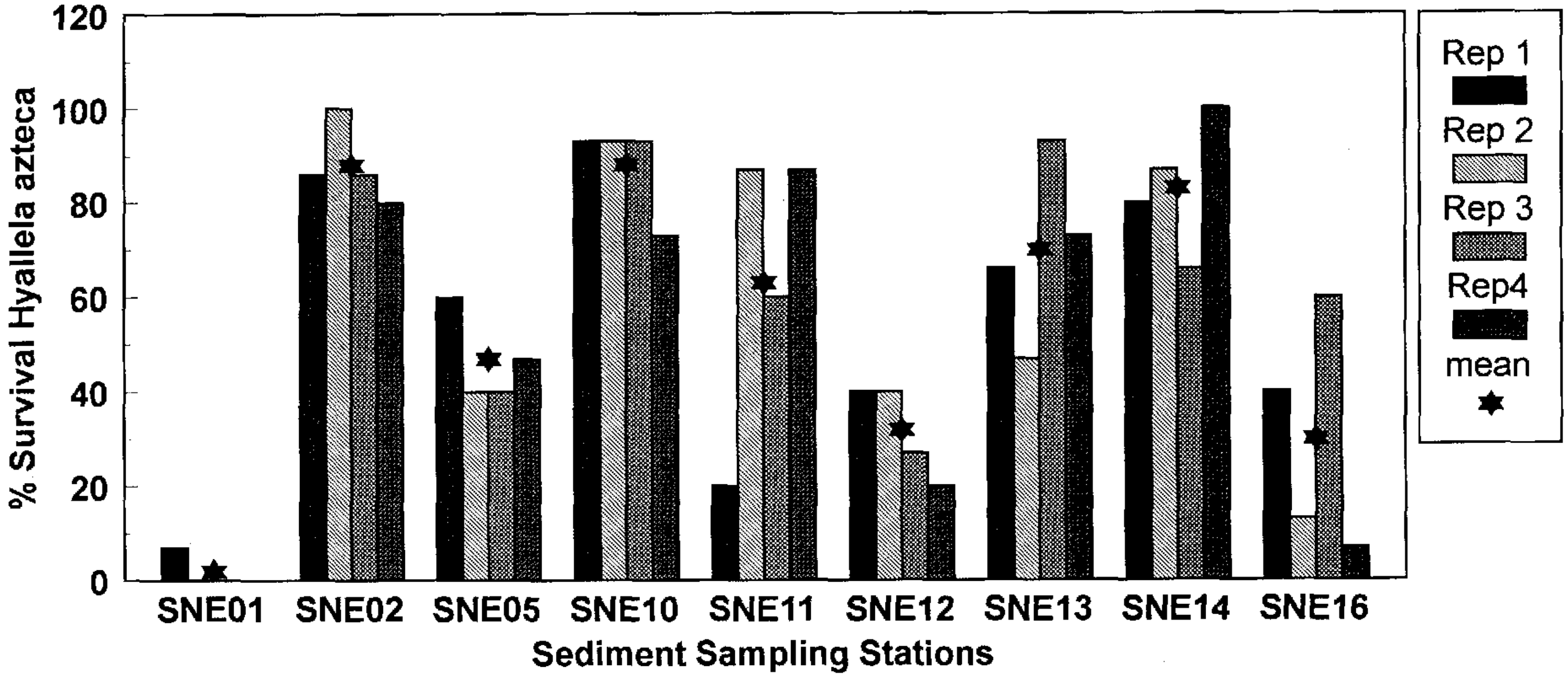
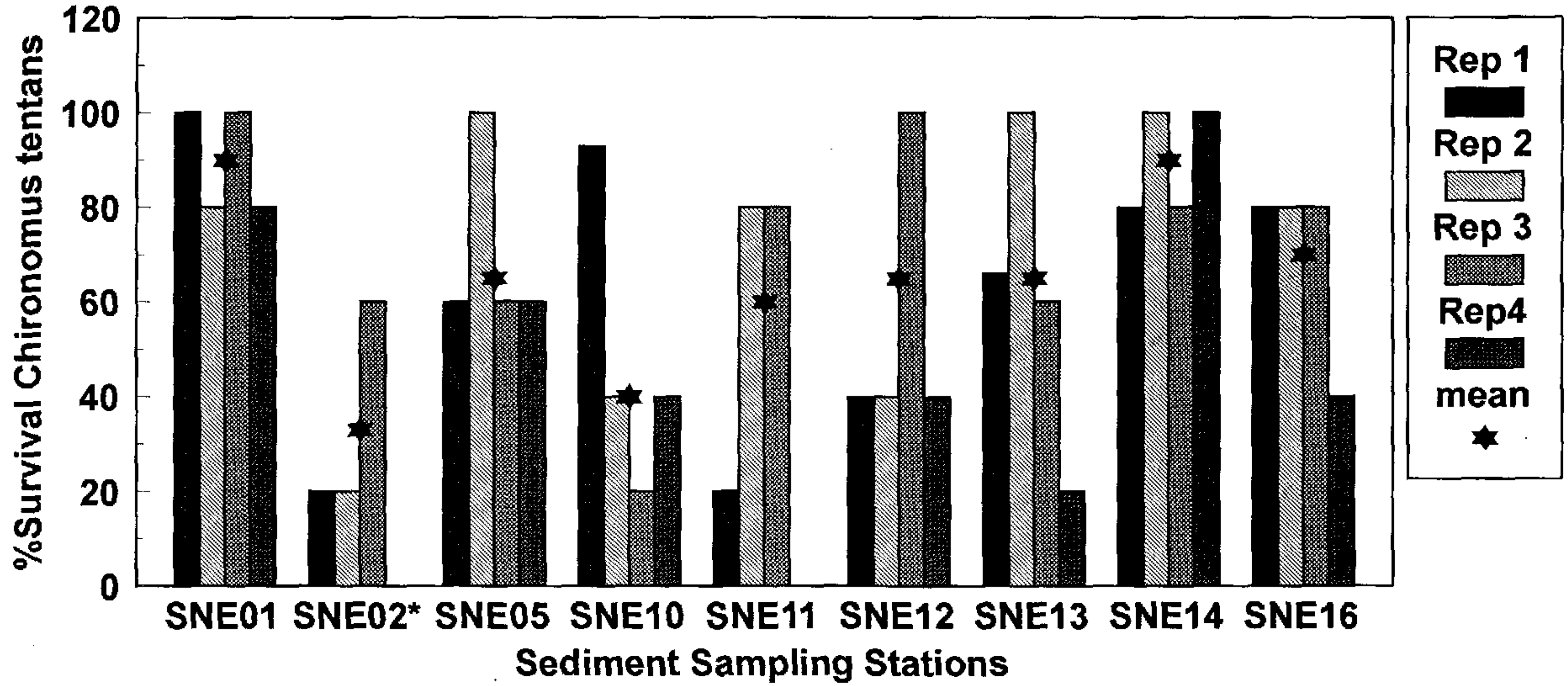


Fig. 3.2. 1994 NEPONSET RIVER BASIN SURVEY. Percent survival of *Hyallela azteca* after a 10-day exposure period in sediment collected from the following stations in the Neponset River Basin: Neponset Reservoir (SNE01), Crackrock Pond (SNE02), Neponset River, Bird Pond (SNE05), Neponset River, Pleasant Street Bridge (SNE10), Neponset River, Neponset Street, MWRA Construction Yard, Canton (SNE11), East Branch Neponset River, Factory Pond (SNE12), Neponset River, Green Lodge Street, Canton/Norwood (SNE13), Neponset River, upstream of Truman Highway, Hyde Park/Milton (SNE14) and Neponset River, Baker Dam, Milton (SNE16). Mean survival calculation based on 4 replicates of 15 organisms per test chamber. Survival of *Hyallela azteca* in reference sediment from Saw Mill Brook, Concord was 100%.



* Three replicates at SNE02 rather than four.

Fig. 3.3. 1994 NEPONSET RIVER BASIN SURVEY. Percent survival of *Chironomus tentans* after a 10-day exposure period in sediment collected from the following stations in the Neponset River Basin: Neponset Reservoir (SNE01), Crackrock Pond (SNE02), Neponset River, Bird Pond (SNE05), Neponset River, Pleasant Street Bridge (SNE10), Neponset River, Neponset Street, MWRA Construction Yard, Canton (SNE11), East Branch Neponset River, Factory Pond (SNE12), Neponset River, Green Lodge Street, Canton/Norwood (SNE13), Neponset River, upstream of Truman Highway, Hyde Park/Milton (SNE14) and Neponset River, Baker Dam, Milton (SNE16). Mean survival calculation based on 4 replicates of 5 organisms per test chamber. Survival of *Chironomus tentans* in reference sediment of Saw Mill Brook, Concord was 100%.

Concentrations of heavy metals in Crackrock Pond (SNE02) were generally in the same "effects level" range as those in the Neponset Reservoir (SNE01), with the exception of Pb, which is intermediate rather than in the S-EL category. Concentrations of the heavy metals were substantially lower in Crackrock Pond, with exceedances of the threshold levels for Cd, Cu and Cr down to factors of 11, 6, and 1, respectively, as compared to those in the Neponset Reservoir mentioned above. The total solids content of the sample was only 7.1%. The concentrations of nutrients were elevated, similar to Neponset Reservoir.

Sediment quality in Bird Pond (SNE05) was quite different from that at upstream sampling stations. Surprisingly, Cd was not detected in the sample, nor was it detected in any of the other samples collected from the mainstem Neponset River downstream from Crackrock Pond (SNE02). Given the extent of the Cd contamination in the Neponset Reservoir (SNE01), this finding is significant. It must be kept in mind, however, that this statement reflects the quality of surficial sediment. Profile data might indicate higher concentrations based on past activity. Additionally, the minimum detection limit (MDL) for Cd was actually > L-EL level; therefore, potential impacts related to the Cd concentration cannot be assessed. The assumption for this analysis will be that the Cd concentration is in the intermediate EL level. Concentrations of As and Pb were three to four times higher than detected in Crackrock Pond. Iron and Mn were in the intermediate category (> L-EL but < S-EL thresholds), while Cr concentrations decreased from the S-EL (upstream) to the intermediate category (downstream). Although elevated (S-EL levels), Cu concentrations decreased (from upstream values) to a factor of 1.5 times the S-EL threshold. Nutrient levels were still elevated, although the TKN was approximately half that documented in Crackrock Pond. Total solids content was low (12%).

All of the analytes measured in the sediments of the Neponset River just downstream from Route 1, Norwood (SNE10) were found to be ≤ L-EL threshold except for Cd and Pb which were in the intermediate ranges. This is likely due in part to the coarse-grained sediments at this location (which as such do not have the binding capacity of the finer, more organic sediments which were prevalent in the upper part of the watershed). The total solids content of the sediment at this station was the highest (74.5%) measured in the Neponset River Basin.

The quality of the Neponset River sediments in Fowl Meadow (SNE11) was quite similar to that in Bird Pond (SNE05), in terms of threshold levels, with the exception of Pb (approximately half that of SNE05) and Hg (above the S-EL threshold level of 2 ppm). The other analytes were essentially in the same range as Bird Pond with TP, TKN, and Cu in the S-EL category, although TP and TKN were approximately 50% lower at SNE11 than at SNE05.

The East Branch Neponset River, the Neponset's major tributary, joins the mainstem in the Fowl Meadow, between stations SNE11 and SNE13. Several analytes (TKN, Cd, Cr, Cu, and Pb) exceeded the S-EL threshold, while the remainder fell into the intermediate category. The sediments collected in Factory Pond (SNE12) contained what appeared to be significant amounts of petroleum products (visible oil sheens on the surface the water column and odor noted as the samples were being retrieved).

The quality of the Neponset River sediments in the vicinity of Green Lodge St., Canton (SNE13) was similar to that documented at SNE11, except for the decrease in concentrations of both TP and Mn, dropping them into the intermediate and low threshold levels, respectively, while the concentration of Zn, although still in the intermediate threshold level, was also much lower at SNE13. The concentration of Hg (3.33 ppm dry weight) was the highest measured in this study.

The quality of the sediments of the Neponset River at the downstream boundary of the Fowl Meadow ACEC (SNE14) was similar to that at SNE10, except TKN, Cu, and Hg, which were in the intermediate threshold level (the similarity may be due in part to the texture of the sediments). The total solids content was the second highest (51.7%) measured in the Neponset River Basin. Concentrations of Mn and Fe were roughly 47 to 57% less at SNE14, while Cr and Hg concentrations were roughly 45% greater than that at SNE10. A general trend toward decreasing concentrations of TP and TKN was observed through the Fowl Meadow area (SNE11 through SNE14), likely the result of accumulation in the wetland system.

The concentration of Cu, Pb, and Hg exceeded the S-EL threshold level in the Neponset River just upstream from the Baker Dam in Milton (SNE16). Nutrients (TP and TKN), As, Cd, Cr, Ni, and Zn were in the intermediate range while Fe and Mn were below the L-EL threshold. In addition, oil deposits were also noted in the sediments during the field collection, evidenced by the appearance of globs and sheens.

The sediment data for As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, and Zn in the Neponset River Basin were also compared to the mean (and range) of heavy metals in 100 Massachusetts lakes and ponds, compiled by Rojko (1990), collected as part of the DEP's Clean Lakes Program baseline and long-term monitoring projects. The data set also included various consultants' information collected to fulfill requirements for lake restoration projects. This data set does not represent ambient or background (pristine) sediment quality information for Massachusetts, but it serves as a reference for typical sediment quality in the state.

The concentration of Cd in the Neponset Reservoir sediment is extremely high, while the concentration in the sediment of Crackrock Pond (SNE02), is also well above the mean Cd concentration of 20.4 mg/kg noted by Rojko (1990). Also of note is the concentration of Hg in the Neponset River sediments. With the exception of SNE10, all of the remaining Hg concentrations were greater than the mean concentration of 0.28 mg/kg, and some stations (i.e., SNE13 and SNE16) had concentrations similar to the maximum values reported by Rojko (1990). On the other hand, the As concentrations from all of the Neponset River sediments samples were below the mean concentration of 22.4 mg/kg. The distribution of the other heavy metals (refer to Figure 3.4) fall within the distribution range noted by Rojko (1990).

The sediment data were also normalized to the Al and Fe concentration for each sample to aid in the interpretation of the data. The results of this analysis (Appendix B, Table 3.5B), indicate that all stations sampled had high enrichment ratios for Cd, and the sediments in Neponset Reservoir and Crackrock Pond (SNE01 and SNE02), Factory Pond, and the East Branch Neponset River, Canton (SNE12) have extremely high enrichment ratios for Cr, Cu and Zn. The enrichment ratio for Pb was also extremely high at Factory Pond and at the Baker Dam impoundment, Milton (SNE16). No similar trends were observed for either As or Hg.

Sediment Quality Rank

Results of the sediment quality rank (Appendix B, Table 3.6B) indicate the overall quality of the sediments in the Neponset River and its impoundments, as well as in the East Branch Neponset River at Factory Pond are severely degraded. The SQR for each river segment was determined by using the worst case SQR assignment of the stations within the stream reach sampled.

DISCUSSION

Upper Neponset River (Segment 1)

As the sediment quality ranking system indicates, sediments in the Neponset Reservoir are highly contaminated with heavy metals, in particular Cd, Cr, Cu, Ni, and Pb. Slightly elevated concentrations of Zn and Hg were also measured. Additionally, the nutrient concentrations of both TP and TKN exceeded S-EL threshold levels earning sediment quality ranks (SQRs) of "3" and "4", respectively. Significant toxicity to the amphipod, *H. azteca*, after a 10-day exposure period, confirms the potential for adverse impacts to the biota

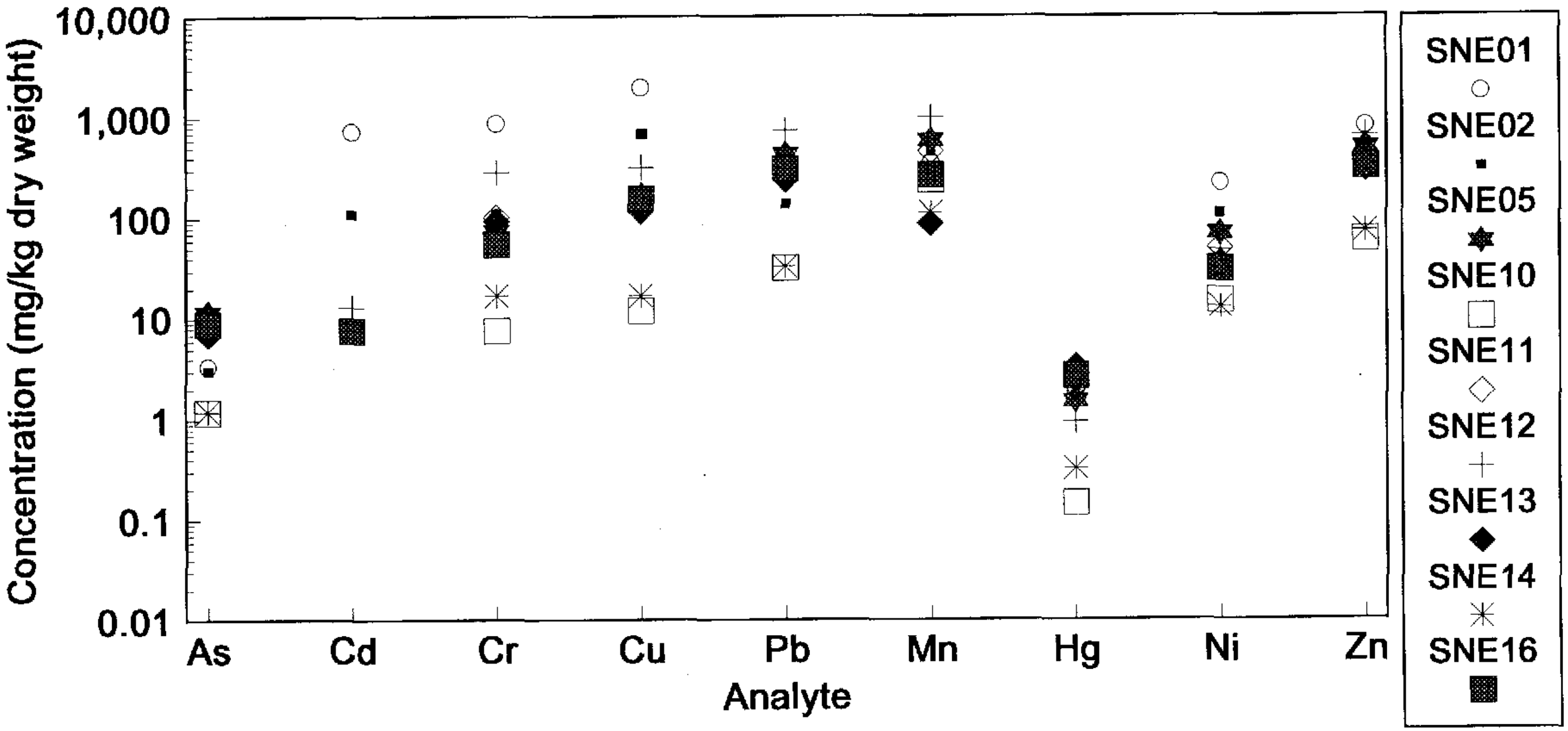


Fig. 3.4. 1994 NEPONSET RIVER BASIN SURVEY. Concentration of selected elements in sediment collected from the following stations in the Neponset River Basin : Neponset Reservoir (SNE01), Crackrock Pond (SNE02), Neponset River, Bird Pond (SNE05), Neponset River, Pleasant Street Bridge (SNE10), Neponset River, Neponset Street, MWRA Construction Yard, Canton (SNE11), East Branch Neponset River, Factory Pond (SNE12), Neponset River, Green Lodge Street, Canton/Norwood (SNE13), Neponset River, upstream of Truman Highway, Hyde Park/Milton (SNE14) and Neponset River, Baker Dam, Milton (SNE16). The ranges (min., max., mean) of heavy metals in the sediments of Massachusetts lakes and ponds (Rojko 1990) noted below for comparison.

Rojko 1990:

Analyte	As	Cd	Cr	Cu	Pb	Mn	Hg	Ni	Zn
maximum	336.0	320.0	1312.0	3663.0	2478	3120	2.87	2158.0	1922
minimum	0.0	0.0	1.5	2.9	3	29	0.0	0.0	5
mean	22.4	20.4	73.8	267.5	244	382	0.28	151.8	332

(survival of one organism out of 60). Bioaccumulation factors in the earthworm, *L. variegatus*, exposed to the Neponset Reservoir sediment for a period of 28 days, also indicates the potential for bioaccumulation of Cd, Cr, Cu, and Zn withBAFs ranging from 0 to 0.581. Enrichment ratios were also extremely high for Cd, Cr, Cu, and Zn. SQRs of "3" and "4" were assigned for enrichment ratios for all the metals. Altogether, the sediment quality in the Neponset Reservoir, as evidenced by SQRs of mostly "3" and "4"s, is severely impaired, and does not support the "aquatic life".

Empirical SOD measurements were performed at selected sampling stations during the 1994 Neponset River survey to provide actual, site-specific deoxygenation rates. Recalibration of the model using measured values for SOD would allow for a clearer definition of existing dissolved oxygen relationships in the Neponset River, and a more reliable waste load allocation for Hollingsworth & Vose, Inc. The SOD rates obtained for the Neponset River (Appendix B, Table 3.1B) were comparable to other freshwater systems measured in New England (Barr 1995). For example, sediment oxygen demand in the impoundments of the Blackstone River system ranged from a low of 1.546 g/m^2-d to a high of 6.026 g/m^2-d (1991 Blackstone River Initiative Report, EPA undated).

The oxygen demand of the sediments from Crackrock Pond (SNE02), given the eutrophication problems associated with the Neponset Reservoir and the discharge of municipal wastewater to Crackrock Pond, was less than expected with a mean rate of 1.81 g/m^2-d. The sediment sample was comprised primarily of organic matter and the total solids content was 7.1%. Although considerably less concentrated, the levels of metals in the sediments of Crackrock Pond still exceeded the S-EL threshold levels with the total metal category rating a SQR of "4". Nutrient concentrations were elevated earning SQRs of "3" and "4". Significant toxicity to the chironomid, *C. tentans*, occurred, however, the amphipod test organisms were not adversely affected when compared to the reference station. Bioaccumulation test results indicate the potential for bioaccumulation of Cd and Cu (BAFs of 0.04 to 0.145) in earthworms exposed to Crackrock Pond sediment. SQRs of mostly "3"s and "4"s indicate the sediment quality was not considered supportive of "aquatic life".

The concentration of nutrients, Cu and Pb exceeded the S-EL threshold levels in the sediment sample collected from Bird Pond (SNE05). The remaining metals were in the intermediate threshold level, generally detected in lower concentrations than at the upstream stations, except for As which increased by a factor of 3.8. The total metal SQR for this station was assigned a "3". The oxygen demand of the sediment was 1.55 g/m^2-d. Significant toxicity was detected in the whole sediment sample to *H. azteca*. Bioaccumulation of heavy metals does not appear to pose a threat to the biota. Overall, however, based on the SQRs of "3" and "4" for total metals, nutrients, toxicity testing and enrichment ratios, the sediments were considered not supportive of the "aquatic life" use.

Sediment sampling of the Neponset River in the vicinity of Pleasant Street bridge in Norwood (SNE10) revealed perhaps the least contaminated station along the Neponset River mainstem. However, the sediment texture was coarse sand, and the sample contained the highest percentage of total solids (74.5%) of all of the sampling stations. As such, it is not surprising that the sediments had the lowest oxygen demand of any of the stations tested (1.25 g/m^2-d). The concentration of nutrients and metals were < L-EL threshold, except for Pb which was slightly higher than the L-EL level. However, due to the significant toxicity (SQR of "3") to *C. tentans* that was observed, the overall assessment of sediment quality at this station is "non-support".

As the sediment quality ranking system indicates, the sediments in the upper Neponset River segment do not support the "aquatic life" use due to severe contamination by excess nutrients, heavy metals, and whole sediment toxicity. A potential also exists for bioaccumulation of Cd, Cr, Cu, and Zn.

Middle Neponset River (Segment 2)

The sediment quality of the Neponset River just upstream from Neponset Street bridge, Canton in the headwaters of Fowl Meadow (SNE11) was found to exceed S-EL threshold levels for nutrients, Cu and Hg with SQRs of "3". The remaining metals fell into the intermediate threshold levels. While not statistically significant different from the reference sediment condition (due to variability between replicates [p-value 0.1012]), reduced *H. azteca* survival at this station was observed. The mean oxygen demand of the sediment at this station was 2.08 g/m^2-d. The sediments are considered "non-support" with SQRs of "3" for total metals and nutrients and an SQR of "4" for enrichment ratio.

Sediment quality of the Neponset River sediments in the vicinity of Green Lodge Street, Canton (SNE13) was similar to that documented at SNE11, except for the decrease in concentrations of both TP and Mn, dropping them into the intermediate and low threshold levels, respectively, while the concentration of Zn, although still in the intermediate threshold level, was also much lower at SNE13. A notable finding at station SNE13 was Hg at a concentration of 3.33 ppm dry weight - the highest concentration measured in the study area. Sediment oxygen demand at this station was 1.98 g/m^2-d. Significant toxicity to the amphipod exposed to whole sediment, as well as slight potential for bioaccumulation of Cu (BAF 0.039) to the earthworm, results in a "non-support" determination for the "aquatic life" use.

The quality of the sediments of the Neponset River at the downstream boundary of the Fowl Meadow ACEC (SNE14) was generally less than the L-EL threshold levels with SQRs of "1". Total kjeldahl nitrogen, Cd, Cu, Pb, and Hg, were in the intermediate threshold level with SQRs of "2". None of the analytes exceeded the S-EL level, and no adverse impacts to the test organisms occurred during the whole sediment toxicity test. Slight potential for bioaccumulation of Cu (BAF 0.341) was measured. Oxygen demand of the sediments at this station was relatively low (0.71 g/m^2-d). Although potentially the result of sediment texture, the trend was towards general improvement in overall bulk sediment concentration of contaminants moving downstream.

The highest SOD measured (2.397 g/m^2-d) was in the sediment collected from the Baker Dam impoundment, Milton (SNE16), which is most likely the cumulative impact of all upstream activities. Many stormwater outfalls, some of which have been identified as having significant cross connections of untreated wastewater, as well as the contribution of any contaminants via Mother and/or Pine Tree Brook tributaries, may also have contributed to the higher SOD at Baker Dam. The SOD in the Baker Dam impoundment is most likely the result of the cumulative impact of all upstream activities. With SQRs of "3" concentrations of Cu, Pb, and Hg exceeded the S-EL threshold levels, while nutrients (TP and TKN), As, Cd, Cr, Ni, and Zn were in the intermediate range (SQRs of "2"). Organic contamination (evidenced by odor and the appearance of oil globs and sheens during collection) may be severe, but was not directly measured. Bioaccumulation tests were not conducted at this station, however significant whole sediment toxicity to the amphipods was documented. With SQRs of "3" for both total metals and toxicity testing, the "aquatic-life" use was not supported.

Like the upper Neponset River segment, severe contamination of the sediments by excess nutrients, heavy metals, whole sediment toxicity, and the potential bioaccumulation of Cu, render the sediments in the lower segment of the Neponset River " non-support" for the "aquatic life" use.

East Branch Neponset River (Segment 4)

Sediments collected from Factory Pond in the East Branch Neponset River with SQRs of "3" and "4" exceeded the S-EL threshold levels for TKN, Cd, Cr, Cu, and Pb, while the remainder fell into the intermediate category. Based on the enrichment rank ratios with SQRs of mostly "3" and "4", the sediments appear to be as severely contaminated as the Neponset Reservoir and Crackrock Pond. The whole sediment toxicity analysis also supports this conclusion with significant toxicity occurring to the amphipods exposed to SNE12 sediment. Oxygen demand of the sediment at this station was 2.30 g/m^2-d. Although not directly assessed within the scope of this survey, organic contamination (i.e., oil from leaking underground storage tanks and recent spills at the Canton High School), is most likely contributing to the overall degradation of sediment quality conditions in this segment. Due to the above-mentioned contaminants, the overall quality of the sediments in the East Branch Neponset River do not support the "aquatic life" use. The exact sources of contamination (with the exception of the known hazardous material releases) are unknown.

Table 3.3 summarizes the evaluation of each component of the sediment monitoring effort and provides the framework for the overall aquatic life use support determination.

Table 3.3. 1994 NEPONSET RIVER BASIN SURVEY. Assessment of aquatic life use support and sediment quality conditions using Sediment Quality Rank (SQR, "1" = low contamination through "4" = high contamination) in the mainstem Neponset and East Branch Neponset River segments.

Assessment	Upper Neponset River (10.4 River Segment Miles)	Middle Neponset River (12.2 River Segment Miles)	East Branch Neponset River (2.6 River Segment Miles)
Total Metals	Segment SQR "4"	Segment SQR "3"	Segment SQR "4"
Nutrients	Segment SQR "4"	Segment SQR "3"	Segment SQR "3"
Toxicity Testing	Segment SQR "4"	Segment SQR "3"	Segment SQR "3"
Normalization to Al	Segment SQR "4"	Segment SQR "4"	Segment SQR "4"
Bioaccumulation Studies	Segment SQR "3"	Segment SQR "3"	Not Assessed
Aquatic Life Use Support Determination	"Non-support"	"Non-support"	"Non-support"

RECOMMENDATIONS

In summary, sediment quality in the impoundments of the mainstem Neponset River and the East Branch Neponset River is severely impacted by high concentrations of heavy metals and excess levels of nutrients. Significant toxicity of whole sediment was also measured at all but two test stations, while the potential bioaccumulation of four of the heavy metals tested (Cd, Cr, Cu and Zn) also pose a threat to the organisms which rely on benthic invertebrates as their food source. **Severe sediment contamination by heavy metals exists in the Neponset Reservoir, Factory Pond, and Crackrock Pond.** Although not assessed, bioaccumulation of Hg, based on the bulk concentration detected in the Neponset River sediments, may also pose a significant ecological risk (and potentially human health risk). Organic analysis (PCBs and PAHs) is strongly recommended for future study based upon field collection observations (oil sheens/globs, odor, etc.) and the urbanized nature of the basin, and their potential impacts on aquatic life. Contamination of the sediments in the middle Neponset River segment with PCBs migrating from the Grant Gear Superfund Site (Meadow Brook, Norwood) should also be assessed.

SECTION 4: BIOLOGICAL ASSESSMENT

INTRODUCTION

Biomonitoring is an integral component of OWM's watershed-based water quality management program. Its importance is underscored in the "Declaration of Goals and Policy" Section 191 (a) of Public Law 92-500 [as amended, (33 U.S.C.1251 et seq.)], The Federal Water Pollution Control Act Amendments, which stresses the need to restore the biological integrity of the nation's waters and achieve a water quality which provides for the protection and propagation of aquatic life. As promulgated in the Massachusetts Surface Water Quality Standards (MA DEP 1995a), which state that "Class B waters are designated as a habitat for fish, other aquatic life, and wildlife..", the narrative criteria for biological integrity is assessed through the biological monitoring conducted in the Neponset River and selected tributaries. The use support determinations are summarized for the two beneficial uses of the Class B waters in the Neponset River Basin: aquatic life (and its subclasses of cold and warm water fisheries) and fish consumption. Aesthetic quality is also partially assessed through biomonitoring activity. The aquatic life and fish consumption use-support determinations are integrated into the overall assessment of the Neponset River Watershed.

This section of the report presents biological survey results for the Neponset River and selected tributaries conducted between 18 and 21 July 1994. The biological studies included periphyton, benthic macroinvertebrate and fish assemblage analyses, supplemented with an assessment of available habitat and measurements of stream flow.

Additionally, fish sampling of Willet Pond and the Neponset River in the headwater area of Fowl Meadow was conducted as part of OWM's Fish Toxics Monitoring Program. Fish toxics monitoring was aimed primarily at assessing human health risks associated with the consumption of freshwater fish. The program is a cooperative effort between three DEP Offices/Divisions, (i.e., Watershed Management, Research and Standards, and Environmental Analysis) the Massachusetts Department of Public Health (MDPH), and the Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement. Fish tissue monitoring is typically conducted to assess the levels of toxic contaminants in freshwater fish, identify waterbodies where those levels may impact human health, and identify waters where toxic chemicals may impact fish and other aquatic life. Nonetheless, human health concerns have received higher priority and, therefore, fish tissue analysis has been restricted to edible fillets. The fish toxics monitoring was designed to screen the edible fillets of several species of fish representing different feeding groups (i.e., bottom dwelling omnivores, top-level predators, etc.) for the presence of heavy metals, PCBs and chlorinated pesticides.

FIELD AND LABORATORY METHODS

Stream Discharge

Stream discharge was measured at each station using a low-flow Swoffer meter (model 2100) according to standard operating procedures (TSB 1989). Field data were recorded on standard flow gauging field sheets. Data reduction and stream discharge calculations were performed at the OWM's Grafton office. Stream discharge of the mainstem Neponset River at South Street in Walpole (NE04) was measured by building a log dam at the entrance of the culvert. Some flow seeped through, and consequently the measurement underestimates the actual discharge value. Additionally, stream discharges under a variety of flow regimes (Appendix B) were estimated for each biological monitoring station by DEM. Measured stream discharge was used to calculate a flow factor, defined as the discharge (volume in cubic feet per second) per square mile of drainage area (cfs/mi^2) to define the flow regime of the basin (or tributary stream) in reference to low-flow conditions (i.e., the seven-day, ten-year low flow or 7Q10).

Biomonitoring Stations and Protocols

Biomonitoring was conducted at 11 stations as described in Table 4.1 and noted in Figure 4.1. Methods used to evaluate the biological data collected during this survey followed those outlined in Protocols II (benthic macroinvertebrates) and V (fish) in Plafkin et al. (1989). These protocols will henceforth be referred to as RBP II and V. Each component of these protocols is described briefly in the following sections as are the supplemental monitoring efforts.

TABLE 4.1. 1994 NEPONSET RIVER BASIN SURVEY. Biological monitoring stations and sampling conducted at each station including habitat assessment (H),stream discharge (Q), non-diatom algae (P) and diatom assemblage (D) inventory, benthic macroinvertebrate sampling (B), fish assemblage (F), and fish tissue/toxics monitoring (T).

STATION[1]	RIVER MILE[2]	DRAINAGE AREA (mi^2)	STATION LOCATION[1]	SAMPLING CONDUCTED
NE04	21.1	11.13	Neponset River, South Street, Walpole	H, Q, P, D, B, F
2B0B	20.0, 5.4	2.19	Mill Brook, Route 109, Medfield	H, Q, P, B, F
NE09	16.3, 0.2	8.63	Hawes Brook, Washington Street, Norwood	H, Q, P, D, B, F
1B03	16.3, 3.6+	--	Willet Pond, Walpole/Westwood/Norwood	T
NE10	15.8	34.7	Neponset River, Pleasant Street Bridge, Norwood	H, Q, P, D, B, F
NE11	13.3	--	Neponset River, Neponset Street, Canton	T
5B01	14.2, 1.7	2.51	Traphole Brook, Cooney Street, Walpole	H, Q, P, D, B, F
5B0B	14.2, 3.2	0.91	Traphole Brook, High Plain Street, Sharon	H, Q, P, B, F
NE12	13.4, 1.8	27.93	East Branch Neponset River, Neponset Street, Canton	H, Q, P, D, B, F
9B0B	13.4, 2.6, 3.9	4.7	Massapoag Brook, Deb Sampson Street, Sharon	H, Q, P, B, F
14B03B	3.9, 0.4	8.13	Pine Tree Brook, Ruggles Lane/School Street, Milton	H, Q, P, B, F

[1] stations and location descriptions are ordered according to stream hierarchy and classification system (Halliwell et al. 1982) where tributaries are indented under their main stem stations.
[2] from mouth of Neponset River as defined as the corporate boundary between Boston and Quincy (at Commercial and Squantum Points), confluence of tributary
-- not calculated; fish toxics monitoring only

Habitat Assessment

An integral component of both RBP II and V is an assessment of the habitat quality at each station. Physical characteristics of the stream substrate, channel morphology, and the structural stability of the stream banks are scored according to the methods outlined in the RBP manual (Plafkin et al. 1989). The percent comparability between the reference station and the test station habitat scores are then utilized to help determine if a change in the biota is due to

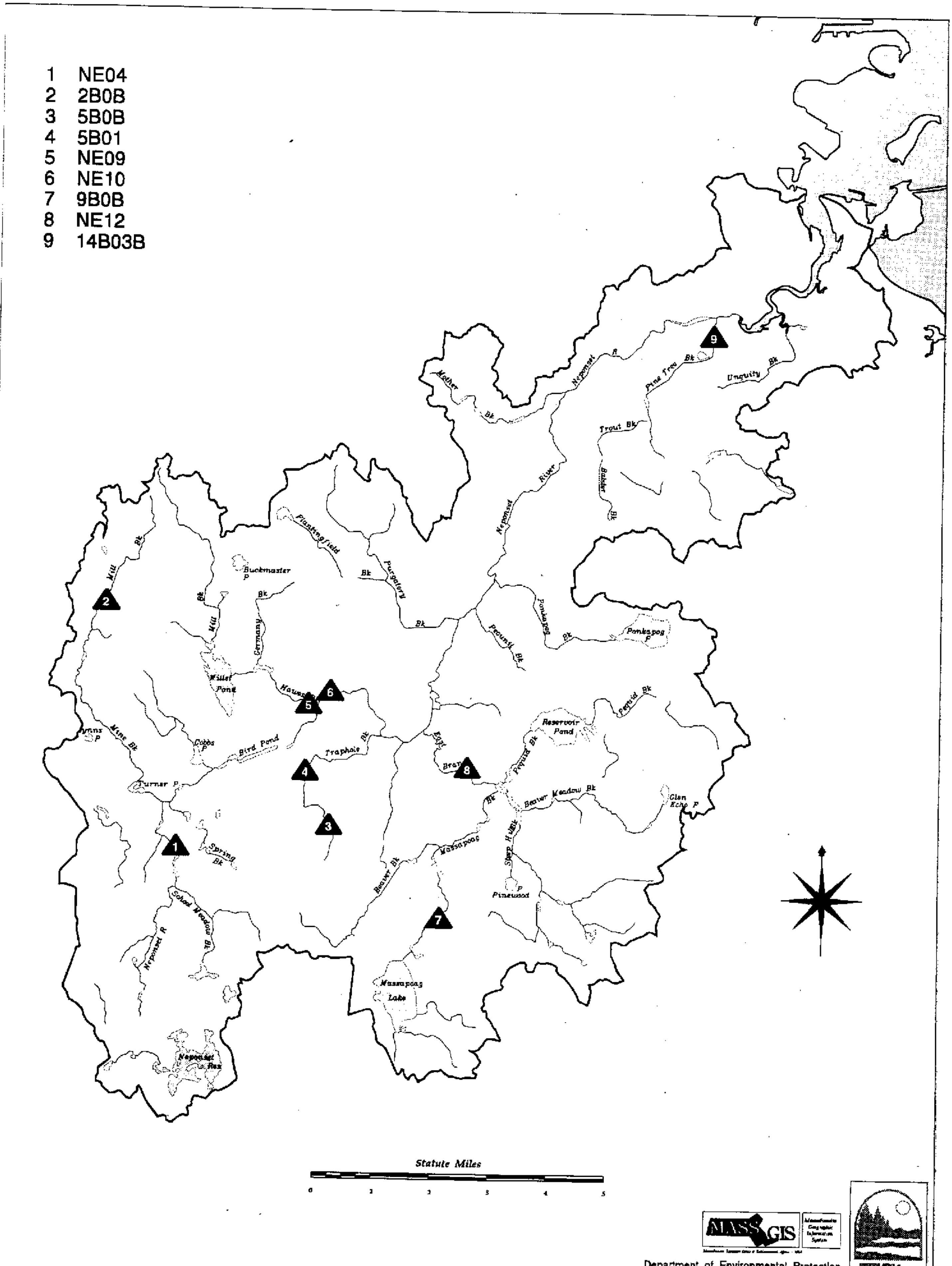


Fig. 4.1. 1994 NEPONSET RIVER BASIN SURVEY. Location of biological monitoring stations.

impacts other than habitat differences. An inventory of the predominant riparian and aquatic vegetation at each site was also included as part of the overall habitat assessment.

Periphyton

A qualitative assessment of the periphyton, or the attached algal assemblage, was made by scraping and cleaning natural substrates from various habitats in the vicinity of the macroinvertebrate sampling locations, where some sunlight penetrated the canopy. The collection method is described in Bahls (1993). An effort was made to sample a variety of substrates at each site, including riffle, run and adjacent pools. The surfaces sampled were rocks, logs, vegetation and sediment. Both macroalgae and microalgae were sampled. Surfaces were scraped with a knife into a 16 ounce wide-mouth jar, creating a composite sample of the algae present. The macroalgae were collected by hand and added to the sample, or they were scraped from the surfaces with a knife. Enough ambient water was added to the sample jar to cover the algae. Jars were labeled, placed in a cooler, and brought back to the lab for examination.

Initial examination of the algae sample, within 24-hours of collection, was done without preservative. For the non-diatom algae, the sample was first shaken and a subsample was removed with a pipette to a Palmer counting cell for examination at 400x. Non-diatom algae were identified to genus. An Olympus compound microscope equipped with Nomarski optics was used for the identifications. After screening, the slide was examined at 200x; the non-diatom algae as well as any diatoms present were classified based on their relative abundance according to the following scheme:

R-rare	fewer than 1 cell/field-of-view at 200x on average;
C-common	at least 1, but fewer than 5 cells/field-of-view;
VC-very common	5-25 cells/field-of-view;
A-abundant	>25 cells/field-of view;
VA-very abundant	cells/field-of-view too numerous to count.

Diatom counts were performed for five of the nine biomonitoring stations: the mainstem Neponset River in Walpole and Norwood (NE04 and NE10, respectively), East Branch of the Neponset River in Canton (NE12), Hawes Brook in Norwood (NE09), and Traphole Brook in Walpole (5B01). Diatoms were cleared of organic matter and examined according to the procedure in Bahls (1993). This involved homogenizing samples and oxidizing away all organic matter. The diatom samples were examined using a Palmer cell at 400x. One-hundred organism samples were used in this analysis and were comprised of the first 100 diatoms that were observed in each sample. These were identified to genus using Dodd (1987). For some stations, several slides were necessary to obtain the 100 diatoms. Data were reported as percent composition of diatom community assemblage.

Aquatic Macroinvertebrate Community (RBP II)

RBP II involves the collection of benthic macroinvertebrates by D-frame kicknet sampling in two square meters of riffle. A 100 organism subsample was sorted and identified from each sample collected in the field, and the identifications were later verified at OWM's laboratory. Coarse particulate organic matter (CPOM) sampling to determine shredder abundance was excluded from the RBP II protocol. Analysis of the macroinvertebrate data followed the procedures for RBP II. Seven metrics (including richness, a modified Family Biotic Index or FBI, functional feeding group, ratio of individual Ephemeroptera, Plecoptera, and Trichoptera or EPT to the Chironomidae individuals, percent contribution of the dominant taxa, EPT index, and the percent similarity of the community structure) were utilized to classify the biological condition of the macroinvertebrate community as non-impaired, moderately impaired, or severely impaired (Plafkin et al. 1989). It should be emphasized that the goal of this analysis was to provide a rough overview of the relative health of the benthic community at each test station relative to that at a reference (least impacted) station of a similar habitat type within the region. Estimates of community structure and function using RBP II may be somewhat variable. More rigorous techniques (e.g., multiple samples and genus-level identification) should be used if the goal of the survey it to provide a more accurate characterization of community structure and function.

Two macroinvertebrate samples were collected in the mainstem Neponset River in the vicinity of Pleasant Street Bridge in Norwood. The first sample (NE10 in Appendix B, Tables 4.5B-4.7B), was collected upstream from the bridge. Large pieces of iron and other anthropogenic debris, along with boulders and other immobile substrates, made the standard kick sampling extremely difficult. A second kick sample was collected approximately 200 m downstream from the Pleasant Street Bridge (referred to as station NE10B), where the substrates were more conducive to obtaining a more representative macroinvertebrate sample. The sample collected at this site was used in the overall assessment of the benthos in the mainstem Neponset River at Pleasant Street in Norwood.

Fish Community (RBP V)

Fish communities were sampled at each station using a battery-powered backpack electrofishing unit (Smith Root Model 12). A single pass was made in a representative stream reach (containing riffle, run, and pool habitat, when available) measuring approximately 100 meters. Fish sampling commenced at a downstream riffle or other barrier (e.g., seine net, culvert, etc.) and proceeded upstream in side to side sweeps. Sampling was terminated at an upstream riffle, net, or other barrier marking the end of the reach. Attempts were made to pick up all fish (except young-of-the-year) observed. All fish collected were held in plastic buckets for identification, enumeration, and subsequent release. Voucher specimens were retained and preserved for later verification if field identifications were questionable.

The RBP V protocol (Plafkin et al. 1989) calls for the analysis of the data generated from fish collections using an established Index of Biotic Integrity (IBI) similar to that described by Karr (1986). A modification of Karr's IBI for use in the Merrimack, Connecticut, and Mohawk River Drainage Basins was drafted by Miller, Daniels, and Halliwell in 1986; however, a final version has not been published. In light of the absence of an applicable IBI for the Neponset Watershed or for its respective ecological sub-region, total number of fish species, presence of intolerant species, and other qualitative analyses and limited quantitative analyses such as density were used to assess the condition of the fisheries community at each station. Surface area was calculated by determining a mean width for each station and multiplying this value by the estimated stream reach in which the fish sampling was performed. Density is reported as the number of fish/100m^2. In some instances, stream size contributed to inefficient backpack electrofishing. Extreme width and/or depth allow many fish to escape the effects of the electrofisher and may result in missed species or low density estimates. Electrofishing efficiency and problems associated with the fish sampling were noted at each station and considered in the overall station analysis.

In addition to stream electrofishing, one station at Willet Pond was sampled using a seine net (150' long by 6' deep bag, 6'x6'x6' with 1/8" mesh, the rest of the net was 1/4" mesh). The seine sampling targeted a shallow flat littoral habitat for young-of-the-year (YOY) and juvenile fishes. The station sampled was located next to the North Walpole Sportsmen's Club swimming beach. Emergent and submergent aquatic macrophytes were present, providing excellent cover for young fishes.

Fish Toxics

Uniform protocols, designed to assure accuracy and prevent cross-contamination of samples, were followed for collecting, processing and shipping fish. Fish were collected with electroshocking gear or gill nets. Lengths and weights were measured, and fish were visually examined for tumors, lesions, or other indications of stress or disease. Scale samples or pectoral spines were obtained from each sample to determine the approximate age of the fish.

Willet Pond was sampled on 26 July 1994 with the assistance of the Massachusetts Division of Fisheries and Wildlife. Gill nets were set, and boat electroshocking was performed in the littoral habitat. Fish collected were stored on board in a live-well filled with site water. Fish to be included in the sample were removed from the live well and placed in ice-filled coolers. Fish were removed from gill nets at the end of the day and placed in an ice-filled cooler. Live fish which were not included as part of the sample were released. Trot lines were baited and set on the afternoon of 18 August 1994. These lines were left overnight and retrieved the morning of 19 August 1994. Fish to be included in the sample were removed from the trot lines and placed on ice for subsequent preparation later in the day.

The Neponset River was sampled by OWM and the MDFW on 27 July 1994 using rod and reel. In addition, boat electroshocking was performed by OWM on 12 August 1994. All fish which were to be included in the sample were stored on ice for subsequent processing later that day.

Fish were transported to the wildlife laboratory at the Massachusetts Division of Fisheries and Wildlife (MDFW) Field Headquarters in Westborough where they were measured, weighed, and examined. The general condition of each fish was recorded as was the species, length, weight, and the sample type (i.e., individual vs. composite).

Fish were filleted (skin off) on glass cutting boards and prepared for freezing. All equipment used in the filleting process was rinsed in hot water to remove slime, scales, and other fluids such as blood, then re-rinsed twice in deionized water before (and/or after) each sample. Two to five fillets from like-sized individuals of the same species (composite samples) were wrapped together in aluminum foil or stored in the single sample container. Fillets targeted for metals analysis were placed in VWR 32 ounce high density polyethylene (HPDE) cups with covers. The opposite fillets were wrapped in aluminum foil for % lipids, Pcb and organochlorine pesticide analysis. Samples were tagged and frozen for subsequent delivery to WES.

Methods used at WES (WES 1994) for analyzing metals include the cold vapor method using a VGA hydride generator for mercury and Varian 1475 flame atomic absorption for all remaining metals. PCB/organochlorine pesticides analyses were performed on a gas chromatograph equipped with an electron capture detector.

RESULTS

Stream Discharge

The Swoffer meter measures velocity accurately to 0.1 feet per second (fps), and the mean velocities at some of the stations were at or near this value (see Appendix B, Table 4.1B). However, only Massapoag Brook in Sharon (9B0B) had a number of individual measurements that were between 0 and 0.1 fps. Flow factors (cfs/mi^2) are also included in Appendix B, Table 4.1B.

Habitat

The habitat assessment scores ranged between 77 (out of a possible score of 135), at the upstream sampling station on Traphole Brook in Sharon (5B0B), to 116 at the East Branch Neponset River in Canton (Appendix B, Tables 4.1B and 4.2B). High values are considered to be diverse and stable habitats, capable of supporting a balanced, indigenous population of aquatic organisms. Low values indicate stressed conditions where one would expect to find less diverse assemblages of aquatic organisms. The habitat scores of the smaller tributaries were lower than the mainstem Neponset River stations and the East Branch Neponset River. Based on the overall habitat assessment score and water temperatures, Hawes Brook (NE09) was selected as the warm water reference station and Traphole Brook (5B01) was selected as the cold water reference station. All of the stations had habitat quality at > 87% comparable to the reference stations, thus, habitat quality would not be considered to be the cause of any impairment in the overall biological assessment at any of the sampling stations. However, neither of the reference stations selected necessarily represent the ideal or model reference condition. The Department has not yet established ecoregional reference stations or biocriteria with which to compare test stations. Results are qualified by the habitat assessment and comparison to the selected reference. Dominant aquatic and riparian vegetation were inventoried in each sampling reach (Appendix B, Table 4.3B).

Periphyton

Periphyton are attached algae that, like other plants, use energy from the sun for photosynthesis and growth. The non-diatom algae include all the algal groups, but exclude the diatoms which have a rigid silica containing cell wall (frustule). The non-diatom algae were not very abundant at the locations that were sampled during July (Appendix B, Table 4.4B). Traphole Brook at Cooney Road in Walpole (5B01) was an exception. Long streamers of the filamentous green alga *Mougeotia* sp. occurred at this station, indicative of nutrient enriched conditions. Also noted in Traphole Brook at Cooney Road in Walpole was the presence of the filamentous bacteria, *Sphaerotilus* sp., another indicator of nutrient enrichment. *Mougeotia* sp. was also found in the mainstem Neponset River in Walpole (NE04).

The diatoms (Appendix B, Table 4.5B) were also indicative of water quality conditions. The distribution of the diatom genera are graphically depicted in Figure 4.2. While the communities were each comprised of approximately the same number of genera present in low numbers, of particular note is the distribution of cell counts among diatom genera at Traphole Brook (5B01). This station exhibited the most number of genera (12) with five or less cells counted for each, an indication of higher diversity. Yet, one genus, *Navicula*, accounted for 35% of all diatom cell counts (according to Patrick, 1973, as organic enrichment increases, some organisms will become very common, and as a result the diversity of the biological community will decrease).

Some physical conditions can also provide a more suitable habitat for algae in addition to nutrient levels. Hynes (1970) noted the temporal nature of a *Mougeotia* bloom as most likely to occur during low water conditions in warm weather. This he describes as indicating "...how opportunistic are many algae, and how quickly they can occupy and exploit favorable situations." Since low flow conditions were present throughout the watershed, this factor may in part provide the conditions for the abundant growth of *Mougeotia* noted in Traphole Brook (5B01).

In contrast, the diatom assemblage in Hawes Brook (NE09) was different from the other stations sampled since it did not have genera present in counts greater than 16 - 20 diatoms. The relative diversity of the diatom assemblage in the Hawes Brook system is indicative of a healthy diatom community.

The diatom genera occurring in samples from the Neponset River were assigned pollution tolerance values according to a classification system reported from Montana (Bahls 1993). Based on this classification system, the diatom assemblage indicated oligotrophic conditions at all sampling stations.

Aquatic Macroinvertebrates (RBP II)

The RBP II inventory of the resident community at each sampling station is

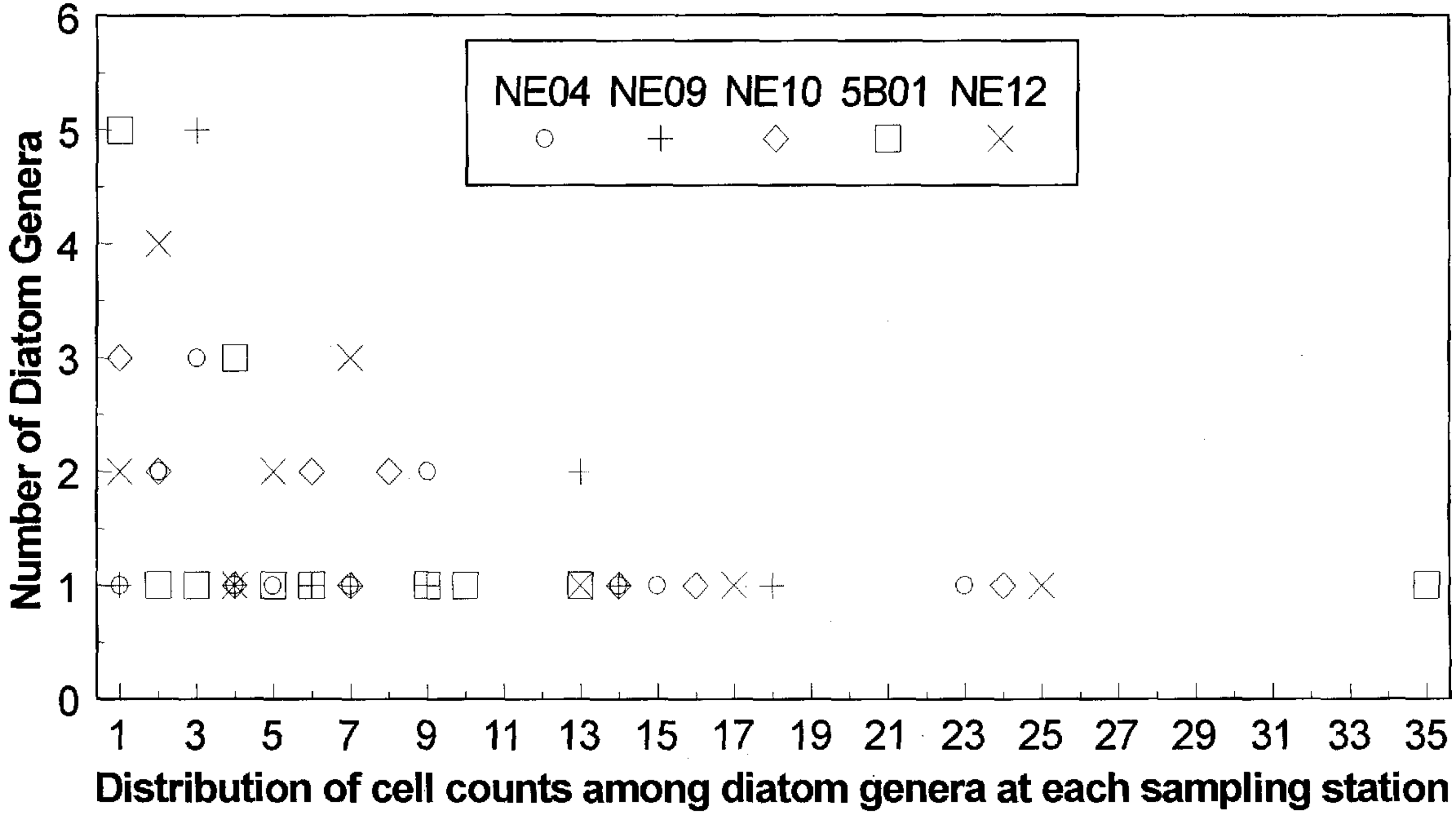


Fig. 4.2. 1994 NEPONSET RIVER BASIN SURVEY. Distribution of cell counts among attached diatom genera recorded for the following stations in the Neponset River Basin: Neponset River, South Street, Walpole (NE04), Hawes Brook, Washington Street, Norwood (NE09), Neponset River, Pleasant Street Bridge, Norwood (NE10), East Branch Neponset River, Neponset Street, Canton (NE12), Traphole Brook, Cooney Street, Walpole (5B01). This graphic presentation is based on 100 cell counts from attached diatom samples collected at each station.

provided in Appendix B, Table 4.6B. The RBP II analysis of the macroinvertebrate communities (Appendix B, Table 4.7B) indicated conditions ranging from non-impaired to moderately impaired (Figure 4.3 and Appendix B, Table 4.8B). Moderate impacts were documented at all test stations with two exceptions, the mainstem Neponset River at South Street in Walpole (NE04) which ranked as borderline non-impacted, and Mill Brook in Medfield (2BOB) when the Hawes Brook (NE09) station was used as the reference condition. However, a second comparison was warranted for the Mill Brook station using Traphole Brook as the reference since historical information (MA DEM 1991, DFWELE 1983) indicates that Mill Brook once supported a self-sustaining population of salmonids (i.e., trout). In this comparison, Mill Brook was found to be moderately impacted (only **46%** comparability to the reference station condition).

Taxa richness at the two reference stations, Hawes Brook (NE09) and Traphole Brook (5B01) was relatively high (taxa richness 17 and 18, respectively) (Appendix B, Table 4.7B). The Ephemeroptera, Plecoptera, Trichoptera (EPT) index in Traphole Brook (5B01) was more than double that of any other station sampled (Figure 4.4). However, the contribution of the dominant families was greater than 30% at both reference stations, also observed at all but two test stations. The percent contribution of the dominant family in Mill Brook (2B0B) and the upstream station on Traphole Brook (5B0B) was 27% and 28%, respectively.

The benthos in the Neponset River at Pleasant Street, Norwood were dominated by the hydropsychids (i.e., net-spinning caddisflies) comprising 97% and 68% of the benthos at NE10 and NE10B, respectively. This imbalance in the community structure is indicative of stress when compared to the community structure of the Neponset River benthos at South Street, Walpole (NE04). Shifts in the structure and function of the macroinvertebrate communities in the mainstem between South Street, Walpole and Pleasant Street, Norwood can be summarized as follows: decrease in the overall taxa richness by 6 families, including one EPT, a decrease in the ratio of the EPT/chironomids (9.11 to 82), and a decrease in the percent contribution of the dominant families (42 to 68%). These negative changes in community structure indicate the presence of pollution sources or other stress between these two sites.

The benthos were also hyperdominated by the hydropsychids (88%) in the sample obtained in the East Branch Neponset River, Canton.

Fish Community (RBP V)

The results of the fish collections at each station are contained in Appendix B, Table 4.9B. The review of the fish assemblages, with regard to the presence of intolerant or true stream species, and the quality of the available fisheries habitat, is presented in the discussion section.

Beach seining at Willet Pond resulted in the collection of 458 fish (including YOY) representing six different species. Species collected in order of abundance included: yellow perch (*Perca flavenscens*) (90), banded killifish (*Fundulus diaphanus*) (83), bluegill (*Lepomis macrochirus*)(68), pumpkinseed (*Lepomis gibbosus*)(44), black crappie (*Pomoxis nigromaculatus*) (42), and largemouth bass (*Micropterus salmoides*)(15), the remaining 116 being YOY sunfish (*Lepomis sp*). These fishes were collected in one pass with the beach seine.

Fish Toxics

Gill netting and electrofishing at Willet Pond resulted in the collection of five largemouth bass. Trot lines produced two brown bullheads (*Ameiurus nebulosus*).

Rod and reel fishing at the Neponset River on 27 July resulted in the collection of two largemouth bass and three black crappie. Electroshocking on 12 August resulted in the capture of two additional black crappie, five common carp (*Cyprinus carpio*) and five brown bullhead.

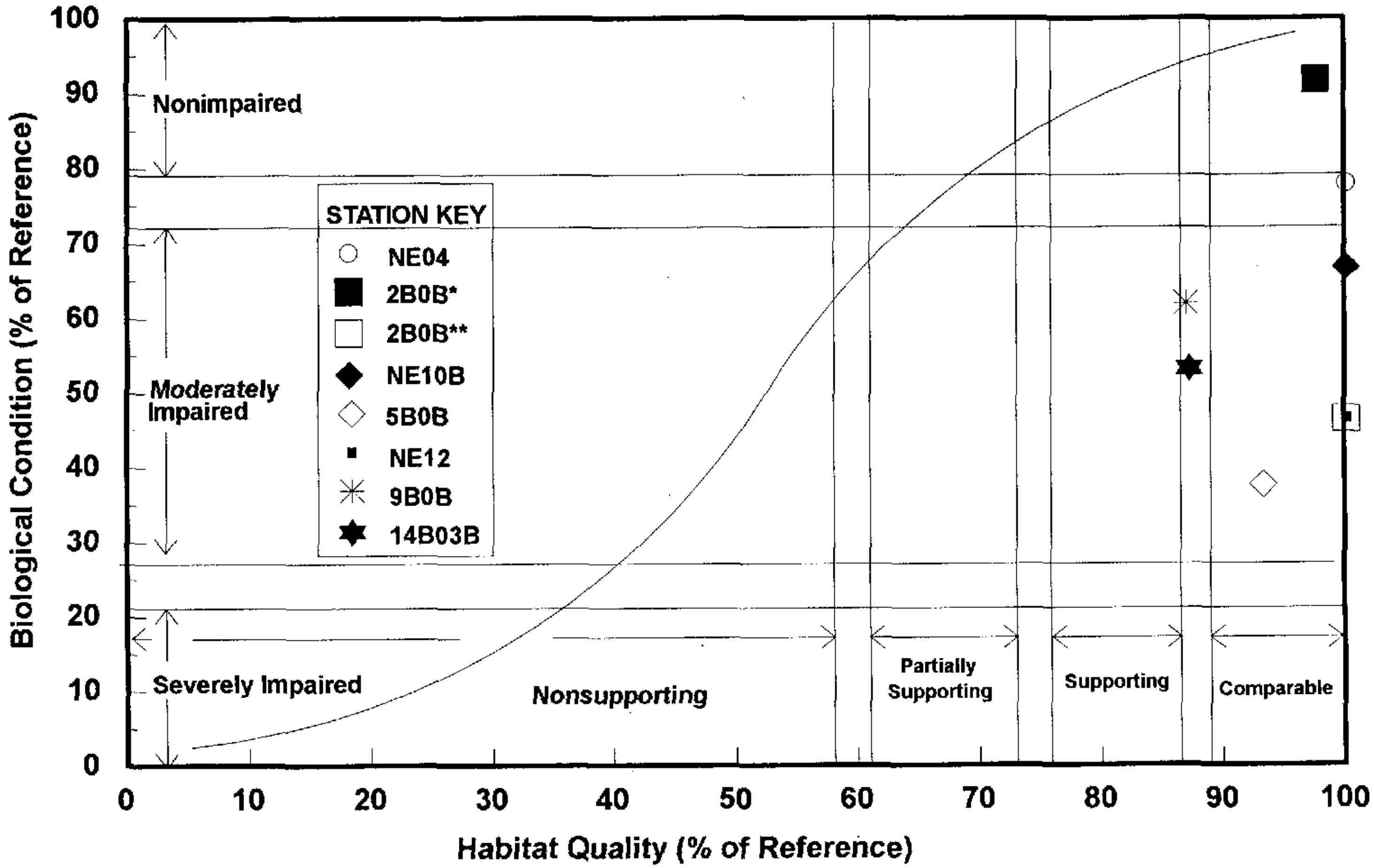


Fig. 4.3. 1994 NEPONSET RIVER BASIN SURVEY. Habitat quality and condition of benthos at the following stations in the Neponset River Basin: Neponset River, South Street, Walpole (NE04), Mill Brook, Route 109, Medfield (2B0B), Neponset River, downstream Pleasant Street Bridge, Norwood (NE10B), Traphole Brook, High Plain Street, Sharon (5B0B), East Branch Neponset River, Neponset Street, Canton (NE12), Massapoag Brook, Deb Sampson Street, Sharon (9B0B) and Pine Tree Brook, Ruggles Lane/School Street, Milton (14B03B).

Note: * reference station NE09, ** reference station 5B01

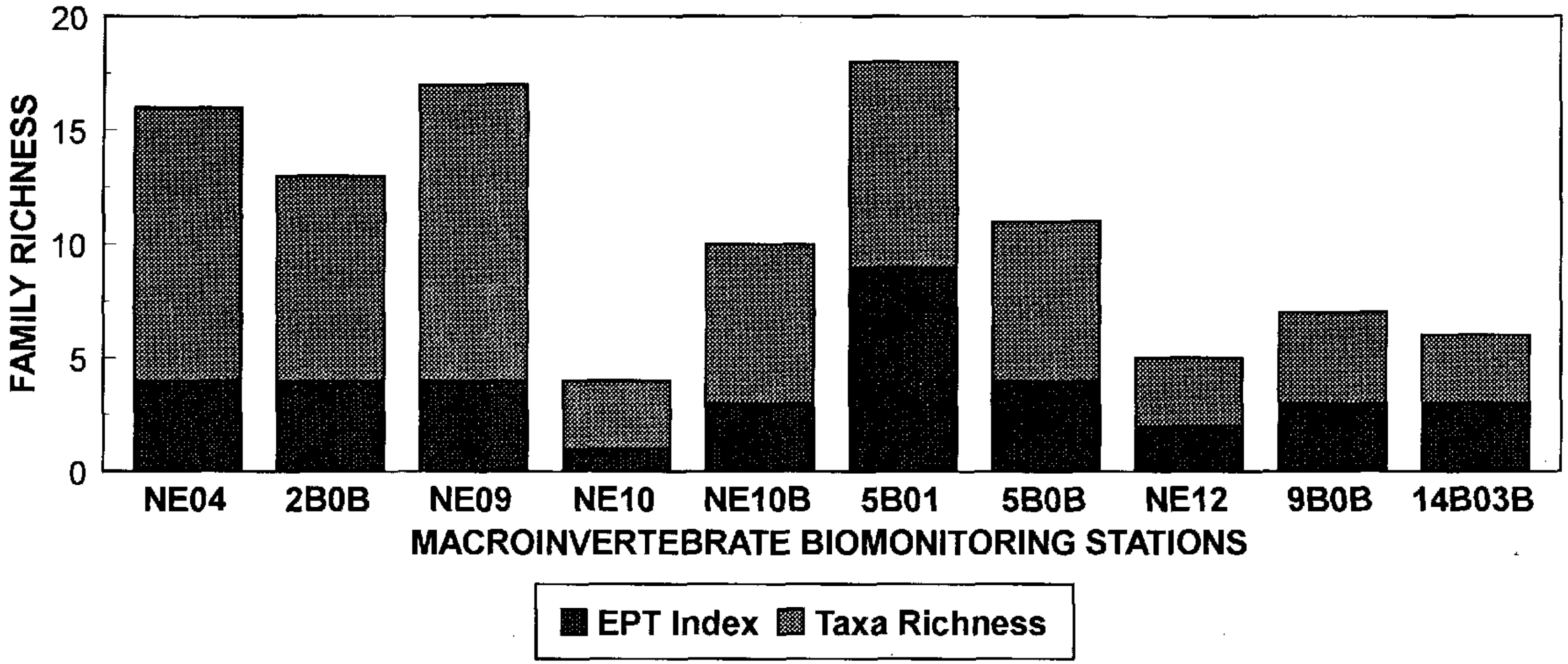


Fig. 4.4. 1994 Neponset River Survey. Results of EPT Index (number of Ephemeroptera, Plecoptera and Trichoptera families) and Taxa Richness (total number of families) of the benthos at the following locations in the Neponset River Basin: Neponset River, South Street, Walpole (NE04), Mill Brook, Route 109, Medfield (2B0B), Hawes Brook, Washington Street, Norwood (NE09), Neponset River, Pleasant Street Bridge, Norwood (NE10), Neponset River, downstream Pleasant Street Bridge, Norwood (NE10B), Traphole Brook, Cooney Street, Walpole (5B01), Traphole Brook, High Plain Street, Sharon (5B0B), East Branch Neponset River, Neponset Street, Canton (NE12), Massapoag Brook, Deb Sampson Street, Sharon (9B0B) and Pine Tree Brook, Ruggles Lane/School Street, Milton (14B03B).

In most cases, fish selected for analysis represented species and sizes desirable by the angling public for consumption, as well as fish from different feeding guilds (i.e., predator, invertivore, omnivore). Appendix B, Table 4.10B lists species, length, and weight data for each composite sample.

Arsenic, lead, and cadmium in edible fillets were below detection (As=<0.040 mg/kg, Pb=<1.0 mg/kg, Cd=<0.20 mg/kg) in all samples analyzed. Selenium was detected in four of the six samples analyzed and mercury was detected in all samples (Appendix B, Table 4.10B). Total mercury ranged from a high concentration of 0.58 mg/kg in largemouth bass from Willet Pond to a low concentration of 0.092 mg/kg in brown bullhead from the Neponset River. Quality Assurance/Quality Control Data can be found in Appendix A.

PCB Arochlor 1254 was detected in two samples from the Neponset River (Appendix B, Table 4.10B). Concentrations ranged from 0.17 mg/kg (ppm) in a composite of largemouth bass (NRF94-1+2) to 1.4 mg/kg in a composite of brown bullhead (NRF94-21-25). PCB Arochlor 1254 was below the method detection limit (MDL) of 0.17 mg/kg in all remaining samples. Organochlorine pesticides were below MDLs in all samples analyzed.

DISCUSSION

Aquatic Life

The assessment of the biological condition of the Neponset River and selected tributaries, in terms of use support for aquatic life and fish consumption, revealed conditions ranging from full "support" to "non-support". Table 4.2 summarizes the evaluation of each component of the biomonitoring survey and provides the framework for an overall aquatic life use support or fish consumption determination. A total of 34.7 river miles were assessed for biological integrity (or aquatic life) while 12.2 river miles were assessed for fish consumption use support. Fish toxics monitoring in Willet Pond is assessed in the Lake Section (5.0) of this report.

Table 4.2. 1994 NEPONSET RIVER BASIN SURVEY. Use support determinations for aquatic life and fish consumption.

Assessment	Upper Neponset River (NE04)	Mill Brook (2B0B)	Hawes Brook (NE09)	Middle Neponset River (NE10)	Traphole Brook (5B01-5B0B)	East Branch Neponset (NE12)	Massapoag Brook (9B09)	Pine Tree Brook (14B03B)
Use Support Determination for •Aquatic Life	Non-support	Non-support	Support	Not Assessed	Support	Non-support	Non-support	Non-support
•Fish Consumption	Not Assessed/ Non-support•	Not Assessed	Not Assessed	Non-support•	Not Assessed	Not Assessed	Not Assessed	Not Assessed
River Miles in segment/subshed	10.4	5.4	3.6	12.2	4.3	2.6	5.1	3.3
Benthos	NI(borderline)/ MI	NI(W)/ MI(C)	NI reference	Not Assessed	MI/NI reference	MI	MI	MI
Fish	stressed	stressed	partial	Not Assessed	stressed/ excellent	stressed	stressed	partial

• Public Health advisory (elevated PCB concentrations in brown bullheads) issued for the Neponset River between Hollingsworth & Vose Dam in Walpole and Tileston Dam in Boston (Hyde Park).

Neponset River (NE04) - The habitat available in the Neponset River at South Street in Walpole was conducive to supporting a diverse and balanced biological community. The benthos, comprised of organisms from 16 families, was considered non-impaired (borderline) in comparison to the Hawes Brook reference station. A total of twenty-six fish representing five different species was collected or observed. Brook trout (*Salvelinus fontinalis*) and redfin pickerel (*Esox americanus americanus*) were each represented by one individual and American eel (*Anguilla rostrata*) was represented by two individuals. The brook trout appeared to be a stocked fish as evidenced by deformed dorsal and pectoral fins which are, in many cases, consistent with hatchery rearing. The fish assemblage was dominated by bluegill, a pond species, and white sucker (*Catostomus commersoni*). Fish cover was plentiful in this reach and the low species richness and number of individuals was indicative of a stressed waterbody. Altogether, the aquatic life use support status of the Neponset River in this segment, was determined to be "non-support".

Mill Brook (2BOB) - The Mine Brook subwatershed in the Neponset River Basin, includes the Tubwreck, Mill, and Mine brooks. Biological monitoring data from Mill Brook off Route 109 in Medfield was selected to assess the aquatic life use support for the subwatershed. Available habitat quality was considered fair and nonpoint sources of pollution (runoff from nearby housing development projects) pose a significant threat to this stream. The benthic community was represented by a total of 13 families, four of which were within the EPT taxa. The dominant family represented 27% of the sample. Although the RBP II assessment using Hawes Brook as a reference condition was found to be non-impaired, the benthos rated as moderately impaired when compared to the benthos in the cold water reference station of Traphole Brook. The fish sample at Mill Brook consisted of 39 fish representing three species and dominated by redfin pickerel, a predator. Five golden shiner (*Notemigonus crysoleucas*) and one pumpkinseed made up the rest of the sample. Fish habitat was limited by shallow depth and the lack of a variety of flow regimes (e.g., deep/shallow pools and riffles). Much of the substrate was sand or mud and streamflow was very low in view of the size of the drainage area (0.09 cfs/mi^2).
Although documented by Massachusetts Fisheries and Wildlife and Environmental Law Enforcement as a naturally reproducing trout stream (Appendix B, Table 4.11B), the high water temperature (26°C) and absence of salmonid species in the stream reach sampled lead to the conclusion that the Mill Brook system is no longer sustaining a cold water biological community. The overall assessment of the aquatic life use for the Mine Brook subwatershed was "non-support".

Given the complexity of the relationship between water quality and quantity, and acknowledging the various uses of the Commonwealth's water resources, a detailed inflow/outflow analysis of the Mine Brook subbasin was undertaken by DEM, and is provided in the water use and streamflow (Section 9) of this resource assessment report.

Hawes Brook (NE09) - This tributary was chosen as the warm water reference station because the habitat quality was considered good with respect to stability and composition of streambed substrates. Instream cover was considered fair. Due to its selection as the reference condition, the biota were considered non-impaired. Additionally, Hawes Brook supported the most diverse fish assemblage of any of the stations sampled in the Neponset River Basin. A total of eleven fish species were sampled; however, only five (American eel, redfin pickerel, fallfish [*Semotilus corporalis*], white sucker, and brown bullhead can be described as true "stream species". Fallfish and white sucker young-of-the-year were abundant. Bluegill, golden shiner, pumpkinseed, largemouth bass and yellow perch are all species more commonly found in the lentic habitats of larger rivers, lakes, and ponds. It is highly probable that these fish were emigrating from a small pond tributary to Hawes Brook upstream of the targeted reach. Despite the presence of five species of stream fishes, none could be considered intolerant of degraded habitat and/or water quality. There was a noticeable amount of trash and debris present which appeared to have been serving as "cover." Again, streamflow was extremely low when compared with the size of the drainage area (0.05 cfs/mi^2). Overall, it was determined that the aquatic life use was "supported" in the Hawes Brook system. The trash noted instream did, however, degrade the aesthetic quality.

Neponset River (NE10) - The habitat quality in the mainstem Neponset River near Pleasant Street bridge in Norwood, a channelized reach, was excellent except for the presence of anthropogenic debris. The macroinvertebrate community was hyperdominated by hydropsychids (generally considered to be pollution tolerant organisms) and was assessed as being moderately impacted. Furthermore, as indicated in the results section, the benthos appeared to be responding to unidentified pollution impact (point and/or nonpoint source) between South Street in Walpole and the Pleasant Street bridge in Norwood. This station has the largest drainage area of any of those sampled, and electrofishing was at times nearly impossible due to great depth or width. Seven species were collected, with four (spottail shiner [*Notropis hudsonius*], fallfish, white sucker, and American eel) representing classic stream species and three (largemouth bass, yellow perch, and bluegill) more indicative of ponds. The absence of an intolerant species was again noted; however, poor sampling efficiency in deep runs and pools could have resulted in missed species. Fallfish and spottail shiner young-of-the year (YOY) were very abundant but not counted, and many adult spottails were observed escaping the electrical field. The overall assessment of aquatic life use is "non-support".

Traphole Brook (5B01 and 5B0B) - Two stations were used to determine the aquatic life use support status of Traphole Brook. In its headwaters, the available habitat was limited by shallow depth and little instream cover. Downstream the habitat was considered good. Local watershed erosion was noted throughout this tributary system and nonpoint source pollution from road runoff may exacerbate the sedimentation problem. The upstream segment of Traphole Brook was originally selected as the reference station. However, the biota were found to be less diverse than the downstream station at Cooney Road. Headwater streams are naturally less productive than larger drainage area segments, which may in part be responsible for the lower number of macroinvertebrate taxa (seven less than documented at the Cooney Road station) and the moderately impaired assessment of the benthic community in comparison to the reference community at Cooney Road. Similarly, the fish collection at the upstream station on Traphole Brook was comprised of only two brook trout parr and two small common carp. The absence of additional trout (especially YOY) could be a concern although gravel spawning riffles were absent. The presence of common carp is even more alarming. These fishes usually inhabit larger rivers and ponds and are known to increase turbidity as a result of their feeding behavior (Scott and Crossman 1973). It was very surprising to find young carp in such a small headwater (coldwater) stream. Reconnaissance downstream of this station revealed a number of small man-made dams creating backyard ponds. The fish sample from Traphole Brook at Cooney Road included nine brown trout (*Salmo trutta*) (4 YOY), ten brook trout (20 YOY), and one white sucker. Electrofishing efficiency was rated excellent and available habitat included riffle/run/pool characteristics with a coarse stony substrate. Fish abundance seemed consistent with habitat availability, with the larger adult fish in the deeper pools and runs and the YOY spread through the shallower habitats associated with available cover. Reproducing brook and brown trout are both considered intolerant of degraded habitat and dissolved oxygen/temperature stress. The presence of these species are indicative of a "least-impacted" station, and therefore served as the reference station condition for the Neponset River Basin. The instream temperature of Traphole Brook ranged between 15.3 and 18.8°C, well within the standards for supporting a cold water fishery. The overall aquatic life use support status for Traphole Brook is "support". This stream, however, could be considered threatened, due to the presence of small man-made impoundments and the common carp in the fish community.

East Branch Neponset River (NE12) - The habitat of the East Branch Neponset

River, although channelized, scored the highest of all of the stations sampled biologically in the Neponset River Basin. Although the available habitat was well stabilized, and a variety of flow regimes were present, the water temperature of this major tributary to the Neponset River was extremely high (31°C) and was in violation of the Massachusetts Surface Water Quality Standards (MA DEP 1995a) for a Class B warm water fishery. The benthos was found to be moderately impaired since only five families were noted with the hydropsychids comprising 88% of the sample. The number of fish present was also extremely low in relationship to the amount of available habitat. The fish assemblage in this reach of the East Branch Neponset River was dominated by yellow perch. Two additional pond species (i.e., bluegill and pumpkinseed) were also present. Stream species present included American eel and fallfish. High water temperature (31°C) may have impacted the stream fish community present and an impoundment located just upstream was probably the source of the yellow perch, bluegill, and pumpkinseed. The overall use support determination for aquatic life is "non-support".

Massapoag Brook (9B0B) - The stream segment sampled in Massapoag Brook, a tributary to the East Branch Neponset River, was very embedded with fine sediment. Slight sediment oils appeared in the kick sampling area, while brown floc covering the streambed caused turbidity when disturbed. On the day of sampling the streamflow appeared adequate, but regulation at the Massapoag Lake outlet and at Manns Pond could affect streamflow at certain times of the year resulting in habitat alteration. Water temperature was 24.1°C, indicative of the impounded nature of the stream. Several planktonic genera were present, which probably originated in the lake. These genera included *Oscillatoria*, *Lyngbya*, *Euastrum*, *Closterium*, and *Staurastrum*. The lake plankton eventually get eliminated from the water column by adhering to periphyton and by the "screening effect" created by submerged aquatic vegetation. Philopotamid and hydropsychid caddisflies dominated the benthic sample indicating moderate impairment in comparison with the Hawes Brook reference station. The fish sample was dominated by sunfish and bass, presumably emigrating from the lake. One American eel, one creek chubsucker (*Erimyzon oblongus*) and three white sucker made up the true stream fish assemblage. Habitat was limited, and fish density was lower than would be expected. The overall aquatic life use assessment was "non-support".

Pine Tree Brook (14B03B) - Although channelized in the sampling reach near Ruggles Lane/School Street, Milton, Pine Tree Brook exhibited available habitat in the form of cobble/gravel substrates with a few scattered boulders. The stream reach was well shaded and the water temperature was 20°C. This was second only to the Traphole Brook tributary (of the stations sampled) in terms of potential to support a cold water fishery. Streamflow, however, was limited (0.02 cfs), as evidenced by the lack of depth in the pool areas. Debris in the form of broken glass and other trash impaired the aesthetic quality of this tributary. The benthic community was hyperdominated by hydropsychid caddisflies, and was moderately impaired in comparison with the Hawes Brook reference station. The fish collection in Pine Tree Brook was dominated by American eel and white sucker. White sucker YOY were present at numbers too numerous to count. One small brown trout was also collected and appeared to be native (due to the lack of deformity on the dorsal and/or pectoral fins). Three redfin pickerel, and two brown bullhead comprised the remainder of the collection. While all six fish species collected were true stream species, the only intolerant species was the single brown trout. Overall, the aquatic life use was determined to be "non-support".

In addition to the overall aquatic life use support determinations, biomonitoring in the Neponset River Basin provided a "baseline" condition from which future monitoring efforts can be compared, particularly when management controls/remediation efforts have been employed. Such before/after evaluations also provide a framework for measuring success.

Fish Consumption

The MDPH reviewed the data on concentration of metals in fish fillets and issued the following advisory based on elevated mercury concentrations in largemouth bass: "Because of health concerns associated with exposure to mercury, the Massachusetts Department of Public Health offers the following recommendations":

1. "Children under 12, pregnant women and nursing mothers should refrain from consuming largemouth bass from Willet Pond in order to prevent exposure of developing fetuses and young children to mercury.

2. The general public should limit consumption of largemouth bass from Willet Pond to two meals per month."

It should be noted that, because of the elevated levels of mercury in certain species of freshwater fish, the MDPH issued a statewide Interim Freshwater Fish Advisory in September 1994. The interim advisory recommends that "Pregnant women should be advised of the possible health risk from eating fish in Massachusetts freshwater bodies in order to prevent exposure of developing fetuses to mercury." The advisory does not include stocked trout or farm-raised fish sold commercially. Over the last ten years, the United States Food and Drug Administration's (USFDA's) Action Level for mercury of 1.0 ppm has been re-assessed by many state health agencies and the US EPA. As a result, the MDPH has set a total mercury "trigger level" of 0.5 mg/kg for any given species. When the average level of mercury in a particular species exceeds 0.5 mg/kg the MDPH issues an advisory to sensitive groups to eat none (of that species) and the general population to eat only 2 meals per month (of that species). Any concentration over 1.0 mg/kg would result in an advisory against consumption of said species by all groups. Although slightly elevated, mercury concentrations in largemouth bass from Willet Pond are consistent with those from a number of other waterbodies across the Commonwealth. While this may suggest "background" levels of mercury, it should be noted that according to MDFW records, Willet Pond was "created ca 1911 by Winslow Brothers Smith Company, a then 100-year-old tannery of Norwood, Mass." It is possible that the mercury in Willet Pond results from historic contamination from mercuric chloride used in tanning leather (Stecher et al. 1968).

Mercury concentrations in Neponset River fishes were very similar to concentrations in Willet Pond fishes. Largemouth bass were not very abundant in the sampling reach of the Neponset River, which resulted in the collection of only two individuals that were just over the legal length of 12 inches. These fish were slightly smaller than those analyzed from Willet Pond and contained a lower concentration of mercury (0.37 mg/kg). Black crappie had slightly higher concentrations than the largemouth bass in the Neponset River (0.425 mg/kg). In both cases, levels were below the MDPH trigger level, so an advisory was not warranted.

Selenium concentrations were very low in all cases and do not pose a health threat according to both the MDPH and the DEP's Office of Research and Standards. Arsenic, lead, and cadmium were below method detection limits in all samples analyzed.

The PCB/organochlorine pesticide data have also been reviewed by the MDPH, and has resulted in the issuance of the following public health advisory in August 1995 based on elevated PCB concentrations in brown bullheads collected from the Neponset River between the Hollingsworth & Vose Dam in Walpole and the Tileston Dam in Boston (Hyde Park). The average PCB concentration in brown bullhead is below the Food and Drug Administration Action Level for Pcb of 2.0 mg/kg but within a level that may pose health concerns for some individuals. Pcb may accumulate in individuals who frequently eat fish contaminated with Pcb thus leading to an increase risk of health effects which include liver damage and cancer. Fetuses and nursing infants are particularly sensitive to the development and health problems associated with Pcb exposure. Because of health concerns associated with exposure to Pcb, the MDPH offers the following recommendations:

1. "Children under 12, pregnant women and nursing mothers should refrain from consuming brown bullhead from the section of the Neponset River between the Hollingsworth & Vose Dam in Walpole and the Tileston Dam in Boston (Hyde Park) to prevent exposure of developing fetuses, nursing infants and young children to Pcb.

2. The general public should limit consumption to two meals per month of brown bullhead caught from the section of the Neponset River between the Hollingsworth & Vose Dam in Walpole and the Tileston Dam in Boston (Hyde Park)."

While contaminant data are not a measure of the condition of a fish community, the dominant community at the Neponset River station was represented by fish species tolerant of low oxygen conditions (i.e., common carp, white sucker, and bullhead). Less tolerant species such as largemouth bass and yellow perch were scarce, although the fisheries habitat appeared excellent.

The fish community present in Willet Pond is consistent with a diverse warmwater pond fish community as evidenced by the results of the beach seining. Fishermen interviewed on site also reported a rich fish community and excellent recreational fishing at this location.

RECOMMENDATIONS

1. The biomonitoring effort revealed the need for substantial improvement of available habitat quality. Local cleanup efforts to remove trash and debris, regular maintenance of roadways including catch basin cleaning and street sweeping, established buffer zones around the surface waterways, in conjunction with the greenway planning for walking trails and fishing areas, and streambank stabilization to reduce local watershed erosion are all viable, tangible products for watershed action. These efforts will be the first steps towards attaining full aquatic life use support.

2. The presence of small common carp in the headwaters of Traphole Brook in Sharon indicates a serious threat to the salmonids. It is strongly recommended that outreach be targeted to the residents of this subwatershed educating them about 1) the detrimental effects of creating small back-yard ponds because they lead to increased water temperature, impose barriers to salmonid migration, and 2) the danger of introducing exotic species, such as carp, into a waterbody.

While Traphole Brook currently supports an excellent cold-water fishery community, and a diverse and intolerant benthic community, there is an indication that it may in fact be threatened as evidenced by the blooms of *Mougeotia* sp. as well as the results of the diatom diversity examination. Further corroborating this possibility, elevated fecal coliform bacteria, chloride, and nutrient concentrations (refer to Section 2) were documented during the water quality surveys. At this time, the Department suspects that these conditions may be the result of failing septic systems. Outreach of septic system maintenance in concert with investigation of septic systems in this subwatershed should be conducted.

3. The extremely high water temperature (31°C) of the East Branch Neponset River, the major tributary to the Neponset River, is a concern that merits further investigation. The potential causes and sources of the elevated instream temperature need to be determined and a restoration plan for mitigating this water quality issue is warranted. Existing dam operation procedures in the East Branch subwatershed need to be reviewed, the impacts of water withdrawals on streamflow, impacts of sedimentation due to stormwater and local watershed

erosion, loss of wetlands due to encroachment, and any other potential causes of water quality impairment need to be investigated.

4. Consideration should be given to designate several tributaries in the Neponset River basin as Class B, Cold Water Fisheries. Specifically, cold water fishery designations should be considered for three tributary systems in the Neponset River Watershed totalling 13 river miles; 4.3 river miles of Traphole Brook, Sharon/Walpole/Norwood, 5.4 river miles of Tubwreck/Mill/Mine Brook, Dover/Medfield/Walpole, and 3.3 river miles of Pine Tree Brook, Milton. Work with DFWELE to develop fisheries management plans in these three subwatershed if deemed appropriate. Other tributaries capable of supporting a cold water fishery should also be determined in future monitoring efforts.

5. The aquatic life use support determination of the Mine Brook subbasin was determined to be "non-support". Although DFWELE records indicate reproducing salmonid species in the system as late as 1987, no salmonid species were documented during the 1994 biomonitoring survey. Furthermore, the water temperature of this tributary was 26°C. Although the benthos were considered nonimpaired when the Hawes Brook reference station was used for comparison, the benthos were moderately impaired when compared with the cold water reference station (5B01) of Traphole Brook. Environmental impacts due to reduced flow, and changes in water quality (elevated temperatures) from water supply well withdrawals in a small subbasin such as Mine Brook, combined with increases in residential developments, and an out-of-basin transfer of the wastewater via the sewer system, may very well be manifested by changes in the aquatic environment. This is most likely the case for the Mine Brook system. It is strongly recommended that strict water conservation measures be employed by the communities in the Mine Brook system, while outreach efforts be aimed at the consumers to make them aware of the environmental consequences of ever-increasing demands for water, and of measures that can be taken to alleviate existing adverse effects on limited water supplies. One source of information that might be particularly useful for this effort is the publication 'Cleaner Water Through Conservation' (EPA 1995).

SECTION 5: LAKE ASSESSMENT

INTRODUCTION

A total of sixty-five (65) lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been identified with PALIS (Pond and Lake Information System codes, Ackerman et al., 1984) in the Neponset River Watershed. Most are relatively small; over 50% are less than 10 acres and more than 90% are less than 30 acres. These small impoundments or enhanced natural ponds are primarily distributed along the Neponset River or its tributaries.

The few larger lakes (5 are 200 acres or more in surface area) in the watershed generally are located at or near headwater areas. Massapoag Lake in Sharon is the largest lake at 353 acres.

None of the lakes in the Neponset River Watershed are designated as a primary water supply or Outstanding Resource Water (ORW), and therefore, are designated as Class B Waters in accordance with the Surface Water Quality Standards (MA DEP 1995a). Class B Waters are considered suitable for primary contact recreation (i.e., extended contact with the water), secondary contact recreation (incidental contact with the water), and propagation of fish and wildlife. Thus, for the purpose of assessing the use support of the Neponset River Watershed lakes the following categories are included: fish consumption, aquatic life, swimmable (contact recreation), secondary contact and aesthetics.

METHODS

Three types of assessments were conducted on lakes in the Neponset River Watershed. First, they were assessed against the criteria for use support from the "Summary of Water Quality Report" (MA DEP 1995b) as presented in Table 5.1. Next, the trophic status (level of nutrient enrichment) of each lake was evaluated. And last, the presence of non-native aquatic and/or wetland plant species was noted.

Information for making each type of assessment was primarily obtained during a series of "synoptic" surveys conducted during the summer of 1994. In rare cases, information from these surveys was corroborated with data collected during baseline surveys conducted in previous years by the DEP or from more extensive diagnostic/feasibility studies conducted in conjunction with the Massachusetts Clean Lakes Program. Fish advisory information was obtained from the Department of Public Health.

Synoptic surveys consisted of taking observations from at least one access point on each lake (multiple access points on larger lakes). At each lake, an attempt was made to observe the entire surface area to determine the extent of areal macrophyte cover.

At each observation site the general water quality was noted and all aquatic and wetland macrophyte species were recorded along with their general abundance and an estimate of the total percent areal coverage of all species. Qualitative macrophyte observations were aided by conducting several hauls with a plant "hook." A weighted grappling hook attached to about a 50' length of rope was thrown to its maximum extension and then retrieved along the lake bottom. The hook was thrown several times in different directions from the observation site to provide maximum coverage.

Where possible, transparency was measured using a standard 20 centimeter diameter Secchi disc attached to a rope with metric calibrations. When Secchi disc measurements were not feasible, transparency was estimated as being above or below 1.2 meters (based on the 4 foot Secchi disc bathing beach standard).

TABLE 5.1. 1994 NEPONSET RIVER BASIN SURVEY. Use support determination criteria for lakes, ponds, and impoundments.

Use Support Status	Criteria
Fish Consumption	
Support -	No advisories/bans in effect.
Partial Support -	Restricted consumption or sub-population risk.
Non-support -	(No consumption) advisory or ban in effect.
Aquatic Life	
Support -	Dissolved oxygen $\geq$ 60% saturation. No significant community modification. *Dissolved oxygen $\leq$ 60% saturation for assessments* based on one survey (includes hypolimnion).
Partial Support -	Some modification, but generally viable community. Dissolved oxygen $\leq$ 60% saturation for multiple surveys over the summer (includes hypolimnion).
Non-support -	Adverse community modification.
Primary Contact Recreation	
Support -	Fecal coliform < 200/100 ml. Secchi disc transparency > 4 ft. Cover of macrophytes (emergent, floating, or submerged growing to the surface < 50% at their maximum extent of growth.
Partial Support -	Fecal coliform $\geq$ 200/100 ml. for assessments based on one survey. Secchi disc transparency $\leq$ 4 ft. for assessments based on one survey. Cover of macrophytes > *50% at their maximum extent of growth.*
Non-support -	Fecal coliform $\geq$ 200/100 ml. for multiple surveys over the summer. Secchi disc transparency $\leq$ 4 ft. for multiple surveys over the summer. Cover of macrophytes > 75% through- out the summer.
Secondary Contact Recreation	
Support -	Cover of macrophytes (emergent, floating or submerged growing to the surface) < 50% at their *maximum extent of growth.*
Partial Support -	Cover of macrophytes > 50% at their maximum extent of growth.
Non-support -	Cover of macrophytes > 75% at their maximum extent of growth.
Aesthetics	
Support -	Total phosphorus < 0.03 mg/l (based on epilimnetic sampling).
Partial Support -	Total phosphorus > 0.03 mg/l (based on epilimnetic sampling) for assessments based on one survey.
Non-support -	Total phosphorus > 0.03 mg/l (based on epilimnetic sampling) for multiple surveys over the year.

All observations were recorded on standardized field sheets. Assessments of trophic status and use impairment were made on site. Later, the assessments and supporting information were entered into the US EPA Water Body System database.

Data on the presence of non-native plants were entered into a separate database intended for downloading to the Massachusetts Geographic Information System (MassGIS).

RESULTS

Individual lake assessments are presented in Table 5.2. Where some use was listed as impaired the cause of the impairment is also listed in the table.

Surveys also focussed on the presence or absence of non-native macrophytes. Six (6) non-native aquatic species and two (2) non-native wetland species were observed in the Neponset River Watershed lakes, as follows.

Non-native Aquatic Plants

Potamogeton crispus - Curly leaf pondweed
Cabomba caroliniana - Fanwort
Myriophyllum heterophyllum - Variable milfoil
Myriophyllum spicatum - Eurasian milfoil
Trapa natans - Water chestnut
Marsilea quadrifolia - Pepperwort

Non-native Wetland Plants

Lythrum Salicaria - Purple loosestrife
Phragmites australis - Common reed

The distribution of these observations is mapped in Figure 5.1. Of the 34 lakes surveyed, twenty-four (71%) had at least one confirmed non-native macrophyte observed. This number potentially could be as high as 26 lakes (76%) since ten of the lakes contained an unidentified species of *Myriophyllum*. The species could have been *M. heterophyllum*, but the flowering and/or fruiting features necessary to confirm the identification were not present. As many as nine (9) lakes were observed to contain two or more non-natives.

The most frequently observed non-native aquatic plant was fanwort (*Cabomba caroliniana*), which was found in seven (7) lakes (21%). Variable milfoil (*Myriophyllum heterophyllum*) was found in six (6) lakes (18%), but that number could be as high as 15 lakes (44%) if unconfirmed milfoil observations prove to be that species. The most frequently noted non-native wetland plant was purple loosestrife (*Lythrum Salicaria*), which was found at 15 lakes (44%).

DISCUSSION

Overall use support status and trophic status of the lakes surveyed in the Neponset River Watershed are presented in Tables 5.3 and 5.4, respectively. It should be noted that lakes or portions of lakes were listed as undetermined when indicators were not readily observable. With this approach, the assessment of lakes in the Neponset River Watershed is limited to a "best case" picture (i.e., only the most obvious impairments are reported). Potentially more of the lake acreage would be listed as impaired or in a more enriched trophic status if more variables were measured and more criteria assessed.

Despite the "best case" scenario that is favored by the Neponset River Watershed lake assessment approach most lakes and ponds showed moderate (mesotrophic) to severe (eutrophic or hypereutrophic) symptoms of eutrophication. Presumably additional testing of dissolved oxygen, chlorophyll, and/or nutrients could indicate that trophic status conditions are more advanced.

TABLE 5.2. 1994 NEPONSET RIVER BASIN SURVEY. Neponset watershed lake status assessment and causes of impairment during summer 1994.

LAKE	LOCATION	SIZE (Acres)	TROPHIC STATE	USE ATTAINMENT (Acres)	IMPAIRMENT CAUSE(S)
Billings St./East St. Pond	Sharon	3	E	Primary Contact-N(3) Secondary Contact-N(3) Aquatic Life-N(3)	Non-native plants
Bird Pond	Walpole	25	E	Primary Contact-P(5);U(20) Secondary Contact-F(20);P(5)	Nuisance plants
Blue Hills Reservoir	Quincy	14	U	Secondary Contact-F(14)	None
Bolivar Pond	Canton	22	E	Primary Contact-P(22) Secondary Contact-T(22) Aquatic Life-T(22)	Turbidity Non-native plants
Buckmaster Pond	Westwood	27	M	Secondary Contact-F(27)	None
Clark Pond	Walpole	6	E	Primary Contact-N(6) Secondary Contact-N(6) Aquatic Life-N(6)	Non-native plants
Cobbs Pond	Walpole	24	E	Primary Contact-N(24) Secondary Contact-N(24)	Nuisance plants Non-native plants
Crackrock Pond	Foxborough	14	E	Primary Contact-P(7);T(7) Secondary Contact-P(7);T(7)	Nuisance plants
Diamond Pond	Walpole	7	E	Primary Contact-P(7) Secondary Contact-P(7)	Nuisance plants
Diamond Brook Flood Impoundment	Walpole	??	U	Secondary Contact-F(unknown)	None
Ellis Pond	Norwood	19	E	Primary Contact-N(4);T(15) Secondary Contact-N(4);T(15) Aquatic Life-N(4);T(15)	Non-native plants
Farrington Pond	Stoughton	5	E	Primary Contact-N(5) Secondary Contact-N(5) Aquatic Life-N(5)	Nuisance plants Non-native plants
Flynns Pond	Medfield	8	M	Primary Contact-N(3);U(5) Secondary Contact-F(5);N(3)	Nuisance plants
Forge Pond	Canton	25	E	Primary Contact-P(25)	Turbidity

TABLE 5.2 (Cont.)

LAKE	LOCATION	SIZE (Acres)	TROPHIC STATE	USE ATTAINMENT (Acres)	IMPAIRMENT CAUSE(S)
Ganawatte Farm Pond	Foxborough/ Sharon/Walpole	55	E	Primary Contact-N(55) Secondary Contact-N(55)	Nuisance plants
Glen Echo Lake	Canton/ Stoughton	16	U	Secondary Contact-F(16)	None
Hammer Shop Pond	Sharon	4	U	Secondary Contact-N(2);U(2)	Nuisance plants
Jewells Pond	Medfield	3	M	Secondary Contact-F(3)	None
Lymans Pond	Westwood	26	E	Primary Contact-N(26) Secondary Contact-N(26)	Nuisance plants
Manns Pond	Sharon	11	E	Primary Contact-P(11) Secondary Contact-N(6);T(5) Aquatic Life-N(6);T(5)	Non-native plants Turbidity
Massapoag Lake	Sharon	397	M	Secondary Contact-F(397) Aquatic Life-T(50);U(347)	Non-native plants
Memorial Pond	Walpole	7	H	Primary Contact-N(7) Secondary Contact-N(7)	Non-native plants Turbidity
Neponset Reservoir	Foxborough	268	E	Primary Contact-P(268) Secondary Contact-T(268) Aquatic Life-T(268)	Turbidity Non-native plants
Pinewood Lake	Stoughton	21	E	Primary Contact-N(21) Secondary Contact-N(21) Aquatic Life-N(21)	Non-native plants
Plimpton Pond South	Walpole	7	U	Primary Contact-NA(7) Secondary Contact-NA(7) Aquatic Life- NA(7)	Flow alteration
Ponkapoag Pond	Canton	203	M	Primary Contact-N(10);T(193) Secondary Contact-N(10);T(193) Aquatic Life-T(203)	Non-native plants
Popes Pond	Milton	13	H	Primary Contact-P(13) Secondary Contact-P(13)	Non-native plants Turbidity

TABLE 5.2 (Cont.)

LAKE	LOCATION	SIZE (Acres)	TROPHIC STATE	USE ATTAINMENT (Acres)	IMPAIRMENT CAUSE(S)
Reservoir Pond	Canton	243	M	Primary Contact-T(243) Secondary Contact-T(243) Aquatic Life-T(243)	Non-native plants
Russell Pond	Milton	6	E	Primary Contact-N(1);P(5) Secondary Contact-N(1);P(5) Aquatic Life-T(6)	Turbidity Non-native plants
Sprague Pond	Boston/Dedham	13	M	Primary Contact-T(13) Secondary Contact-T(13)	Turbidity
Town Pond	Stoughton	6	E	Primary Contact-N(3);P(3) Secondary Contact-N(3);P(3) Aquatic Life-N(3);P(3)	Non-native plants Nuisance plants
Turner Pond	Walpole	17	M	Secondary Contact-F(17)	None
Turners Pond	Milton	11	E	Primary Contact-P(11) Secondary Contact-F(11)	Turbidity
Willet Pond	Norwood/Walpole Westwood	200	U	Secondary Contact-F(200) Fish Consumption-N(200)	Fish Advisory
Woods Pond	Stoughton	21	E	Primary Contact-N(21) Secondary Contact-N(21) Aquatic Life-N(21)	Non-native plants Nuisance plants

INFORMATION CODES:
Trophic State-- O= Oligotrophic, M= Mesotrophic, E= Eutrophic, H= Hypereutrophic, U= Undetermined.
Use Attainment-- N= Non-support, P= Partial support, F= Full support, T= Threatened, NA= Not-attainable, U= Undetermined.

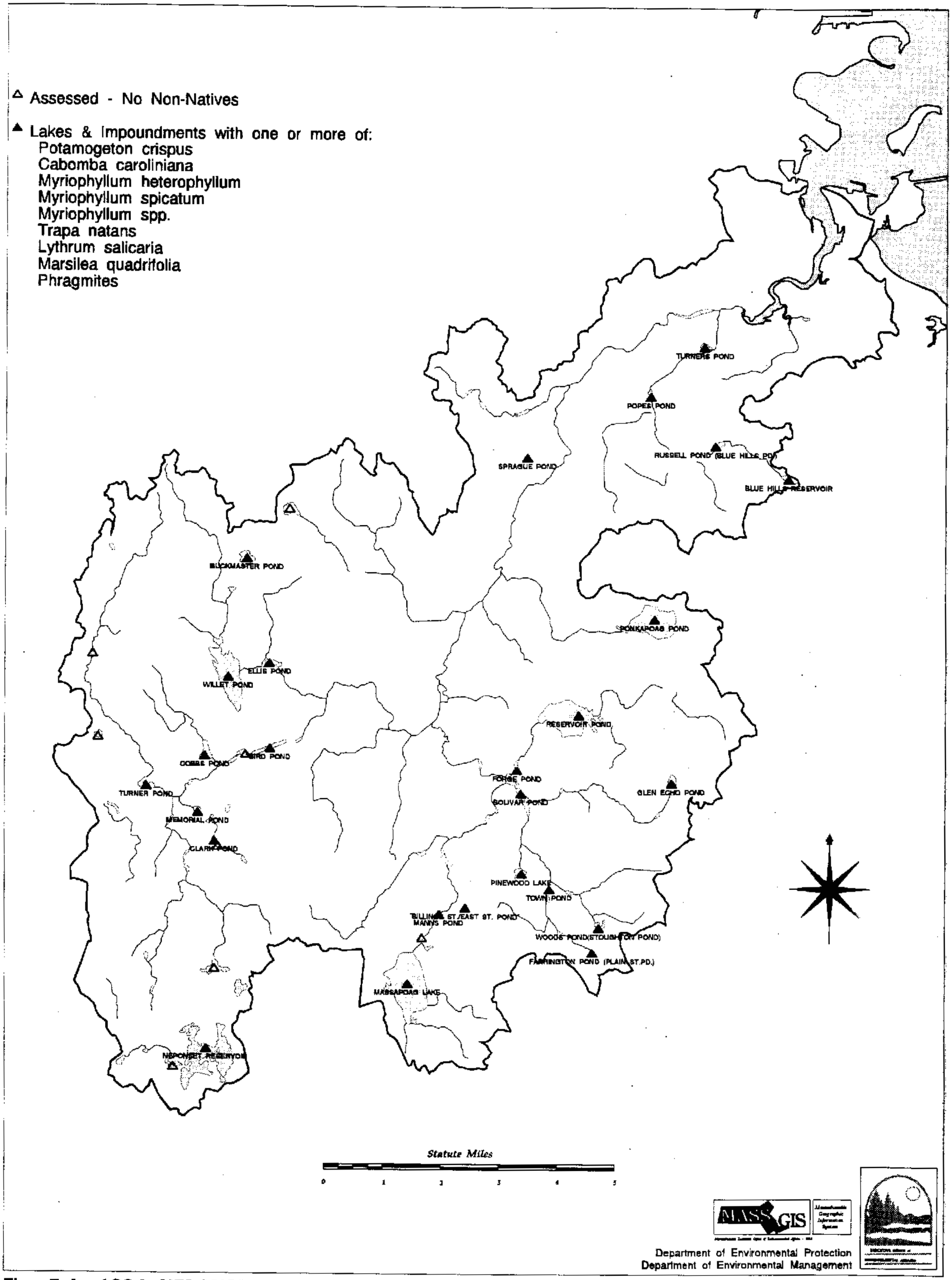


Fig. 5.1. 1994 NEPONSET RIVER BASIN SURVEY. Distribution of non-native aquatic and wetland plants in Neponset River Basin lakes and impoundments.

TABLE 5.3. 1994 NEPONSET RIVER BASIN SURVEY. Summary of use support determinations (in acres) for the Neponset River Basin lakes, ponds, and impoundments.

USE/DEGREE SUPPORTED	FULL SUPPORT	THREATENED	PARTIAL SUPPORT	NON-SUPPORT	NON-ATTAINABLE	NOT ASSESSED
AQUATIC LIFE	0	544	271	93	5	832
FISH CONSUMPTION*	0	0	1545	200	0	0
SWIMMABLE	0	471	377	189	5	703
SECONDARY CONTACT	723	723	70	173	5	51
AESTHETICS	0	0	268	0	0	1477

N.B. - These results represent the most recent assessments of lakes/ponds in the Neponset River Watershed; some are more recent than the Commonwealth of Massachusetts Summary of Water Quality (MA DEP 1995b).

* - A recent health advisory, which warns pregnant women not to consume fish caught from any of the Commonwealth's inland waters, results in all lakes/ponds having at least a partial use designation. In addition, an advisory for Willet Pond indicates that pregnant women and nursing mothers should not eat largemouth bass from that waterbody.

TABLE 5.4. 1994 NEPONSET RIVER BASIN SURVEY. Summary of trophic status of Neponset River Basin lakes, ponds, and impoundments.

TROPHIC STATUS	NUMBER OF LAKES	ACRES
OLIGOTROPHIC	0	0
MESOTROPHIC	8	911
EUTROPHIC	18	307
HYPEREUTROPHIC	3	288
UNDETERMINED	5	239
TOTAL	* 34	* 1745

N.B.- These results represent the most recent assessments of lakes/ponds in the Neponset River Watershed; some are more recent than the Commonwealth of Massachusetts Summary of Water Quality (MA DEP 1995b).

* - Although these data represent only about 53% (34 of 64) of the lakes/ponds in the Neponset watershed they represent about 90% (1745 acres of 1935 acres) of the acreage.

Because the synoptic surveys focus on just three criteria (macrophyte cover, transparency, and biocommunity modifications) only a few uses could be assessed fully. Since macrophyte cover is the only criterion needed to assess the secondary contact recreation, this use category was assessed at each lake surveyed. Lakes exhibiting impairment of the primary contact recreation use (swimmable) because of macrophyte cover and/or transparency were noted as either partial or non-support. However, if a lake met these criteria it, or part of its area, was listed as unassessed because no data were available for fecal coliform bacteria. The same approach was used for assessing the aquatic life use category since no dissolved oxygen data were available. The aesthetic use category was not assessed on any of the Neponset River Watershed lakes due to lack of total phosphorus data.

The fish consumption use category represents a special case. Fish consumption assessments were based strictly on the Department of Public Health advisory information. The only non-consumption advisory issued for a specific waterbody in the watershed was on Willet Pond in Norwood, Walpole, and Westwood. It is advised that pregnant women and nursing mothers not consume any largemouth bass from that waterbody. But, since a statewide health advisory warns that pregnant women should not consume fish from any inland Massachusetts waters, all surface acreage is listed as, at least, partially meeting for this use.

With these qualifications for the overall assessment of lake resources in the Neponset River Watershed, the surveys indicated that the use of at least a third of the surface acreage is impaired. If threatened waters are added, there is potential that about 60% of the acreage faces problems. Generally, the least impacted lakes are larger and are located toward the headwaters of the Neponset River tributaries while most of the smaller, run-of-the-river impoundments most often have some use impairment. Neponset Reservoir, however, is an exception, being a large, headwater lake that shows impairment.

Due to the focus of the surveys conducted, the major cause for use impairment was aquatic plants (either native or non-native). Turbidity was noted less frequently as a cause. The causes noted reflect symptoms of cultural eutrophication, a process of accelerated enrichment from excessive plant nutrients and sediments being introduced to the lakes. This phenomenon is also reflected in the distribution of lake trophic conditions, which is decidedly skewed toward the higher trophic categories (eutrophic and hypereutrophic).

The sources of impairments are almost entirely unknown, at least based on direct knowledge. However, for "run-of-the-river" impoundments it can be surmised that the same sources affecting various reaches of the Neponset River and its tributaries would lead to problems there as well. Nutrients delivered from storm water runoff, on-site wastewater disposal systems, and other non-point sources are likely to cause the increased algal or macrophyte productivity that has resulted in impairments.

Non-native plant species represent a special cause of impairment that is not always directly related to the cultural eutrophication process. Since these species are introduced from other parts of the country or world they are generally free from the natural control mechanisms (e.g., insects or diseases) that keep most native plant populations in check. Without controls the populations of many non-native species can grow rapidly to out-compete native plant species. This growth habit is termed invasive. It throws the biological community out of balance and can impair uses such as swimming (primary contact) and boating (secondary contact). In Massachusetts, the Office of Watershed Management is tracking the distribution of about a dozen of these non-native aquatic and wetland plant species and the impairment they are causing.

In the Neponset River Watershed four (4) non-native aquatic plants were found in only one lake each. *Potamogeton crispus*, curly leaf pondweed, was observed in Russell Pond, Milton, *Myriophyllum spicatum*, Eurasian milfoil, was noted in Ponkapoag Pond, Canton, *Trapa natans*, water chestnut, was recorded at Clark Pond, Walpole, and *Marsilea quadrifolia*, pepperwort, was found in Manns Pond, Sharon. Of these, the first three are of particular concern because of their potentially explosive growth habit that threatens not only the resident waterbody but downstream and adjacent waterbodies as well. These sightings were primarily in the headwater areas, so the threat of their spreading downstream is of heightened concern. One wetland plant, *Phragmites australis*, Common reed, was noted only at two sites, Forge Pond in Canton and Blue Hills Reservoir in Quincy.

Occurrences of *Cabomba caroliniana*, fanwort, were recorded most frequently (4 of 7) in the East Branch Neponset River system and its tributaries. Other individual records were noted in the lower Hawes Brook system, the lower Mine Brook system, and Neponset Reservoir. Any of these could, or may already have, spread to infest the main stem of the Neponset River.

The variable milfoil, *Myriophyllum heterophyllum*, was most frequently noted (4 of 6 occurrences) in the East Branch Neponset River system, as well. In addition, 5 out of 9 occurrences of an unidentified milfoil (suspected to be *M. heterophyllum*) also occurred in this system. Isolated sightings were also recorded at the head waters of Ponkapoag Brook (Ponkapoag Pond) and in the middle reaches of the Spring Brook system (Clark Pond). The unidentified milfoil was also noted at scattered locations toward the headwaters of the Neponset River and Hawes Brook systems. As with the fanwort these populations could or may already have spread to the main stem.

The most frequently occurring non-native wetland species was *Lythrum Salicaria*, purple loosestrife. Populations of this plant seemed to be broadly distributed throughout the entire watershed and exhibited no particular trend.

RECOMMENDATIONS

For non-native aquatic or wetland plant species that were isolated to one locale quick action is advisable to manage these populations in order to alleviate the need for costly and potentially fruitless efforts to do so in the future. Two courses of action should be pursued concurrently. More extensive surveys need to be conducted, particularly downstream from these recorded locations, to determine the extent of the infestation. And, "spot" treatments should be undertaken to control populations at these sites before they spread further. These treatments may be in the form of carefully hand pulling individual plants, in small areas, or selective herbicide applications in larger areas. In either case, the treatments should be undertaken prior to fruit formation and with a minimum of fragmentation of the individual plants. These cautions will minimize the spreading of the populations.

Two aquatic species (*Cabomba caroliniana* and *Myriophyllum heterophyllum*) and one wetland species (*Lythrum Salicaria*) have become more wide-spread in the Neponset River Watershed lakes. Accordingly these species will require an extensive program aimed at 1) determining the extent of the distribution, 2) reducing impairment, and 3) controlling further spreading to unaffected waterbodies.

As with the isolated cases, a program to manage the more extensive plant infestations should include additional monitoring efforts to determine the extent of the problem. Plant control aspects of any plan to manage the two problem non-native aquatic species mentioned above can select from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.), each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should be discouraged because of the propensity for these plants to reproduce and spread vegetatively (from cuttings).

Another important component of a management plan is prevention of further spreading of these plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations occurring in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake users to the problem and responsibility of spreading these species.

SECTION 6: WATER SUPPLY

INTRODUCTION

Water quantity is an essential part of water quality management planning for any watershed. The Water Management Act (WMA), M.G.L.c.21G and accompanying regulations (MA DEP 1992), enacted in 1985 (and periodically updated, the most recent in July 1992), authorized the DEP to regulate water withdraws from either ground or surface sources in excess of an average of 100,000 gallons per day (GPD). The purpose of the Act is to manage the water resources of the Commonwealth, both surface and groundwater, as a single hydrologic unit to ensure adequate water supplies while maintaining healthy aquatic habitats.

The WMA allowed water suppliers and other large-volume water users with the opportunity to register their historical water for the period 1981 to 1985. DEP issued registration statements authorizing the continuation of the average historical withdrawal for the period. The opportunity to register historic withdrawals ended in January of 1988.

A WMA water withdrawal permit is required for any withdrawer who did not register but should have, for the addition of any new source with a capacity of 100,000 GPD or more, or for any increase in excess of 100,000 GPD over a registered volume. Withdrawals from a single withdrawal point can be both registered (historical) and permitted (increased). The WMA permit program was implemented in a phased-approach which included reviewing and issuing permits in accordance with the river basin schedule outlined in the Act (MA DEP 1992).

Prior to issuance of a WMA permit, the application is reviewed with respect to the following:

1. establishing the need/demand for the water,
2. availability of water, and
3. a site specific, local impact(s) analysis of the water withdrawal.

1. **DEMAND.** The Department of Environmental Management/Office of Water Resources (DEM/OWR), which serves as technical staff to the Water Resources Commission (WRC), works with municipalities to develop forecasts of future water needs based on population projections, current and planned water conservation and system efficiency measures, and analyses of water use patterns. The water needs forecasts are reviewed and approved by the WRC. A report titled "Neponset River Basin, Inventory and Analysis of Current and Projected Water Use" (MA DEM 1989) describes the demand forecast methodology and results for the Neponset River Basin. In 1991, OWR revised and updated the report and produced the "Neponset River Basin Plan" (MA DEM 1991). Updated water needs forecasts included in that report were approved by the WRC in March 1991. These forecasts were used to develop the Neponset River Basin WMA permits. In February 1995, the report was again updated, showing a continued slow growth in population and water use. Permit volumes for non-municipal water users were based on projections submitted by the applicant.

2. **AVAILABILITY.** Consideration of the availability of water to meet permit demand was based on estimating the safe yield of the basin and the portion of the withdrawal that would be consumptively lost. Basin safe yield was calculated using a surface water statistical model and minimum streamflow values proposed by DEM/OWR and reviewed and approved by the WRC. A description of the methodology for determining minimum streamflow values and the results of the analysis can be found in the report "Neponset River Basin Plan" (MA DEM 1991). It should be noted that the concepts of minimum streamflow threshold and basin safe yield have undergone significant review since then, and currently are not in active use. This method of review has been replaced with an enhanced local impacts review described below. The 1991 Basin Plan describes the hydrology of the Neponset River Basin and nine subbasins along with recommendations for

conservation and water supply development.

3. **IMPACTS.** Consideration of the site specific, local impacts associated with groundwater withdrawals was based on pumping tests and other hydrogeologic information which was used to predict water table drawdown in the immediate vicinity of the withdrawal. The potential for negative impacts to wetlands, streams, ponds or other wells was considered as part of the permit review. In some cases where site specific criteria were not available monitoring of the potentially effected resources was required as a permit condition. If unanticipated impacts are found to result from the permitted withdrawals over time, DEP has the authority to modify the conditions of the withdrawal permits.

Withdrawal permits are conditioned upon implementation of water conservation programs to ensure careful use of the resource. The water conservation requirements for public water suppliers are based on standards approved by the WRC in "Water Conservation Standards for the Commonwealth of Massachusetts" (WRC 1992). Additionally, public water suppliers were required to delineate the Zone II (land area contributing recharge to the well under the most severe pumping conditions) for their wells and to implement zoning and non-zoning land use controls to protect the integrity of the land contributing water to their wells.

WMA permits authorize average daily water withdrawal volumes (on an annual basis) for a period of up to 20 years, with a synchronized five-year review of all permits in the basin. The five-year review process allows the DEP to assess the need for increased withdrawal, compliance with permit conditions, and the potential for adverse environmental impact associated with increased water withdrawals.

According to the DEM "Neponset River Basin Plan" (1991), as of 1987, the population of the 11 communities in the Neponset River Basin totalled 201,000. According to the 1990 census shown in the 1995 update, the population remained stable. Ninety-seven percent of the population was serviced by public water supply. Although two communities, Norwood and Milton obtained all of their water from the MWRA public water supply system, the average day demand (ADD) for water by the Neponset River Basin population was 25.5 MGD. The permitted volumes by the year 2020 total 31 MGD. Of the communities serviced at least in part by water supply sources within the Neponset Basin, Walpole relies entirely on sources within the basin, followed by Medfield, Dover, Sharon and Dedham/Westwood which obtain 94%, 86%, 74%, and 73%, respectively, of their ADD from sources within the Neponset River Basin. The other communities, Stoughton, Canton, and Foxborough, rely primarily on sources outside of the basin, meeting their ADD by 48%, 34% and 30%, respectively, from sources within the basin.

METHODS

A number of methods were used to address water supply withdrawals in the Neponset Watershed including:

1. The five-year review of the WMA registered and/or permitted withdrawals in the basin,

2. A review of the recommendations by DEM (1991), and the current implementation status by the communities of those recommendations,

3. A review of streamflow data (USGS Water Year Reports 1989-1993 at their long term monitoring gages on the Neponset River and the East Branch Neponset River) (USGS 1990, 1991, 1992, 1993, and 1994) in terms of meeting various streamflow threshold levels approved by the WRC which support such instream uses as sufficient spawning habitat and velocity for trout and smelt during their spawning periods, and for canoeing, and

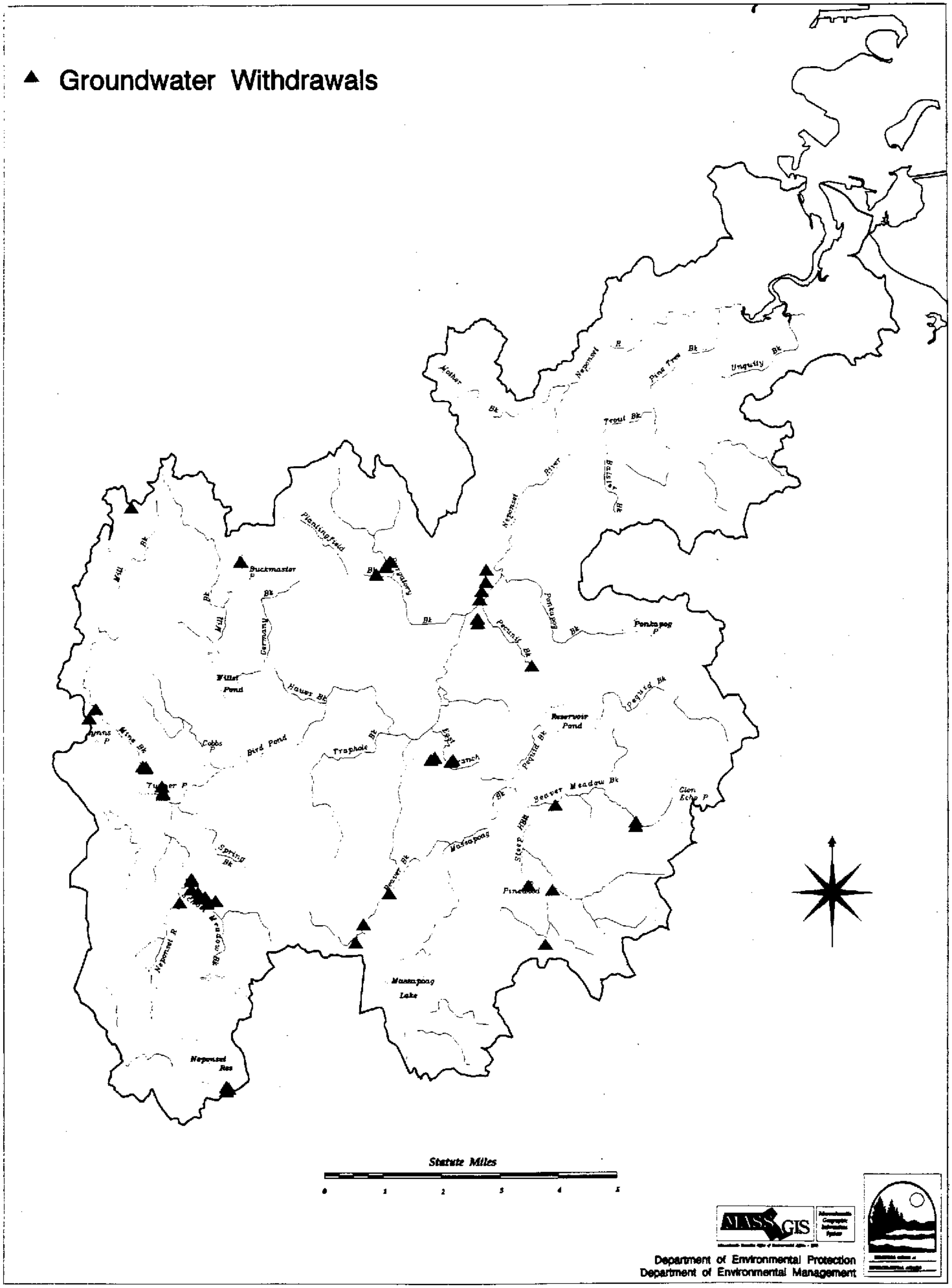


Fig. 6.1. 1994 NEPONSET RIVER BASIN SURVEY. Registered and permitted public water supply withdrawals in the Neponset River Basin.

4. The Medfield Water Department has two registered sources in the Mine Brook subwatershed in the Neponset River Basin as well as other sources (both registered and permitted in the Charles River Basin). The registered volume is 0.92 MGD from the Mine Brook wells. While the 1994 withdrawal was 0.63 MGD, the range was between 0.3 and 1.0 MGD with the higher rates occurring in the summer. The residential use calculated from information contained in the Medfield Water Department 1994 annual report was 85.6 GPCD based on a service population of 10,474. Although the registered volume has not been exceeded, the town of Medfield requested and was granted, on 20 April 1995, a Declaration of Water Supply Emergency (MA DEP 1995c), under Sections 15 and 17 of Chapter 21G of the Massachusetts General Laws (MA DEP 1992).

Due to the contamination (VOC) of Medfield's Charles River Basin water supply sources (Wells # 1 and 2), the potability of the water is expected to be unsuitable in the very near future, and therefore, the town requested that the wells be shut down. However, the capacity of Medfield's Mine Brook wells (#3 and 4) will not be sufficient to meet the ADD; the system-wide ADD in 1994 was 1.164 MGD, while the maximum daily consumption was 2.577 MGD (DEP letter to Medfield, 20 April 1995). Medfield has contacted the towns of Norfolk and Walpole, and both towns have agreed to provide water to Medfield in their State of Emergency. Outstanding issues: 1) leak detection surveys need to be completed on a more frequent basis than once every five years, 2) a water conservation plan needs to be submitted, 3) public and residential buildings need to be retrofitted with water saving devices, and 4) a strong educational program on water conservation needs to be implemented.

5. The Dover Water Company is currently not regulated by DEP's Water Management Program. While the Company has sources in both the Neponset (Mine Brook subbasin) and Charles River Basins, withdrawal volumes in both basins have remained below the permitting threshold. While the 1994 system-wide withdrawal volumes was 0.11 MGD, 0.09 MGD came from the Neponset River Basin (Mine Brook subbasin). The range was from 0.05 to 0.1 MGD with the highest rates occurring in the summer. The residential use calculated from information contained in the Dover Water Company 1994 annual report was 104 GPCD based on a service population of 960 .

6. The Hollingsworth & Vose Company has a registered withdrawal (1.02 MGD) from the upper segment of the mainstem Neponset River (Hollingsworth & Vose impoundment). Actual withdrawal in 1993 was 0.35 MGD, significantly less than the registered volume. While the Company attributes the reduction of water use to a number of factors including conservation measures, reuse, and type/amount of product produced, the Company has recently been issued an NPDES permit to discharge 0.7 MGD of treated wastewater to the Neponset River, rather than to the MWRA sewer.

7. The Lost Brook Golf Course is registered to withdraw on average a volume of 0.22 MGD from an irrigation pond on Purgatory Brook, Norwood between February and October. Actual metered withdrawals are much less than the threshold level of 0.1 MGD (between 0.04 and 0.05 MGD during peak demand).

8. The Canton Water Department is not registered but is permitted to withdraw 1.22 MGD from their two wells along the middle segment of the Neponset River (South Fowl Meadow), and the third source near Pecunit Brook. Their 1994 withdrawal was 0.51 MGD (from the Neponset Basin) with the daily withdrawal rates ranging from 0.38 to 0.61 MGD, with the higher rates occurring in the summer. The remaining 2.29 MGD was purchased from MWRA. Residential use calculated from information contained in the Canton Water Department 1994 annual report was approximately 73 GPCD based on a service population of 18,790. Their overall withdrawal volumes are significantly below those originally projected by DEM, although Canton will most likely rely on MWRA for the majority of its supply. Outstanding issues: 1) confirmation that the entire system has been and will continue to be surveyed for leaks every two years, 2) status with regards to

completing the retrofit of public buildings with water savings devices, and 3) the date full cost pricing/enterprise system was adopted.

9. The Blue Hill Country Club is registered for a 0.37 MGD withdrawal volume/over 148 days from one well adjacent to Pecunit Brook, from which 0.23 MGD was withdrawn in 1993. While less than their registered volume, a second well may have been added which may require a registration amendment or a WMA permit. Additional information regarding this change (well locations, depth, volumes) should be filed with OWM.

10. The Plymouth Rubber Company, Inc.'s estimated registration statement was issued for 4.33 MGD from a surface water withdrawal (Reservoir Pond to Forge Pond) in the East Branch Neponset River subbasin. Actual withdrawals by the Company are approximately half the registered volume (2.42 MGD since 1992).

11. The MDC's Ponkapoag Golf Course registered for 0.17 MGD from Ponkapoag Pond in Canton. Outstanding issue: the annual reports have not been submitted.

12. The Spring Valley Country Club is registered to withdraw 0.31 MGD from one irrigation pond and one irrigation well from the middle Neponset River subwatershed between April to October. Outstanding issue: actual withdrawal volumes are unknown because annual reports have not been submitted since 1988.

13. The Sharon Water Division maintains three wells each (both registered and permitted) in the Neponset and Taunton River Basins. The total permitted withdrawal volume from the Neponset River Basin sources for 1995, located in the Beaver Brook subwatershed in the East Branch Neponset River drainage system, is 0.90 MGD, while the system-wide withdrawal is 1.66 MGD. The actual 1994 withdrawal from the Neponset River Basin wells was 0.81 MGD, although Sharon did exceed their combined registered and permitted withdrawal volume (0.76 MGD) in the Taunton Basin. The range of withdrawals from the Beaver Brook subbasin was between 0.45 and 1.46 MGD with the higher rates occurring in the summer. The residential use calculated from information contained in the Sharon Water Department 1994 annual report was 69 GPCD based on a service population of 18,331. Outstanding issues: 1) Zone II's for each source was to have been completed by 1 June 1994; only one (Well #5) has been completed, 2) water audit/leak detection surveys need to be conducted every two years, 3) water rates need to reflect the full cost of supplying water, 4) the 21% unaccounted-for water use needs to be explained and 5) the wetlands monitoring information, required for all three wells to assess any impacts due to the withdrawals, needs to be submitted.

14. The A.A. Will Materials Corporation registered for an estimated 0.39 MGD surface water withdrawal point in Stoughton (within the East Branch subbasin). The exact withdrawal point is in the vicinity of Beaver Meadow/Redwing Brook. Volumes reported for 1993 and 1994 (0.02 MGD) are both estimates and are significantly below their registered volume. While sand and stone are not currently washed on site, truck and trailer washing does occur on site according to recent telephone communication with company personnel. Outstanding issue: the company should be made aware of their options depending upon their projected water use; 1) rescind permit, 2) voluntarily register (which will require metering), or 3) maintain their existing registration if sand and stone washing is anticipated on site in the future.

15. Charles A. Northrop of Sharon voluntarily registered 2.10 acres of cranberry bog in the School Meadow Brook subbasin (1.2), although he is below the registration threshold of 4.66 acres. Acreage of his cranberry bog in 1993 was 2.23 acres.

16. The Stoughton Water Division is registered and permitted in the Neponset (1.08, and Taunton River Basins (1.14 MGD). Both permits are for one new source only. 1994 water-use was 2.24 MGD with 1.17 MGD being withdrawn from the

Neponset River Basin sources. Neither permit authorizes additional withdrawal volumes until the final 5 years of the permit. No additional volumes were issued despite a DEM projected water need of 2.31 MGD in 1995, which is larger than Stoughton's combined registered volume (2.22 MGD). Stoughton has been right around, and actually has exceeded that threshold in 1992 (1.22 MGD) in the Neponset Basin. Overall, system-wide volumes have been below the 2.31 MGD projected through 1995 for every year except 1992 (2.39 MGD). The town has been under a Department-declared Emergency for years (since 1987). Conservation has been required as a condition of the Emergency Declaration. Outstanding issues: 1) explanation for the exceedance of the safe yield (0.32 MGD) from the Harris Pond Well in 1994 (0.45 MGD) and 2) wellhead protection will need to be adopted within two years for the Pratt's Court Well.

According to Stoughton's most recent Emergency Declaration extension (8 June 1995, MA DEP 1995d), the town has a system-wide safe yield of 2.4 MGD. Because the town is near or has been exceeding their system-wide safe yield volume, they explored and received a favorable response (dated 20 July 1994) from the MWRA relative to their formal application for MWRA membership and their associated request for 0.50 MGD. However, the town voted to move forward with the development of a new site in the Taunton Basin, the Cedar Swamp well, rather than purchasing water from the MWRA.

17. The Dedham-Westwood Water District has both registered and permitted sources located in the Neponset River Basin. The wells are all located in the middle segment of the Neponset River in the vicinity of University Ave., Canton/Dedham. In addition to being registered (2.62 MGD) and permitted (0.12 MGD) in the Neponset River basin, Dedham-Westwood Water District is also registered in the Charles River Basin. The 1994 withdrawal from the Neponset basin was 2.35 MGD, ranging from 1.5 to 3.6 MGD with the highest rates occurring in the summer. The residential use calculated from information contained in the Dedham-Westwood Water District 1994 annual report was approximately 58 GPCD based on a service population of 37,405.

The new well (Fowl Meadow Well), included in the Neponset River Basin permit, has yet to be completed. Problems have developed with regards to the actual location of the proposed well. The District did not control the 400' radius around the well, and the DEP will not allow them to develop the well. Much discussion is taking place about this issue. An Interbasin Transfer Approval (ITA) from the WRC was required for the Fowl Meadow Well. The ITA required that extensive conservation conditions be met before approval was given. The ITA also required that a staff gage be installed at the Milton Lower Falls Dam that would provide information on water flow rate. When streamflow in the Neponset River falls below 0.15 cfs/mi^2, no withdrawals may occur from the Fowl Meadow well. In addition, no withdrawals are allowed from the Fowl Meadow Well during the months of March, April and May when the flow in the Neponset River is less than one foot in depth, or 95 cfs, whichever is greater. The Army Corps of Engineers permit for the Fowl Meadow Well also requires extensive wetlands monitoring to assess any potential impacts from the withdrawal. Various wetlands monitoring information has been submitted since the permit was issued. The most recent report titled "Fowl Meadow Public Water Well Site AN-1, Wetland Monitoring Program, Water Elevation Readings #9 - January 1995" has been submitted. The Water District has been working with both the towns of Dedham and Westwood to adopt the appropriate Wellhead protection measures. Dedham-Westwood's actual system-wide withdrawal volume of 3.98 MGD in 1994 was below the 4.65 MGD projected through 1995 by DEM. Assuming the Fowl Meadow Well is finally developed, Dedham-Westwood should have volumes sufficient to meet their average daily demand of 5.02 MGD in 2010. Outstanding issues: status of conservation plan (leak detection survey dates) needs to be checked.

18. The Bay State Paper Company now holds the registration (transferred on 1 February 1995) of 2.06 MGD from the Neponset River at the Tileston Dam, Hyde Park.

19. The L.E. Mason Company had registered for 0.38 MGD from one groundwater source in the Mother Brook subwatershed. The actual volume withdrawn in 1993 was 0.22 MGD. However, the company was knowingly withdrawing contaminated groundwater and discharging it illegally into Mother Brook. The DEP's Environmental Strike Force has settled a case with the L.E. Mason Company. Details on the settlement decision can be located in (SECTION 7). Water needs for the facility will be met by water purchased from the City of Boston.

Streamflow Thresholds

Instream uses, such as aquatic life and secondary contact recreation, depend in part upon sufficient streamflow. Due to the export of a significant amount of wastewater through the MWRA sewer system which services approximately 70% of the households and establishments within the MWRA service area, low streamflow is a serious problem in the Neponset River Basin. According to the Neponset River Basin Plan Update (MA DEM 1995), the ADD of the eleven public water supply systems in the Neponset Basin was 22.13 MGD in 1993. While 9.64 MGD (44%) came from sources in the basin, only 4.09 MGD (18%) remained in the basin as wastewater discharge. In 1994, the ADD of the municipal systems from the Neponset River Basin was 9.78 MGD, while 5.23 MGD was withdrawn by golf courses and industries in the basin. Table 6.2 summarizes the number of days that recommended streamflow thresholds (MA DEM 1991), approved by the WRC, were not met at the two long-term monitoring gages on the mainstem and East Branch Neponset River. Smelt spawning, followed by secondary contact recreation, are the two instream uses most threatened by the low flow in the Neponset River based on this assessment.

1994 Average Day Demand (ADD) of Water Withdrawals by Subbasin

The ADD of the registered and permitted water suppliers in the Neponset River Basin are presented below (refer to subbasin delineation system in Fig. 1.2):

1. Headwater subbasins (1.1 + 1.2): 3.03 MGD
2. Mine Brook subbasin (1.31): 1.4 MGD
3. Spring Brook/Neponset River (1.3): 0.49 MGD
4. Fowl Meadow subbasin (2.1 + 2.2): 5.53 MGD + unreported volumes
5. Beaver Brook subbasin (2.13): 0.83 MGD
6. Steep Hill Brook subbasin (2.16): 1.17 MGD
7. Middle Neponset River (2.3): 1.9 MGD

While the majority of the water is withdrawn from the Fowl Meadow subbasins, the smaller subbasins may in fact be more susceptible to reduced streamflow due to water withdrawal. A detailed inflow/outflow analysis of the Mine Brook system, located in Section 9 of this report, illustrates the competing uses of the water resources in the Neponset River Basin.

Water treatment facility (WTF) discharges from the municipal supply systems are almost non-existent; that is the treatment, if any, occurs in-line (i.e., corrosion control through pH adjustment, fluoridation, etc.). However, two WTFs, do discharge filter backwash water; the Walpole's Harold E. Willis WTF which is discussed in the Wastewater Discharges (Section 7) of this report, and Stoughton's Pratt Court Well, which is not currently regulated by DEP.

Water from Stoughton's Pratt Court Well is filtered to remove iron and manganese. Once every 24 hours, between 0.057 and 0.059 MGD of water is used to backwash the filters. Filter backwash is discharged to one of two fine sand bottomed lagoons, to remove the particulates, before infiltrating to groundwater. Each lagoon is

TABLE 6.2. 1994 NEPONSET RIVER BASIN SURVEY. Recommended streamflow thresholds and the number of days below thresholds (percentage of days below thresholds) at the mainstem Neponset River, Norwood (USGS gage # 01105000) and East Branch Neponset River, Canton (USGS gage # 01105500). Monthly median flow needs include 0.61 cfsm March15-June15 for trout, 2.68 cfsm in March, 2.41 cfsm in April and 1.59 cfsm in May for smelt and 1.82 cfsm for canoeing. Additionally a minimum streamflow threshold (0.15 cfsm) and minimum streamflow (95 cfs) was recommended by DEM (1991) at the Lower Mills Dam, Milton (March-May).

Recommended streamflow threshold	Recommended stream discharge at each gage (cfs)		Flow		Days recommended streamflow NOT met at Norwood Gage / East Branch Gage				
	Norwood	East Branch	Use	days needed	1989	1990	1991	1992	1993
0.15 cfsm	5.2	4.1	minimum flow	365	1/0 (0.27/0)	0/0 (0/0)	10/12 (2.7/3.3)	2/0 (0.55/0)	28/37 (7.7/10)
95 cfs	28.1	22.1	minimum flow	90	2/0 (2.2/0)	0/0 (0/0)	9/5 (10/5.6)	11/11 (12/12)	4/5 (4.4/5.6)
0.61 cfsm	21.2	16.6	trout	90	0/0 (0/0)	0/0 (0/0)	13/5 (14/5.6)	10/7 (11/7.8)	4/3 (4.4/3.3)
2.68 cfsm	93.0	73.2	smelt	30	27/24 (90/80)	29/27 (97/90)	24/14 (80/47)	22/7 (73/23)	16/11 (53/37)
2.41 cfsm	83.6	65.8	smelt	30	14/10 (47/33)	12/13 (40/43)	23/22 (77/73)	19/20 (63/67)	0/2 (0/6.7)
1.59 cfsm	55.2	43.4	smelt	30	8/9 (27/30)	2/1 (6.7/3.3)	21/21 (70/70)	23/21 (77/70)	20/19 (67/63)
1.82 cfsm	63.2	49.7	canoeing	365	252/237 (69/65)	188/185 (52/51)	245/258 (67/71)	248/223 (68/61)	230/211 (63/58)

cfsm = cubic feet per second per square mile of drainage area
cfs = cubic feet per second

excavated once per year (one in the spring, one in the fall) to remove the accumulated residual. The residual is landfilled (upland disposal) by a contractor, after being tested for iron, manganese, and other potential contaminants. To date the town has not had a problem with landfilling these residuals.

DISCUSSION

The majority of the WMA registered and permitted water suppliers are operating within their permit limits. The majority of the non-compliance appears to be lack of reporting and follow-through with recommended conservation measures. While the general trend was for municipal ADD to increase during the summer months, two communities, Dover (104 gpcd) and Medfield (85.6 gpcd), had extremely high per capita usage. Two other communities, Foxborough and Walpole need to determine the reasons for their unaccounted for water use of 27% and 26%, respectively. With the exception of Foxborough, the other three towns mentioned withdraw their water from the Mine Brook subbasin, which is exhibiting signs of stress (refer to Section 9).

Approximately 42% of the municipal water supply withdrawn from the Neponset River Watershed is transferred out-of-basin via the MWRA sewer system as wastewater (MA DEM 1995). This loss of water essentially reduces available streamflow, and threatens instream uses such as aquatic life, habitat quality and quantity and recreational uses such as canoeing. Strong conservation measures through implementation strategies such as block rate pricing, installation of water-saving devices in homes and public buildings, in concert with a strong educational program, will all help reduce the stress placed on the water resources in the Neponset River Watershed.

RECOMMENDATIONS

1. Implement block rate pricing structure in the following communities: Dover, Walpole, and Dedham/Westwood.

2. Address high per capita demand through education and conservation efforts in Dover, Walpole, Medfield, and Sharon, and high summer demand in Dedham/Westwood.

3. Retrofit public buildings and homes with water saving devices in Canton, Foxborough, and Walpole.

4. Address unaccounted for water use in Foxborough and Walpole, and offset any increase in demand through water conservation efforts to the extent feasible.

5. Dover should be encouraged to initiate a strong water conservation program as they are currently unregulated by the WMA program.

6. Water withdrawals from the Mine Brook system should be reduced during critical (low-flow) conditions.

7. Require compliance with permit conditions for each water supplier noted as outstanding issues in the five-year review.

SECTION 7: WASTEWATER DISCHARGES

INTRODUCTION

Assessment of wastewater discharges is an essential part of water quality management planning for any watershed. Historically, the Neponset River was used as the disposal site for industrial and sanitary wastewater. Industrial development in the Neponset River watershed started in the early 1600's. From that time until the late 1960's water quality of the river was heavily impacted by direct discharges of wastewater from industries. The results of the 1994/1995 Neponset River wastewater discharge assessment indicate a significant decrease in the number of point source discharges since the 1960s.

Throughout Massachusetts major reductions in point source loadings from direct discharge of wastewater have been made by constructing wastewater treatment plants (WWTP), extending sewer lines, and implementing source reduction measures. With the exception of Dover, Medfield, Foxborough and Sharon, the communities within the Neponset watershed are serviced by the Massachusetts Water Resources Authority sanitary sewer system. It is estimated that 70% of all households and establishments are connected to the sewer lines within these MWRA sewered communities. In addition, a small portion of the town of Foxborough is sewered to the Mansfield WWTP.

The discharge of wastewater to a surface waterbody requires a National Pollutant Discharge Elimination System permit under the provisions of Section 401 of the Federal Clean Water Act (EPA 1992). In Massachusetts the U.S. Environmental Protection Agency is responsible for issuing NPDES permits, as Massachusetts has not assumed NPDES program delegation. This permit program is administered through EPA Region I, with DEP certifying permit conditions according to the requirements of Section 401. In addition, the DEP signs each NPDES permit, creating separate state and federal permits which provide equal regulatory and enforcement authority for both agencies. DEP reviews the conditions of each NPDES permit and certifies the permit unconditionally or with special conditions if appropriate.

NPDES permits limit the amount of pollutants that can be discharged from a point source in order to protect the designated instream uses of the receiving water, and contain monitoring requirements for discharges. Limits and monitoring requirements vary from permit to permit, and are developed specifically to address the type and amount of discharge, the seven day, 10 year low flow (7Q10) of the receiving stream, as well as other factors.

EPA has established a rating system to categorize discharges as either "Major" or "Minor". Any facility discharging one million gallons per day (MGD) to a surface water is categorized automatically as a major discharge. A facility discharging less than this amount may also be categorized as a major, depending upon the type of wastewater being discharged and/or the relationship of the discharge to the receiving stream 7Q10 flow. In addition, any municipal wastewater treatment plant that is required to implement a pretreatment program is categorized as a major, regardless of the volume of wastewater being discharged.

Traditionally, NPDES permits have been issued for discharges of process wastewater, sanitary wastewater, combined sewer overflow (CSO), and contact and/or noncontact-cooling water. In 1992, the EPA initiated the Storm Water NPDES Permit Program to regulate discharges of certain types of storm water; this new permit program is discussed in Section 8, Storm Water and in Appendix E. It should be noted that a number of the existing Neponset River Basin permits covered storm water discharges prior to the start up of the Storm Water NPDES Permit Program.

METHODS

A number of methods were used to address wastewater discharges in the Neponset Watershed, including: investigation of 21 facilities that discharge to waters of the basin, and review of the Final CSO Conceptual Plan and System Master Plan (MWRA 1994) to determine the status of the three remaining CSOs in the Neponset Basin. The Neponset River Basin wastewater discharges are listed in Table 7.1 and located in Figure 7.1.

In addition, the DEP Environmental Strike Force conducted investigations within the basin to identify illegal discharges.

Finally, a review of 21E files was conducted by DEM staff and interns to identify existing and potential impacts on surface and groundwater. A 21E site is a property impacted by a release of oil and/or hazardous materials as defined by the Massachusetts Contingency Plan of MA General Laws, Chapter 21E (MA DEP 1993).

TABLE 7.1. 1994 NEPONSET RIVER BASIN SURVEY. Facilities discharging wastewater to the Neponset River Basin.

SITE	FACILITY NAME AND ADDRESS	NPDES PERMIT NUMBER	RECEIVING WATER	SEGMENT/ SUBWATERSHED	TYPE OF DISCHARGE
1	The Foxboro Company 38 Neponset Avenue, Foxborough	MA0004120	Neponset Reservoir via Gudgeon Brook	1/1.1	Storm Water
2	Foxborough State/Wrentham State Hospital Payson Road, Foxborough	MA0102199	Crackrock Pond	1/1.1	Sanitary Wastewater
3	Bird Machine Company 100 Neponset Street, South Walpole	MA0000230	Neponset River	1/1.2	Storm Water, Non-Contact Cooling Water
4	Senior Flexonics Inc., Metal Bellows Division 1075 Providence Highway, Sharon	MA0035629	Tributary to School Meadow Brook	1/1.2	Process Wastewater, Non-Contact Cooling Water
5	Mobil Service Station 751 Main Street, Walpole	MA0033812	Neponset River via Storm Drain	1/1.2	Remediated Groundwater
6	Harold E. Willis Water Treatment Plant Leonard Road, Walpole	MA0025488	Mine Brook via Wetland	1/1.3	Water Treatment Filter Backwash
7	Hollingsworth & Vose Company Washington Street, East Walpole	MA0004570	Neponset River	1/1.3	Strainer Backwash (Proposed Discharge of Process Wastewater)
8	Bird Roofing Company 1077 Pleasant Street, Norwood	MA0003531	Neponset River	1/1.3	Process Wastewater, Non-Contact Cooling Water
9	Gibbs Service Station 469 Walpole Street, Norwood	MA0034029	Hawes Brook	1/1.33	Remediated Groundwater
10	Factory Mutual Engineering 1151 Boston-Providence Highway, Norwood	MA0003639	Neponset River	2/2.1	Fire Fighting Safety Equipment Test Water
11	Mobil Service Station 971 Providence Highway, Norwood	MA0032905	Neponset River	2/2.1	Remediated Groundwater

Table 7.1. (continued)

SITE	FACILITY NAME AND ADDRESS	NPDES PERMIT NUMBER	RECEIVING WATER	SEGMENT/ SUBWATERSHED	TYPE OF DISCHARGE
12	Sunoco Service Station 960 Providence Highway, Norwood	MA0034312	Neponset River	2/2.1	Remediated Groundwater
13	Grant Gear Inc. 921 Providence Highway, Norwood	MA0029262	Meadow Brook	2/2.1	Storm Water
14	Plymouth Rubber Company 104 Revere Street, Canton	MA0000884	East Branch Neponset River	4/2.17	Storm Water, Non-Contact Cooling Water
15	Shield Packaging Company 21 University Road, Canton	MA0035629	Neponset River via Wetland	2/2.2	Remediated Groundwater
16	Devaney Oil Company 111 River Street, Dedham	MA0030848	Mother Brook via Storm Drain	2/2.3	Truck Wash Water
17	L.E. Mason Company 98 Business Street, Hyde Park	MA0003999	Mother Brook	2/2.3	Non-Contact Cooling Water
18	James G. Grant Recycling Facility 28 Wolcott Street, Hyde Park (Readville)	None at this time	Neponset River	2/2.3	Storm Water
19	Milton Academy 325 Randolph Avenue, Milton	MA0034061	O'Hare Pond	2/2.31	Remediated Groundwater
20	Town of Milton Town Office Building 525 Canton Avenue, Milton	MA0100536	Neponset River	2 and 3/ 2.31 and 3.1	Sewer Line Bypass/Combined Sewer Overflow
21	US Army National Guard Armory 70 Victory Road, Dorchester	MA003025[illegible]	Dorchester Bay via Storm Drain	3/3.1	Truck Wash Water
22	Boston Water and Sewer Commission 10 Post Office Square, Boston	MA0101192	Neponset River and Tenean Bay	3/3.1	Combined Sewer Overflow

RESULTS

Site Investigations

During the summer/fall of 1994 site investigations/visits were conducted at 21 facilities located in the basin. A Summary Fact Sheet, containing the information obtained from the investigations, was completed for each site; these fact sheets can be found in Appendix D.

At the headwaters of the basin, the Foxboro Company's (Number 1, Figure 7.1) past and present activities are a major concern in the watershed. Currently, all process and sanitary wastewater from the company is discharged to the Mansfield WWTP and cooling water is recirculated via a closed-loop system. Only storm water is discharged to the Neponset Reservoir from the property via Gudgeon Brook. During low flow periods, concentrations of volatile organic compounds (VOCs) in excess of drinking water standards have been detected in Gudgeon Brook; the company is investigating the source(s) of these VOCs. While these investigations continue, Foxboro Company is treating Gudgeon brook with air stripping. In addition, high concentrations of cadmium and other heavy metals in the Neponset Reservoir sediments, as well as high nutrient levels, have been linked to the company's past activities. Pickerel Cove, into which the company previously discharged wastewater, has been identified as a 21E

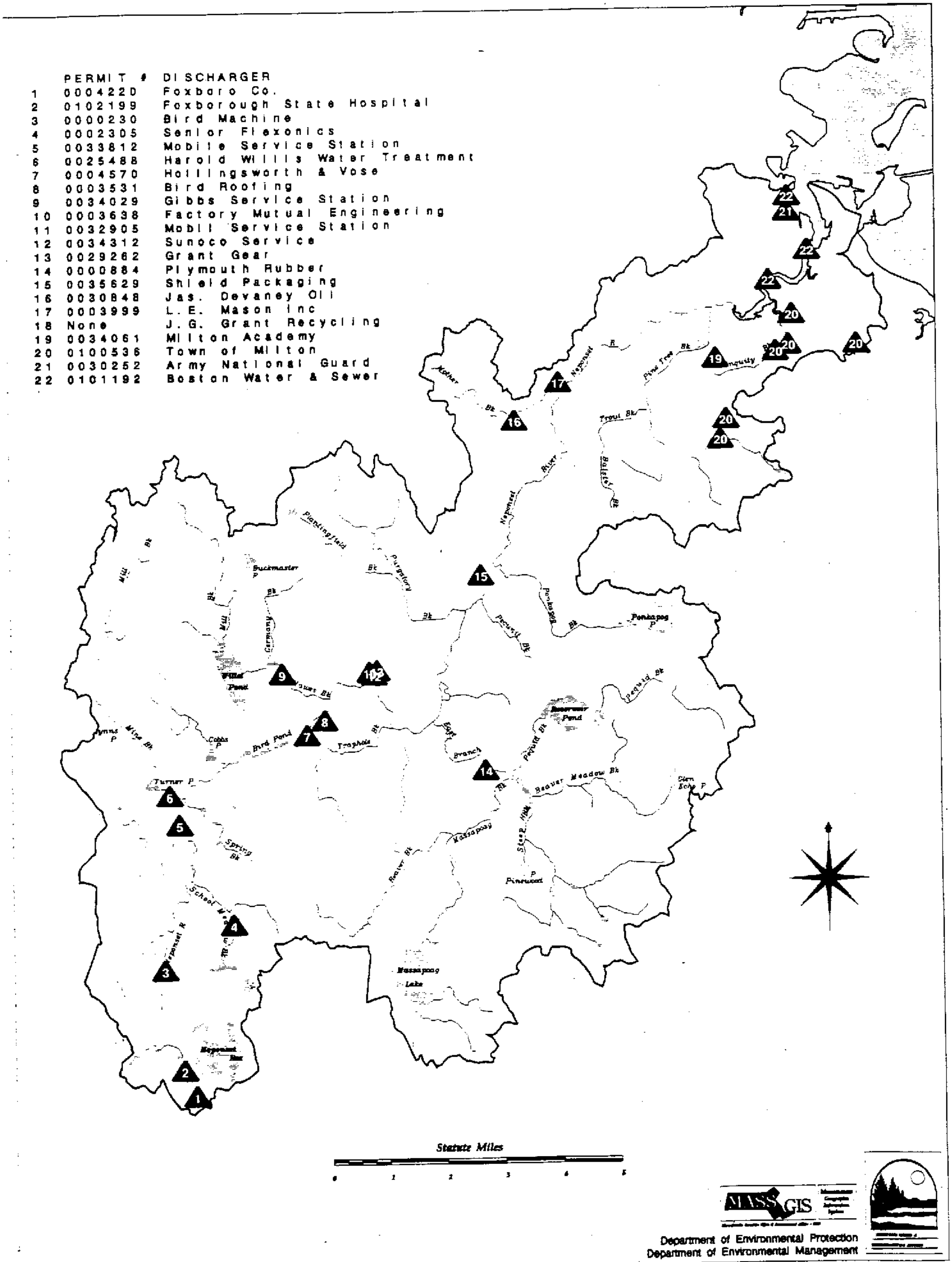


Fig. 7.1. 1994 NEPONSET RIVER BASIN SURVEY. Location of permitted facilities discharging wastewater to the Neponset River Basin.

site, and Foxboro Company was issued a Notice of Responsibility (NOR) for this site on May 19, 1995. In accordance with the requirements of the Massachusetts Contingency Plan (MCP) (MA DEP 1993), Foxboro Company hired a Licensed Site Professional (LSP), ERM-New England, Inc., to manage, supervise and/or actually perform the response actions which Foxboro Company intends to undertake at the site. In response to the MCP requirements, ERM-New England, Inc. has submitted a study plan for the reservoir, which is currently being reviewed by DEP.

The one remaining sanitary wastewater discharge in the basin is at the location of the Foxborough State Hospital (Number 2, Figure 7.1). Although the hospital has been closed for a number of years, an elderly housing unit still discharges to Crackrock Pond via the hospital's wastewater treatment plant; it is proposed to tie this discharge into the Mansfield WWTP in the future. However, if the connection has not been made by September, 1996 when the NPDES permits are scheduled to be reissued, this facility will again receive a permit.

Going from the headwaters of the basin in Foxborough into Walpole the next facility discharging to the mainstem Neponset is Bird Machine Company (Number 3, Figure 7.1). This is categorized as a minor discharge consisting of seven storm water outfalls and one non-contact cooling water discharge. No Best Management Practices (BMPs) to control/treat the storm water were observed during the inspection. In addition, two of the storm water outfalls were discharging during the visit, although it had not rained for several days. This discharge could be groundwater seepage, however, this needs to be confirmed.

Senior Flexonics Inc. in Sharon (Number 4, Figure 7.1) discharges process wastewater from an electroplating operation and cooling water to a tributary of School Meadow Brook. In addition to the NPDES permitted discharges, this is a 21E site due to chlorinated hydrocarbon contamination of soil and groundwater caused by a previous owner, Parker Hannifin, Corp. As a result of the groundwater contamination and its subsequent migration, a remediation system has been installed at the town of Walpole Washington Well #6.

A Mobil Service Station (Number 5, Figure 7.1) located at 751 Main Street in Walpole discharges remediated groundwater from a granular activated carbon treatment system. Groundwater contamination at this site occurred as a result of a leaking underground storage tank (UST).

The Harold E. Willis Water Treatment Plant (Number 6, Figure 7.1) discharges water treatment filter backwash to a wetland that drains to Mine Brook. The town of Walpole, which operates this plant, was notified of the availability of the new General Permit for water treatment filter backwash discharge. This General Permit was promulgated by the EPA and certified by DEP in December, 1994.

Currently Hollingsworth & Vose Company (Number 7, Figure 7.1) discharges sanitary wastewater, and the majority of its process wastewater, to the MWRA sewer system via the local sanitary sewer. Plans are underway for the company to discharge 0.7 MGD of treated process wastewater to the mainstem Neponset. On May 3, 1995 EPA issued Hollingsworth & Vose an NPDES for this discharge, in addition to the current permitted discharge of 0.004 MGD of strainer backwash. With the issuance of this permit, the company can prepare the final design for the required treatment system. It is anticipated that the discharge from this company to the river will start up within the next two years.

Bird Roofing Company (Number 8, Figure 7.1) is located approximately ½ mile downstream from Hollingsworth & Vose. The Company owns and operates two facilities, a Roofing Material Manufacturing Plant (with raw material and fuel storage) and a Granule Manufacturing Plant (a stone crushing operation), with contact cooling water (outfall 001) and process wastewater (outfall 002) discharges to the Neponset River. The process discharge from this company has a distinct milky color. During a site visit conducted on 26 July 1994, a plume from the discharge was noted in the river. Current Discharge Monitoring Report (DMR) data submitted by the company indicates a discharge of two to six pounds per day of total suspended solids (TSS), in compliance with their current discharge permit limit of 90 pounds per day of TSS. In addition to point source discharges, storm water runoff from the facility grounds also contributes pollutants to the Neponset River. The company has implemented some pollution prevention measures (i.e., oil and grease traps for all of their storm water outfalls). Additionally, the company has designed a detention basin to collect all process and storm water runoff from the Granule Plant. This storm water BMP should be completed during 1996. This company did apply for a multi-sector storm water permit, which has not been issued at this time.

The Hawes Brook confluence with the Neponset occurs ⅛ mile downstream from the Bird Roofing property, while Meadow Brook converges with the Neponset ⅜ mile downstream from the Hawes Brook - Neponset confluence. There are four minor discharges in this area of Norwood, a Gibbs Service Station (Number 9, Figure 7.1), a Sunoco Service Station (Number 10, Figure 7.1), a Mobil Service Station (Number 11, Figure 7.1) and Factory Mutual Engineering Inc. (Number 12, Figure 7.11), and one major discharge, Grant Gear Inc. (Number 13, Figure 7.1). The three service stations discharge remediated groundwater and are listed 21E sites. The intermittent discharge from Factory Mutual Engineering consists of water used to test fire fighting safety equipment. Grant Gear, Inc. is a Superfund site (due to past practices of a previous owner), and discharges storm water to Meadow Brook. It should be noted that Meadow Brook is severely impacted by the discharge from leaking/broken sewer lines in the area; this situation is discussed in Section 2, Water Chemistry.

Less than a mile downstream from the Neponset confluence with Meadow Brook, the East Branch Neponset River converges with the mainstem. Plymouth Rubber Company (Number 14, Figure 7.1) is the only permitted wastewater discharge in the East Branch subwatershed. The discharge from this facility consists of non-contact cooling water and storm water; the impacts of this discharge on the receiving water needs further investigation.

Approximately three miles downstream from the East Branch-Mainstem confluence is Shield Packaging Company (Number 15, Figure 7.1). This discharge is remediated groundwater from three extraction wells; treatment consists of in-line filtration, air stripping and carbon adsorption for removal of chlorinated solvents. The manufacturing (filling, assembling and packaging aerosol cans with chemicals and propellants) which operated at this site was relocated to a facility in Webster, MA in 1982.

The confluence of the Neponset mainstem with Mother Brook in Hyde Park occurs approximately five miles downstream from Shield Packaging Company. Devaney Oil Company (Number 16, Figure 7.1) applied for an NPDES permit to discharge truck wash water via a storm drain to Mother Brook. L.E. Mason Company (Number 17, Figure 7.1) was permitted to discharge non-contact cooling water to Mother Brook, however, the company has now installed a closed-loop recirculating system. This company was the subject of an Environmental Strike Force case during the 1994 Neponset River Watershed Project; results of this case are described below.

Just downstream from the Neponset Mainstem - Mother Brook confluence, is a large metals recycling facility, James Grant Recycling Company (Number 18, Figure 7.1). The property consists of 15 to 20 acres with large piles of unprotected, exposed scrap metals. Although there is an approximate 100 foot buffer strip between the facility and the river, additional BMPs may be necessary to protect the river from site runoff during storm events. In addition, due to the nature of the operation, there is a concern with the potential for soil and groundwater contamination at the site. James Grant Recycling currently does not have an NPDES permit, nor is there a record of the company having applied for a storm water permit.

Three additional investigations were conducted in the lower portion of the basin. Milton Academy (Number 19, Figure 7.1) has an NPDES permit for the discharge of remediated groundwater to O'Hare pond; this is considered a minor discharge. The U.S. Army National Guard Armory (Number 20, Figure 7.1) applied for an NPDES permit for an intermittent discharge of vehicle washwater to Dorchester Bay via a Boston Water and Sewer Commission (BWSC) sewer line. Based on information from the BWSC, this discharge goes to a combined sewer, and, therefore, an NPDES permit may not be needed. The town of Milton (Number 21, Figure 7.1) has a permit for ten bypass points from the town's separate sanitary sewer system. Currently, there are six sewer/pump overflow stations scattered throughout Milton. Formerly, four additional siphon overflow valve stations existed, however these have been shut off in recent years. Records indicate that the six remaining bypass points discharge at least several times per year. Bypasses occur during high groundwater and/or rainy periods, particularly in the spring. Besides groundwater contributing to sewer line infiltration, basement sump pump tie-ins are known to contribute inflow to the sewer lines throughout Milton. When bypasses occur, there are potentially serious pollution problems, particularly with regards to pathogens, to immediate receiving tributaries which in a short distance converge with the mainstem Neponset.

The three remaining permitted wastewater discharges in the basin are combined sewer overflows from the MWRA/BWSC sewer system. These discharges are addressed by the MWRA Final CSO Conceptual Plan and System Master Plan (MWRA 1994), and are discussed below. A combined sewer is one which conveys both sanitary sewage and storm water, and may overflow during storm events when the capacity of the sewer line is exceeded. The combined sewer overflow is the point at which a combined sewer is relieved when its capacity is exceeded and combined sewage is discharged to a receiving water.

Review of the MWRA Final CSO Conceptual Plan

The MWRA has completed its Final CSO Conceptual Plan, which is an integral part of its comprehensive System Master Plan (MWRA, 1994). The system master plan combines interceptor and transport needs, infiltration/inflow (I/I) control, and secondary treatment capacity needs to determine impacts on the Conceptual Plan for CSO control.

The MWRA's long term CSO Control Program consists of several past, present and future phases:

- I Improvements Made (1988-1992);
- II Ongoing System Optimization and Improvements (1992-1997);
- III Recommended CSO Control Facilities (1997-2010);
- IV Watershed Planning Efforts (Ongoing).

System improvements have decreased annual CSO volumes throughout the MWRA area from 3.3 billion gallons in 1988 to 1.5 billion gallons in 1992. These volumes are expected to decrease to about one billion gallons by 1997, and 0.5 billion gallons after full plan implementation in 2010. Along with these decreases, the remaining portion of the CSO flow which is treated will rise to 96%. Future plans focus on the control of bacteria and floatables to increase swimming, shellfishing, and aesthetic/recreational uses of the receiving waters. In the case of "critical use waters" the plan is to eliminate all CSO discharges. MWRA has designated the lower Neponset as a high priority project area because of the critical use, shellfishing.

The segment of the Neponset River impacted by combined sewer overflows is tidal and is classified as SB-Fishable/Swimmable. Currently this portion of the river is not meeting water quality standards; all shellfishing is prohibited, and existing water use is confined to boating. Outfall BOS095 is located adjacent to the Granite Avenue Bridge; the second CSO discharge outfall, BOS093, is located approximately one mile below BOS095. The third CSO discharge, BOS090, is located at Commercial Point, where the Neponset enters Dorchester Bay. Treatment of the BOS090 discharge, screening and chlorination, is provided at the Commercial Point CSO Treatment Facility.

The CSO discharges contribute fecal coliform and nutrient loadings to the river, however, research conducted by the MWRA has indicated that storm water and upstream discharges are principally responsible for non-attainment of water quality standards in this segment. It has been estimated by MWRA that during a one-year storm, the two untreated CSO discharges, BOS093 and BOS095, contribute approximately 20% of all fecal coliform and 10% of nutrient loadings to the lower portion of the Neponset

River. On an average annual basis, these CSOs contribute less than 4% of the fecal coliform and less than 1% of the total nutrient loading to the river.

Several alternatives were considered for CSO control at these three outfalls. The various options which were studied tried to balance quality benefits with future uses, siting issues and cost. Consistent with the approach taken for other CSOs in Dorchester Bay, elimination of CSO discharge to critical use areas, the option of complete sewer separation was recommended. Separation in this area is scheduled as listed in tables 7.2 and 7.3.

TABLE 7.2. 1994 NEPONSET RIVER BASIN SURVEY. Schedule for sewer separation in South Dorchester Bay, impacting CSO BOS090.

ACTIVITY	START DATE	END DATE
Facilities Planning/Environmental Impact Report	January 1, 1996	March 31, 1998
Site Acquisition	April 1, 1999	September 30, 2008
Design	April 1, 1998	March 31, 2008
Permit Acquisition	April 1, 1999	March 31, 2008
Construction	April 1, 2000	September 30, 2010

TABLE 7.3. 1994 NEPONSET RIVER BASIN SURVEY. Schedule for sewer separation in the lower Neponset River Basin, impacting CSOs BOS093 and BOS095.

ACTIVITY	START DATE	END DATE
Facilities Planning/Environmental Impact Report	January 1, 1996	June 30, 1997
Site Acquisition	April 1, 1999	March 31, 2000
Design	April 1, 1998	September 30, 1999
Permit Acquisition	April 1, 1999	September 30, 1999
Construction	April 1, 2000	September 30, 2001

In the interim, prior to the implementation of the sewer line separation, the Commercial Point facility will be upgraded to include dechlorination by March 31, 1998.

Environmental Strike Force Investigations

The Environmental Strike Force (ESF) is continuing its comprehensive investigation of both NPDES dischargers which are in violation of permit limits, as well as unpermitted dischargers. Investigation of the NPDES dischargers includes activities ranging from review of EOEA's Facility Master File (FMF) and EPA files to aerial and ground surveillance. Unpermitted dischargers are identified through river surveys, aerial surveillance and the random identification of pipes in industrial areas. Though all ESF targets must remain confidential until cases are brought to court, there are several potential violators currently under investigation.

One recent success story for ESF in the Neponset River Watershed was the settlement of the L.E. Mason case. L.E. Mason, a 200-employee manufacturing firm, was caught discharging TCE (tricholoethylene) to Mother Brook. As a result of the ESF civil action, the company agreed to pay a penalty of $250,000. In addition, L.E. Mason will completely eliminate the use of TCE and convert to a water-based system for degreasing. This pollution prevention measure will not only have a positive environmental impact on Mother Brook and the Neponset River, but will also protect workers who were previously exposed to a known carcinogen.

In all Neponset River Watershed cases the ESF will strive to deter illegal behavior, while seeking pollution prevention, appropriate penalties, and the highest environmental yield possible.

Review of 21E Files

DEM staff and interns reviewed the 21E files located at DEP's Northeast and Southeast Regional offices and compiled a database, **21E Sites in the Neponset River Basin**. The purpose of this database is to provide information regarding the location of 21E sites, contaminants of concern, resources being affected, source(s) of the contaminants, and effects on surface and groundwater.

A total of 257 21E sites have been identified within the basin. Due to time restrictions, the database does not include those portions of Boston and Quincy which are located within the Neponset River Watershed. Table 7.4 lists the number of 21E in each municipality:

TABLE 7.4. 1994 NEPONSET RIVER BASIN SURVEY. Breakdown of 21E Sites in Neponset River Basin Municipalities.

MUNICIPALITY	NUMBER OF 21E SITES
Canton	75
Dedham	17
Dover	0
Foxborough	7
Medfield	0
Milton	10
Norwood	69
Randolph	0
Sharon	5
Stoughton	22
Walpole	34
Westwood	18

Gasoline measured as benzene, toluene, ethylbenzene, and xylene (BTEX) is the primary contaminant found at 21E sites in the basin. There are 91 sites that feature gasoline as the sole or primary pollutant; this accounts for 35% of the total sites. BTEX contamination primarily results from leakage of underground storage tanks. Gasoline is a highly volatile liquid consisting of a mixture of organic compounds. The BTEX components of gasoline are highly soluble in water, thus, they have the potential to migrate relatively rapidly along an aquifer upon reaching the water table. The accompanying volatility enables these compounds to also migrate vertically into the unsaturated zone as the contaminant plume moves horizontally along the aquifer. This potential for simultaneous horizontal and vertical subsurface migration requires that cases of gasoline contamination be dealt with in a timely manner.

Fuel oil is found at 46 sites or 18% of all identified 21E sites, and chlorinated hydrocarbons (CHCs) are found at 43 sites or 17% of all sites. Although not as mobile as gasoline, both fuel oil and CHCs contain carcinogenic components, and any contamination of drinking water supplies by either of these pollutants generates a public health concern.

The primary source of soil and groundwater contamination within the Neponset River Watershed is leaking underground storage tanks, occurring at 63% of all sites in the basin.

A copy of the Neponset 21E database was given to the Neponset River Watershed Association for distribution to citizen monitoring groups and community officials, so that they are aware of these sites when performing shoreline surveys and other activities within the basin.

In cases where groundwater contamination has occurred at a 21E site, treated groundwater may be discharged to a surface water during the site remediation. In many of these cases, an NPDES Permit Exclusion would be issued by the EPA for the discharge of the remediated groundwater. The emergency exclusion system was developed by EPA to issue permits, in a timely manner, for temporary, low flow discharges with limited pollutant concentrations. The issuance of a "regular" NPDES permit is a lengthy process, involving water quality investigations and a 30 day public comment period. Emergency exclusions, like NPDES permits, contain sampling requirements and conditions for discharge.

Exclusions are issued for a variety of temporary discharges, including:

- Dewatering of excavations for UST replacement or pipelines (presumption of contamination);
- *Dewatering for contaminated soil removal;*
- Remediation of contaminated groundwater;
- Pump tests, cleaning and purging of groundwater monitoring wells, recovery wells, and water supply wells;
- Hydrostatic testing of above-ground oil tanks;
- Building basement dewatering following floods, firefighting, frozen pipes, etc. (presumption of contamination).

Since the start of 1994, 18 sites in the basin have been issued exclusions.

DISCUSSION

As stated above, the results of the 1994 *Neponset* River wastewater discharge assessment indicate a significant decrease in the number of point source discharges since the 1960s. The 21 facilities listed in Table 7.1 represent only a portion of the prior dischargers in the Neponset River Watershed. Since the 1960s, at least 20 facilities have ceased their direct discharges to the Neponset Basin, including:

1. Perkit Folding Box Corporation (1960s)*
2. Rosenfeld Washed Sand and Stone Company, (1960s)
3. Foxboro Raceway (1967)
4. Farrington Texol Company (1970)
5. Allis Chalmers Company (1970s)
6. Boston Envelope Company (1970s)
7. New London Mills (1970s)
8. Sun Chemical Company (1970s)
9. Tileston and Hollingsworth (1970s)
10. American Davidson, Sturtevant Division (1978)
11. Rogers Packing Corporation (1981)
12. American Biltrite Inc., Amtico Flooring Division (1983)
13. Kendall Company (1985)
14. Norwood Hospital (1985)
15. Jet-Line Service, Inc. (1987)
16. Dedham Water Company, Well #3 (1989)

17. Qual-Craft Industries (1989)
18. Reliable Electronic Finishing Company (1989)
19. Patriot Paper Company (1993)

20. Northrop Corporation (1994)

* Date of termination of the discharge.

The processes performed by these companies included: paper making, metals processing, wood and materials fabrication, rubber product manufacturing, food processing, meat processing, animal food productions, stone/gravel processing, health and hospital, hazardous chemicals processing. These industries, in many cases, discharged of significant pollutant loadings to the Neponset River and its tributaries. In addition, several of the industries that still discharge show significant decline in discharge volume and pollutant loadings resulting from declining production activities, and/or the discharge of certain wastewaters to the municipal sewer systems.

Other actions in the basin which have (or will in the future) resulted in decreased pollutant loadings are those projects being undertaken by the MWRA and the BWSC to improve the sewage collection system. In addition to the CSO work being planned and implemented by those agencies, the MWRA is in the process of upgrading the New Neponset Valley Relief Sewer, including the Walpole Extension Relief Sewer and the Stoughton Extension Relief Sewer. This work will alleviate the stress on the sewer lines under wet weather conditions by increasing sewer trunk capacity. The BWSC has an established Storm Water Management Program which includes remediating illegal sanitary connections to storm drains (BWSC's program is discussed in greater detail in Section 8, Storm Water). Efforts such as these can only result in lower pollutant loadings to the watershed.

While reducing pollutant loadings from direct discharges is a positive goal, this also has resulted in the reduction of the volume of water being discharged back to the surface waters of the Neponset Basin. Currently, much of the water being withdrawn in the basin is being transferred out of basin to Boston Harbor via the MWRA sewer system or to the Taunton River Basin via the Mansfield WWTP. Low stream flow is a serious problem in the Neponset River Basin, and is discussed in further detail in Section 9. This concern over low flow was a major consideration in granting Hollingsworth & Vose a permit to increase their discharge by 0.7 MGD. The reasoning behind this permit was that with proper waste treatment and strict discharge limits the resulting instream increase of flow would be of overall benefit to the Neponset River.

CONCLUSIONS

There has been a significant decrease in pollutant loadings from direct discharges to the Neponset River Basin since the 1960s. However, results of the sediment analyses (Section 3, Sediment) have generated concerns that past disposal practices in the basin may be affecting current water quality. In addition, reduction in wastewater discharge flows have resulted in a reduction of instream flow and an increase in out of basin transfer of water. Although pollutant loadings from the direct discharge of wastewater have significantly decreased, the river is still not attaining water quality standards (Section 2, Water Chemistry). Other sources of pollutant loadings have been identified, such as storm water and leaking sewer lines, and are being assessed and addressed. 257 21E sites have been identified within the basin, excluding Boston and Quincy. These sites are another potential source of pollution to the surface waters of the basin.

The data generated from the site investigations will be utilized to update existing, or generate new NPDES permits to be issued in September, 1996. As noted above, a general permit for water treatment filter backwash discharge was promulgated by the EPA and certified by DEP in December, 1994. In addition, a general permit was promulgated for non-contact cooling water discharges in April, 1994. A general permit covers a specific type of wastewater that has similar discharge characteristics and contains generic limits and conditions for the wastewater type which it addresses. The purpose of developing general permits is to ease the administrative burden of the NPDES program and to issue updated permits for discharges that are considered minor discharges.

RECOMMENDATIONS

Laboratory resources are needed to perform wastewater analyses. This data is necessary to confirm the DMR analytical results submitted to the EPA and the DEP by the permittees and to calculate discharge loadings.

The review of the 21E files indicate that the primary source of soil and groundwater contamination within the Neponset River Watershed is leaking underground storage tanks. Distribution of outreach materials that assist owner/operators in identifying potential UST related problems may help to reduce this pollution source.

The Summary Fact Sheet (Appendix D) for each industry contains specific recommendations to be considered when the permits are reissued. The following summarizes these recommendations for the priority discharges.

1. Foxboro Company, Foxborough - At this time only storm water is being discharged from this site to the Neponset Reservoir. The renewed NPDES permit needs to include provisions for storm water BMPs and a pollution prevention plan. In addition, based on the results of the Gudgeon Brook monitoring, VOC analytical requirements and limits may be warranted. Other concerns over past company practices are being handled by the DEP Southeast Regional Office, in coordination with the EPA and the town of Foxborough.

2. Bird Machine Company, Walpole - Further investigation is warranted to determine the source of the storm drain discharge during dry weather. The renewed NPDES permit needs to include provisions for storm water BMPs and a pollution prevention plan.

3. Senior Flexonics Inc., Metal Bellows Division, Sharon - Monitoring of this company's process wastestream is required to confirm the DMR analytical results submitted and to calculate current discharge loadings.

4. Hollingsworth & Vose Company, Walpole - Impacts of the discharge need to be studied and assessed once the actual increase in process discharge occurs.

5. Bird Roofing Company, Norwood - Monitoring of this company's process wastestream is required to confirm the DMR analytical results submitted and to calculate current discharge loadings. The renewed NPDES permit will need to address effluent quality (i.e., turbidity) as well as provisions for storm water BMPs and a pollution prevention plan.

6. Grant Gear, Norwood - The storm water management plan for the site needs to be reviewed.

7. James Grant Recycling Company, Hyde Park - Potential storm water impacts from the site to the Neponset River need to be addressed.

8. Town of Milton - Overflow discharges from six sewer pump stations need to be eliminated.

SECTION 8: STORM WATER and NONPOINT SOURCE POLLUTION

INTRODUCTION

The effects of storm water runoff and nonpoint sources of pollution on receiving water have been given increased attention over the past number of years. In the past, efforts to improve water quality in Massachusetts have focused on controlling direct discharges from municipal and industrial facilities. These "point sources" of pollution have been regulated, for the most part, by the NPDES permit program, and major reductions in point source loadings have been made by constructing wastewater treatment facilities and implementing source reduction measures. Despite these measures, the waters of the state continue to be degraded, and storm water runoff is now recognized as a significant contributor of contaminants to Massachusetts receiving waters.

Industrial development in the Neponset River watershed started in the early 1600's. From that time until the late 1960's water quality of the river was primarily impacted by point source discharges from industries. The results of the 1994 Neponset River wastewater discharge assessment (Section 7) indicate a decreasing number of direct discharges in the basin. Despite the reduction of wastewater discharges, the Neponset River, like many other surface waters in Massachusetts, is still not meeting water quality standards, and storm water and other nonpoint sources of pollution are contributing to the water quality problems in the Neponset basin.

For the purpose of this report, storm water is divided into two general categories: permitted storm water discharges and nonpoint source storm water discharges. In an attempt to control storm water pollutant sources, the EPA now regulates storm water discharges from certain types of industries, municipalities and construction sites under the NPDES Storm Water Permit Program. This program is described in greater detail below, and in Appendix E. Storm water discharges not subject to the NPDES program are classified as nonpoint sources of pollution, unless regulated by local bylaws. As the phased NPDES storm water permit program progresses, additional nonpoint sources of pollution may be regulated under this program

Whether storm water runoff is categorized as a "point source" discharge, requiring a permit, or as a "nonpoint source", the changes in water quantity and quality resulting from development within a watershed can adversely impact the water resources. During development natural land cover is removed, impervious area is enlarged with paving of land and construction of buildings, and natural drainage systems are modified to remove runoff faster. The increased runoff volume provides a larger capacity to transport pollutants, and as land use intensifies, the concentrations and types of contaminants available also increase. In addition, the increase of impervious area within a watershed reduces the opportunity for natural treatment of storm water via infiltration and evaporation.

Nonpoint source (NPS) pollution is defined by the USEPA as "pollution of surface water or groundwater supplies originating from land-use activities and/or the atmosphere, having no well-defined point of entry". Land-use activities that are considered to be major contributors of nonpoint source pollution include, agriculture, silviculture, urban development, mining, land disposal (including septic systems, landfills and hazardous waste sites), and hydraulic habitat modification. Other nonpoint sources of pollution include underground storage tanks, in-place sediments, and atmospheric deposition.

METHODS

A number of methods were used to assess storm water and nonpoint source pollution impacts in the Neponset Basin, including:

1. an audit of the NPDES Storm Water Permit Program;

2. a review of the Boston Water and Sewer Commission Municipal Storm Water permit application;

3. shoreline surveys conducted by local "Stream Teams";

4. outreach of s.319 competitive grant program;

5. a review of the Best Management Practices at two sites;

6. storm water modelling in the Neponset River Basin.

RESULTS

NPDES Storm Water Permit Program Audit

In response to the need to address pollution problems associated with storm water, the USEPA has initiated a program to establish NPDES requirements for certain storm water discharges. Phase I of this program, which began in 1992, requires storm water permits for municipalities with a population over 100,000 serviced by separate storm water sewer systems, certain categories of industries and construction sites of five or more acres. Detailed information regarding the storm water permit program is provided in Appendix E.

An audit of the Storm Water NPDES Permit program was conducted to assess the effectiveness of the program and industry compliance with the program requirements. The storm water permit program audit included a review of the list of industries which have applied for permits, inspection of five of these industries and the compilation of a list of industries within the basin that may need permits, but did not apply. In addition, the Boston Water and Sewer Commission (BWSC) storm water permit application was also reviewed as part of the audit. This audit was conducted by Department of Environmental Management interns in conjunction with DEP staff.

Industrial Storm Water Permit Audit

The first step of the audit was to obtain and review USEPA's list of facilities that have applied for NPDES Storm Water Discharge permits within the municipalities of Foxborough, Sharon, Walpole, Norwood, Canton, Dedham, Westwood, Milton, Dover, Medfield, Stoughton, Randolph and Quincy. Since only two of these municipalities are located entirely within the boundaries of the Neponset Basin (Canton and Norwood), it was necessary to find and mark the location of the permit applicants on quad sheets to determine which facilities are actually located within the basin. This review indicated that from the Neponset River Basin USEPA received 34 applications for coverage under the NPDES general storm water permit, one for an individual permit, and 22 for multi-Sector permits. These permit applicants are listed in Table 8.1. It should be noted that the City of Boston was not included in this process. To complete those areas of the basin which were reviewed, the DEM interns spent approximately 70 hours on the audit. In addition, another 25 hours was spent by DEP staff in coordinating the audit, conducting site visits, and assessing the data.

The next step was to generate the list of basin facilities that may need storm water permits, but did not apply. USEPA's list of SIC codes (Standard Industrial Classification codes) for facilities required to apply for a storm water permit was compared to the SIC codes included in available lists of industries. These lists included permitted industrial users within the Massachusetts Water Resources Authority (MWRA) Sewer District, the Dunn and Bradstreet computer files, and the 1994 Business to Business Guide from the Neponset Valley Chamber of Commerce. The result of this comparison shows a wide discrepancy between the number of Neponset Basin industries which may need storm water permits and the

TABLE 8.1. 1994 NEPONSET RIVER BASIN SURVEY. NPDES industrial storm water permit applicants.

GENERAL STORM WATER PERMITS			
PERMIT NUMBER	FACILITY NAME	FACILITY ADDRESS	CITY/TOWN
MAR00A158	AGM Industries Inc.	110 Shawmut Rd.	Canton
MAR00A136	American Chain Link Fence Co. Inc.	55 North St.	Canton
MAR00A465	APA Transport Corp.	30 Industrial Dr.	Canton
MAR00A676	Town of Canton Landfill	Pine St.	Canton
MAR00A677	Town of Canton Landfill	Pine St.	Canton
MAR10A067	Copley Pharmaceuticals Inc.	25 John St.	Canton
MAR00A293	Cumberland Farms Inc.	777 Dedham St.	Canton
MAR00A378	Emerson & Cuming Inc.	59 Walpole St.	Canton
MAR00A073	Emerson & Cuming Inc.	869 Washington St.	Canton
MAR00A119	Harrison Specialty Co., Inc.	15 University Rd.	Canton
MAR00A485	Kinney Vacuum Co.	495 Turnpike St.	Canton
MAR00A864	Master-Halco Inc.	55 North St.	Canton
MAR10A122	Neponset Valley Relief Sewer	N/A	Canton
MAR00A084	Phillips Manufacturing Co.	25 Industral Dr.	Canton
MAR00A068	Cummins North Atlantic Inc.	100 Allied Dr.	Dedham
MAR00A790	Entenmann's	105-107 Providence Highway	Norwood
MAR00A132	Northrop Corp.	111 Morse St.	Norwood
MAR00A133	Northrop Corp. Plant 2	934 Washington St.	Norwood
MAR00A134	Northrop Corp. Plant 3	100 Morse St.	Norwood
MAR00A135	Northrop Corp. Plant 6	623 Pleasant St.	Norwood
MAR00A161	Olympic Adhesives Inc.	670 Canton St.	Norwood
MAR00A086	Polaroid Corp.	1 Upland Rd.	Norwood
MAR00A224	Star Market Co.	625 University Ave.	Norwood
MAR00A210	Spears Associates Inc.	249 Vanderbilt Ave.	Norwood
MAR10A157	Westbrook Estates	Off Bay Rd. & West St.	Stoughton
MAR00A029	Wikoff Color Corp.	194 Tosca Dr.	Stoughton
MAR00A229	Bird Johnson Co.	110 Norfolk St.	Walpole
MAR00A470	Bird Johnson Co.	110 Norfolk St.	Walpole
MAR00A362	CIBA Corning Diagnostics Corp.	333 Coney St.	Walpole
MAR00A849	International Paper-Veratec	100 Elm St.	Walpole
MAR00A706	Minor Residuals Landfill	Lot 717 Main St.	Walpole

Table 8.1 (continued)

GENERAL STORM WATER PERMITS			
PERMIT NUMBER	**FACILITY NAME**	**FACILITY ADDRESS**	**CITY/TOWN**
MAR00A704	Minor Residuals Landfill	Lot 717 Main St.	Walpole
MAR00A342	The Stop & Shop Supermarket Co.	82 South St.	Walpole
MAR10A108	Wal-Mart	590 US Route 1	Walpole

INDIVIDUAL PERMITS		
FACILITY NAME	**FACILITY ADDRESS**	**CITY/TOWN**
DuPont Medical Products	240 University Ave.	Westwood

GROUP PERMITS		
FACILITY NAME	**FACILITY ADDRESS**	**CITY/TOWN**
APA Transport Corp.	30 Industrial Dr.	Canton
Interpolymer Corp.	Dan Rd. & Route 138	Canton
Interpolymer Corp.	330 Pine St.	Canton
MA Dept. of Public Works	West Street	Dedham
H.P. Hood, Inc.	44 Wharf St.	Milton
The Savogran Co.	259 Lenox St.	Norwood
United Parcel Service, Inc.	1045 University Ave.	Norwood
Entenmanns	105-107 Providence Highway	Norwood
Bird, Inc.	1077 Pleasant St.	Norwood
Gale Associates, Inc.	P.O. Box 766	Norwood
MA Dept. of Public Works	Route 27	Sharon-Walpole
A.A. Will Materials Corp.	168 Washington St.	Stoughton
MA Dept. of Public Works	Route 27	Stoughton
Bardon Trimount, Inc.	1101 Turnpike St.	Stoughton
Veratec-Walpole Headquarters	100 Elm St.	Walpole
West Sand & Gravel	331 West St.	Walpole
MA Dept. of Public Works	Route 1	Westwood
Atlas Oil-Westwood	385 University Ave.	Westwood
Foster Brothers, Inc.	22 Everett St.	Westwood
J.M. Huber Corp.	35 Harvard St.	Westwood

number of storm water permit applications actually received by USEPA. One hundred sixty-four facilities from the MWRA list, 208 facilities from Dunn & Bradstreet, and 10 facilities from the Business to Business Guide may need storm water permits. Some of the facilities listed in Dunn and Bradstreet are also included in the MWRA list; a comparison of these two lists is needed to quantify this overlap. In addition, according to the federal regulations an industry is required to apply for a permit only if 51% of its revenue is derived from an SIC activity listed as requiring a storm water permit. Despite these caveats, it is safe to conclude that within the Neponset River Basin the majority of facilities that may need storm water permits did not submit applications to USEPA.

The final step of the audit was to inspect five companies which had applied for a General Storm Water Permit and review their records. Because the storm water permit program is relatively new, the site visits were undertaken primarily to develop anecdotal information on how well the permittees understand the program and are complying with it.

A high degree of compliance and understanding of the regulations was found at all five industries during the site visits. At each industry the personnel demonstrated a working knowledge of the storm water permit program, and each industry had taken steps to comply with the regulations. A detailed storm water pollution plan was available for review, and employee training is a part of standard operating procedures at these industries. Only one violation was noted during these inspections; one company had failed to submit its required annual monitoring data.

It is interesting to compare these results to the storm water permit audit results contained in the draft Blackstone River Watershed Resource Assessment and Management Plan (Hartman et al. 1995). The Blackstone site visits indicated a wide range of compliance and understanding of the regulations, which is probably more typical of conditions in other basins. However, 130 facilities in the Blackstone River Basin applied for permit coverage, in comparison to the 57 applications filed in the Neponset River Basin.

The Blackstone report concluded that a more comprehensive permit review to determine compliance status and field reconnaissance to identify facilities requiring permit coverage are top priorities. In addition, mapping of facility locations is needed to assess areas of potential problems and to target future wet weather sampling. These recommendations are valid if an effective storm water permit program is to be implemented.

The 1994 Neponset River Basin survey data indicates continuing water quality problems despite decreased direct discharges of wastewater. Based on this fact, it is recommended that auditing of the storm water permit program continue to be a priority management effort. It is also recommended that an outreach program be developed to reach those facilities that should have applied for a storm water permit.

Review of BWSC Municipal Storm Water Permit Application

Only two Massachusetts municipalities, Boston and Worcester, were required to file for NPDES Storm Water Permits under Phase one of the program. The Boston Water and Sewer Commission has responsibility for providing water and drainage, both sanitary and storm service, to the City of Boston; as part of this service BWSC operates a separate storm drainage system that serves approximately 108,000 people. BWSC maintains a total of 189 storm drain outfalls system-wide, 60 of which discharge to the Neponset River and its tributaries. It should be noted here that combined sewers (systems that convey both sanitary sewage and storm water) do not fall under the storm water permit program, and are covered under a separate NPDES permit issued to BWSC (Section 7).

BWSC completed its NPDES storm water permit application in May 1993. The NPDES storm water permit regulations required BWSC to submit a two-part application for its separate storm water system. Part I included an inventory and field screening of BWSC's storm water discharge outfalls, a description of existing programs to control pollutants, and a proposed sampling program for Part II. Field screening was conducted in 1991 and 1992, and consisted of visual observation of each outfall during dry weather (72 antecedent dry hours) and completion of a field inspection form. For each outfall where flow was observed, and was not visually judged to be groundwater infiltration, a grab sample was taken and analyzed using a Chemetrics test kit.

Part II of the permit application included the results of wet weather sampling in representative areas; two outfalls, 2F120 and 8J102, in the Neponset River were included in this sampling. Part II also included a storm water management plan to eliminate the discharge of pollutants to storm drains, and a proposed monitoring program for the term of the permit which is expected to last five years.

BWSC has developed a Storm Water Management Program emphasizing best management practices, protecting the structural integrity and hydraulic capacity of the drainage system, and control of the discharge of pollutants to storm drains. BWSC has implemented numerous measures to eliminate contaminants before they enter a storm drain including: cleaning and flushing of storm drains and catch basins to remove debris and sediment; and identification and elimination of sanitary connections to storm drains. In 1994 BWSC corrected 75 illegal connections, 28 of which were in the Neponset River Basin. In 1995 BWSC will eliminate an additional 101 illegal connections, 29 of which are in the Neponset River Basin.

BWSC has also participated in improving public awareness through activities aimed at controlling or eliminating the introduction of pollutants to storm drains including: the distribution of household hazardous waste brochures; household waste collection days; presentations to local schools; and other special projects such as the storm drain stencilling program, and the waste oil recycling center. These measures are applied on a system-wide basis which includes the Neponset River Basin.

BWSC's NPDES storm water permit is expected to require implementation of a storm water pollution control plan over a five-year period. The permit is also likely to include a public education program, continued maintenance activities, estimates of seasonal pollutant loads, removal of illicit connections, and monitoring of storm water discharges. BWSC's NPDES Storm Water Permit has not, as yet, been issued.

<u>Shoreline Surveys</u>

In the fall of 1994 the Adopt-A-Stream Program of the Department of Fisheries, Wildlife, & Environmental Law Enforcement, in association with the Neponset River Watershed Association and the U.S. Natural Resources Conservation Service (NRCS) began a concerted effort to enlist local support of River Initiative. The Adopt-A-Stream Program has developed the Stream Team Approach to river watching, which utilizes Shoreline Surveys to aid watershed residents in identifying problems and prioritizing both the short term and long range work to be done. Stream Teams are established in the subwatersheds of a river basin and trained in Shoreline Survey methodology. Surveys are the conducted in the reasonable sized segments of the subwatersheds. Guidance for establishing Stream Teams and conducting Shoreline Surveys is provided in <u>Shoreline Survey - A Stream Team Monitoring Project</u> (DFWELE 1994).

By September, 1995 six Stream Teams had been established and trained in the Neponset River Watershed, including, the Headwaters Group, Canton River Watershed Watchdogs (East Branch Neponset River), Mother Brook Coalition, Pine Tree Brook Subwatershed Team, Neponset Monitors (comprising the lower freshwater portion of the basin), and Friends of the Neponset Estuary. The results of the East Branch, Mother Brook and Friends of the Neponset Estuary Shoreline Surveys of have been summarized by the Riverways Program and are contained in Appendix F.

Outreach of the s.319 Nonpoint Source Competitive Grants Program

Section 319 (s.319) of the Clean Water Act of 1987 was established as a national program to control NPS pollution. In Massachusetts the s.319 program is administered by DEP, Office of Watershed Management, and each year DEP issues a Request for Proposals (RFP) for competitive projects to be funded under s.319. The s.319 program focuses on the implementation of activities and projects for the control of NPS pollution. The competitive grants provide an important source of funding for these projects.

The Neponset River Watershed Project Technical Advisory Group (TAG) was recognized as the vehicle for outreach of the s.319 Nonpoint Source Competitive Grants Program. TAG was initiated by the Neponset River Watershed Association in June of 1994. This group is made up of representatives from state and federal agencies, local governments, businesses, and concerned citizens who want to share their technical expertise with the subwatershed groups and others working on basin issues. TAG's goal is to open lines of communication between agencies and local partners and to bridge the lack of technical expertise at the local level. The focus of the s.319 grant program and specific ideas for s.319 projects were discussed at a number of TAG meetings.

As a result of this outreach effort, three s.319 grant proposals for projects within the Neponset River Basin were submitted to DEP for review on 17 April, 1995, and two projects have been recommended to the USEPA for s.319 funding. One project will assist Neponset Basin Boards of Health in implementing a computer database that tracks inspections, repairs and replacements of septic systems. The other project will fund runoff remediation measures to be implemented at the Foxboro Park Raceway; this project is discussed in further detail in the BMP Review subsection below.

TAG was also used to outreach the s.604(b) grants program to the Neponset River Basin. Under s.604(b) of the Clean Water Act, USEPA is authorized to award funds to states for water quality assessment and management planning. DEP has determined that the focus of these grants will be for watershed or subwatershed based NPS assessment type projects that will provide diagnostic information which will support OWM's basin-wide water quality management activities. Eligible applicants for these grants include regional planning agencies, councils of governments, counties, municipalities, other state public planning agencies, and interstate agencies (of which Massachusetts is a party).

Twenty s.604(b) grant proposals were submitted to DEP for review in February, 1995; none of the proposals received for federal fiscal year 1995 funding were for work within the Neponset Basin.

BMP Review

During reconnaissance of the Neponset River basin, it was noted that BMPs had been installed at the new Wal-Mart facility on Route 1 in Walpole. After inspecting these BMPs, DEP staff requested copies of the development plans and BMP designs for review; this information was provided by the Walpole Conservation Commission. These plans called for two sedimentation basins and two subsurface detention areas, and were accompanied by a maintenance schedule for the BMPs.

In looking at the Wal-Mart BMP designs, DEP staff had a number of comments with regards to the adequacy of these BMPs. In January, 1995, Wal-Mart requested a Certificate of Compliance from the Walpole Conservation Commission for their facility. In answer to this request, the Conservation Commission forwarded DEP's comments regarding the BMP plans, along with their comments, to Wal-Mart for response. At this time the Walpole Conservation Commission is still monitoring progress at the site before issuing the Certificate of Compliance.

The Foxboro Park Raceway has been identified as a significant source of sediment to the Neponset River. Sediment washed off the site during rain events renders the downstream river turbid for a distance of several miles, as noted during field reconnaissance after a rainstorm. In addition, sediment has partially filled three or four impoundments downstream.

The Foxboro Park was built in the 1940s directly over the Neponset River. Significant areas of wetland and flood plain were filled to build the racetrack and practice track, to erect a number of associated barns and other buildings, and to provide parking. Although the river is exposed in the middle of the racetrack, it is culverted beneath the track itself, and beneath the parking areas to the north and south. The Park remained in operation from its construction until the early 1980s, when it was abandoned.

The current site managers leased the track and grounds in 1992, and began renovations. These renovations have included storm water controls, including stone-lined drainage swales and two detention basins. These BMPs have reduced the sediment loads from what they were before 1992, but more effort is needed to stabilize and control sources of erosion on the property.

In January, 1995, the Foxborough Board of Selectmen requested assistance from the Norfolk County Conservation District in remediating runoff/sedimentation to the Neponset River from the raceway grounds. The District turned the request over to the NRCS, which asked the Massachusetts Community Assistance Partnership to provide this assistance.

The Massachusetts Community Assistance Partnership (MassCAP) has been established by the NRCS to help community and watershed groups identify, prevent and address natural resource and environmental problems. Currently, MassCAP is a pilot program being conducted in Massachusetts east of Route 495. This program operates in partnership with the Executive Office of Environmental Affairs, the Massachusetts Association of Conservation Districts, the University of Massachusetts, and other organizations which share similar goals and objectives. MassCAP can assist municipalities and watershed groups in wetlands management and protection, flood plain management, water quality and quantity protection and/or improvement, land use planning and resource management, storm water management, erosion and sediment control, and development of standards and guidelines.

As a result of Foxborough's request for assistance, MassCap conducted a site assessment of the raceway on 23 and 24 March, and submitted a detailed report of their findings to the town and the raceway on 4 April. Based on their assessment of conditions at the track, MassCAP provided a list of suggested BMP practices, with estimated costs and equipment and material needs.

As mentioned above, the Foxboro Park Raceway applied for an s.319 grant to implement some of the remediation measures suggested by MassCAP; this project was recommended to the USEPA for funding in Federal Fiscal Year 1996. It is anticipated that work on this project will commence, once DEP's federal grant application is approved.

Neponset River Basin Computer Modelling

Under a grant from the Massachusetts Bays Program, the Metropolitan Area Planning Council (MAPC) will assess three Neponset Basin subwatersheds, Purgatory Brook, Spring Brook and the lower Neponset Basin between the confluence of Mother Brook and Pine Tree Brook using the P-8 model. This model can be used to predict pollutants loadings in storm water runoff from various types of land uses, and results from this modeling and the 1994 water chemistry survey data can be used to prioritize subwatersheds contributing pollutant loadings from runoff. Based on this prioritization, further assessment work could lead to the identification of remediation measures in these subwatersheds, such as issuing and enforcing of NPDES Storm Water Permits.

Another project, the Neponset River Watershed Modeling Project, was developed by DEP for funding under the federal 104(b)(3) grant program, and involves the development of computer modeling capability and user guidance necessary for implementation of the Statewide Watershed Management initiative in Massachusetts. A suite of models will be identified and evaluated for use in developing relationships between land use, point and nonpoint source pollution, water withdrawal and water quality in rivers and estuaries throughout the state. The models will be used to predict changes in water quality from different pollution control strategies, allowing targeting of those efforts which promise the greatest environmental benefit and economic return. To demonstrate this, modeling will be specifically applied in the Neponset River Basin to quantify pollution source and assess in-stream impacts and assist in evaluating various best management control options.

DISCUSSION

The efforts described above are indicative of the types of activities that can be used to assess the storm water and NPS related impacts in the absence of wet weather data to quantify storm water and NPS loadings to the basin. While most of these efforts involved public outreach and technical assistance, more is needed. Industries need to be informed of the NPDES Storm Water Permit requirements; it is surmised that the lack of knowledge about the program has resulted in a low application rate.

General education is needed relative to storm water and NPS related pollution, and both public organizations and private citizens need to be made aware of their opportunities to address these issues. The Neponset River Watershed Association TAG group has planned a series of presentations, starting in January 1996, which will address various watershed management issues, including, storm water management, wetlands restoration, hazardous waste management, stream flow issues, etc.

The Shoreline Survey effort by the Riverways Program represents a major resource for educating the general public. In addition, the results of these surveys provide data which can be valuable in identifying pollution sources. Extensive resources would be needed by the watershed team in order to duplicate the efforts of the Stream Teams.

Additional outreach of the 604b and 319 grant programs is needed to demonstrate the opportunities available to address NPS pollution. Working directly with watershed groups to develop project proposals may prove to the most effective method of ensuring that priority NPS sources are addressed in the near future.

The BMP site reviews indicate the type of technical assistance that is required by the municipalities in the basin. During the management phase of the Neponset Initiative, the technical assistance requirements of municipal officials should be assessed and an outreach plan developed.

Modelling of storm water and NPS inputs can be used to predict impacts on water quality, target high priority areas, and identify potential areas for remediation efforts. The Neponset River Basin modelling projects will provide valuable information upon which to base watershed management decisions.

A primary source of fecal coliform bacteria in the basin appears to be failing septic systems, which are considered a nonpoint source of pollution. The new Title 5 regulations should, ultimately, ameliorate septic system failures. To assist communities in implementing these new regulations, the recommended s. 319 grant will provide Boards of Health in the Neponset River Basin with a method of tracking inspections, repairs and replacements of Title 5 systems, and will provide technical assistance to the Boards.

CONCLUSIONS

The efforts described above show how storm water and nonpoint source pollution problems can be addressed in a watershed without intensive and costly wet weather surveys. The Neponset River Basin Management Plan should review these efforts and base management decisions on this work.

RECOMMENDATIONS

1. To implement an effective storm water permit program a more comprehensive permit review to determine compliance status and field reconnaissance to identify facilities requiring permit coverage are top priorities. The mapping of facility locations should be used to assess areas of potential problems and to target future wet weather sampling.

2. It is recommended that auditing of the storm water permit program continue to be a priority management effort. It is also recommended that an outreach program be developed to reach those facilities that should have applied for a storm water permit.

3. The Boston Water and Sewer Commission storm water permit should be issued as soon as possible.

4. Data from the Shoreline Surveys should be utilized to make subwatershed management recommendations and for developing grant funded projects.

5. An education program addressing storm water and NPS related pollution should be implemented, and both public organizations and private citizens should be made aware of their opportunities to address these issues.

6. Additional outreach of the 604b and 319 grant programs is needed to demonstrate the opportunities available to address NPS pollution. Working directly with watershed groups to develop project proposals may prove to the most effective method of ensuring that priority NPS sources are addressed in the near future.

7. During the management phase of the Neponset Initiative, the technical assistance requirements of municipal officials should be assessed and an outreach plan developed.

8. A listing of Neponset River Basin community bylaws which address storm water and nonpoint source pollution issues should be compiled.

9. The results of the MAPC P-8 modeling and the Neponset River Watershed Modeling Project should be utilized to show communities how increasing development impacts water quality within a subwatershed and the Basin as a whole.

10. Results from the modeling projects can be used to prioritize subwatersheds contributing pollutant loadings. Based on this prioritization, further assessment work could lead to the identification of remediation measures in these subwatersheds (such as issuing and enforcing of NPDES Storm Water Permits).

11. The Neponset Team will oversee the grant projects which have been funded to date in the basin, and additional opportunities for grant funding of remediation/education projects should be investigated.

12. Wet weather sampling should be conducted in the future to assess pollutant loadings from storm water runoff.

SECTION 9: WATER USE AND STREAMFLOW

INTRODUCTION

A thorough understanding of the relationship between multiple water uses (e.g., water supply, recreation, aquatic life) and their respective streamflow requirements, is essential to the proper management of the water resources in the Neponset River Basin. This relationship is examined herein as a key component of the Neponset River Watershed Pilot Project. Ninety-seven percent of the population (201,000) living in eleven communities studied by DEM are served by public water supplies. Two municipalities, Milton and Norwood, obtain all of their water from the MWRA distribution system. The other communities rely, either wholly or in part, on groundwater withdrawals within the Neponset River Basin. The average-day demand for water is projected to increase to 31 MGD by the year 2020 (MA DEM 1991). This represents 5.5 MGD more than the 1987 average-day demand.

DEM completed an updated version of their Neponset River Basin Plan in February, 1995. They reported that, in 1993, 44% (or 9.64 MGD) of the public water supply was withdrawn from the Neponset River Basin, but only 18% (4.09 MGD) was retained in the basin through the use of septic systems (MA DEM 1995). Only one domestic wastewater discharge (0.26 MGD) currently exists in the basin, and this will soon be eliminated when it is connected to the Mansfield sewerage system. The remainder of the municipal wastewater in the Neponset River Basin is discharged to the MWRA collection system. The net transfer of water out of the basin through the MWRA sewer is 5.55 MGD (25%). This situation underscores the need to assess the existing and potential future effects of the water withdrawals on streamflow, water quality, and biological integrity in the watershed.

In an attempt to begin to assess the complex relationship between streamflow and water use, the Mine Brook subbasin in Dover, Medfield, and Walpole was targeted for a detailed inflow/outflow analysis. This small subbasin of approximately 6 square miles, contains several public water supply wells, and one NPDES-permitted wastewater discharge; a filter backwash flow from the Harold E. Willis Water Treatment Facility (WTF). The 1991 DEM basin plan made several recommendations with respect to those water supplies. First, to protect the existing salmonid fishery, it was recommended that no new or increased withdrawals from the Mine Brook subbasin be allowed. In addition, several use-specific minimum streamflow thresholds were recommended. A summary of these flow recommendations, along with the number of days that these thresholds were not attained during the period 1989-1993, was discussed in Section 6 of this report. The inflow/outflow analysis is described below.

The Mine Brook Subbasin is located in the northwest portion of the Neponset River Watershed (Figure 9.1). Mine Brook is composed of Tubwreck Brook in Dover which joins and flows into Mill Brook and then continues down to Jewells Pond in Medfield. Mine Brook flows from the outlet of Jewells Pond to Turner Pond. The total stream length of these brooks is approximately 6 miles. The total drainage area of the subbasin which terminates at the inlet to Turner Pond is 5.98 square miles while the stratified drift area in the subbasin is 3.64 square miles. Land use consists mainly of light to medium density residential and forest land.

Water is withdrawn from several wells in the subbasin for municipal water supply. The purpose of this analysis is to examine the relationship of water withdrawals with the stream flow in the subbasin, and attempt to determine whether or not current municipal water supply use is impacting the ecology of the Mine Brook watershed.

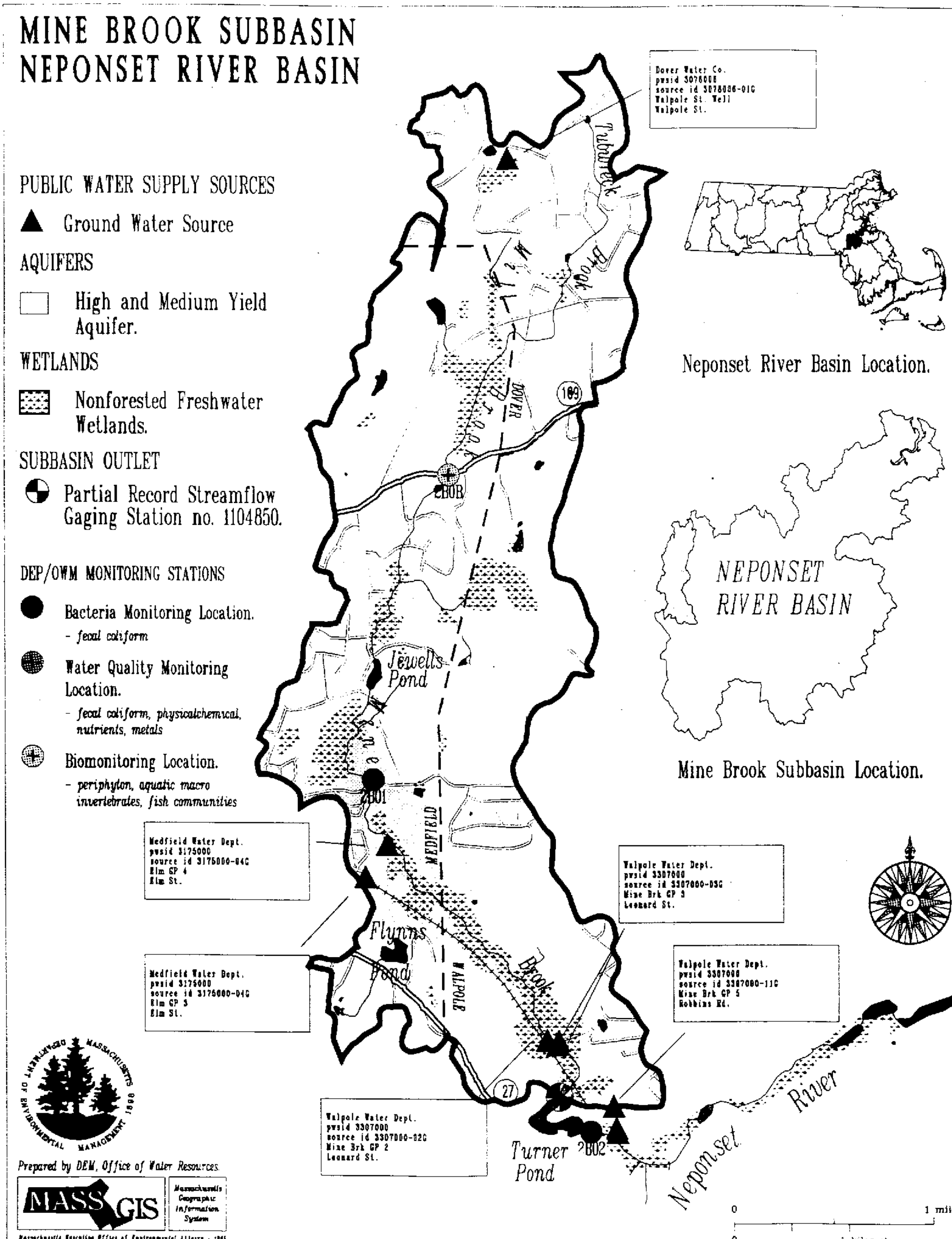


FIG. 9.1. 1994 NEPONSET RIVER BASIN SURVEY. Overview of the Mine Brook subwatershed: water supplies, aquifers, wetlands and monitoring locations.

METHODS

Water Supply

Water use for the three most recent years of data (1991, 1992, 1993), for each municipal water supply well, was analyzed on a monthly basis to determine water withdrawal volumes and pumping schemes. Discussions with Water Department/Company officials and site reconnaissance were used to determine the net impacts of the water supply wells on Mine Brook discharge. Each water supply system is briefly described below.

The towns of Medfield and Walpole have water supply wells in the lower part of the subbasin while Dover Water Company withdraws water from one well in the upper reaches of the subbasin. The Dover Water Company's Walpole Street Well in the headwaters of Mill Brook supplies the southern section of town. The other two Dover Water Company wells located in the Charles River Basin do not currently supply any portion of the town in the subbasin.

Walpole maintains twelve wells in the Neponset River Basin, four of which are located in the Mine Brook Subbasin. Two of those wells are currently not in use: Mine Brook Well #2 is off line due to elevated levels of iron and manganese, while mine Brook Well #4 is permitted, installed, and capped for future use by the town. The remaining two wells, Mine Brook #3 and Mine Brook #5, are pumped daily and undergo treatment for iron and manganese removal before entering the distribution system. Mine Brook Well #5 is located on the subbasin drainage divide near Turner Pond, however, the impact of groundwater withdrawal will affect, if not in whole, at least in part Mine Brook streamflow upstream of Turner Pond. Thus well #5 was included in the analysis.

Medfield Water Department operates two wells in the Mine Brook subbasin and two wells in the Charles River Basin. The two Elm Street Wells #3 & #4 are located approximately 1 mile south of Jewells Pond along Mine Brook. The town is currently in the new source approval process for Well #6 in the Charles River Basin to help replace some of their use in Mine Brook, in particular Well #4.

As mentioned above the entire subbasin is supplied by municipal water supply from wells either located in the subbasin or mixed with water from wells out of the subbasin. Return flow to the subbasin is from residential septic systems and occurs at 85% of the households in the subbasin. The remaining 15% percent of the homes are on municipal wastewater collection (2 subdivision off Rte. 109 in Medfield and approximately 150 connections between Pemberton Street and Turner Pond in Walpole). Water use and return flows to the subbasin by Dover and Medfield are based on estimates of persons per household for the service area as established from Dover Water Company. That is, four persons per household and 78 gallons per capita per day. The housing units in the Walpole section of the Mine Brook subbasin are generally smaller and more densely located, warranting a persons per household value of 3.5 and 78 gallons per person per day.

Hydrology

Recorded streamflow data for Mine Brook consists of 13 months of measurements from July 1, 1967 to July 31, 1968 as well as approximately 30 or so miscellaneous measurements made from the mid 1960's to the summer of 1994. This data was used to generate a flow relationship between Mine Brook and other regulated as well as unregulated gages in and around the basin (index station method; Searcy, 1959). Flows were adjusted by removing measurements of data from the 1960's, a time when streamflow was highly impacted by industrial uses as well as municipal withdrawals. Also, other outlying data points were removed using standard techniques. From this relationship, discharges for the lower end of the flow duration curve were developed, yielding low flows which may be expected in Mine Brook. Seven day two-year and ten-year low flows were also calculated using the regression equation developed by the index station method as were the median

August, mean and other low flow months of Mine Brook.

An analysis comparing unregulated subbasins in the Neponset with unregulated gaged streams outside the basin was performed to locate a gage that most closely correlates flows in Neponset subbasins. Old Swamp River near South Weymouth was chosen. As a result, the unregulated values for the lowest end of the flow duration curve for Mine Brook were determined using the USGS Open File Report 93-38, "Estimation of Low-Flow Duration Discharge in Massachusetts" (Ries 1993) in which the Mine Brook subbasin flows were estimated. Other low flow values were developed using the low flow regression model developed in the USGS WRI 94-4100" Estimating the Magnitude and Frequency of Low flows of Streams in Massachusetts" (Risley 1994). To estimate other unregulated flows (monthly, mean annual, August median) for Mine Brook a drainage area ratio method was employed.

RESULTS

Water Supply

Analysis of monthly pumping data (Appendix B, Tables 9.1B - 9.4B) indicates that the Medfield wells located in the Charles Basin (Rte. 109, Wells #1 & 2) are pumped at greater volumes in the summer to meet the increased summer demand. The Elm Street Wells located in Mine Brook subbasin, particularly Elm Street #3 (the town's most reliable well), do not vary greatly due to summer demand. According to Medfield Water Department, most of the seasonal increases in demand are accommodated by the Rte. 109 wells in the Charles River Basin.

Water usage (according to the Dover Water Company) from the Walpole Street well, although not metered monthly, indicates typical annual water usage: higher pumping rates in the summer months and the lowest water use occurring in the winter months.

The well pumping scheme as indicated by the DEP Water Supply Statistical Reports for 1991, 1992, 1993 and verified by Walpole Water Department personnel, portrays typical annual well usage. That is, pumping increases and peaks during the summer months and gradually decreases into the fall and winter months. This is generally the case for operation of all of the Walpole wells.

The total water returned to the subbasin on an annual basis for those portions of the three communities in the Mine Brook subbasin amounts to approximately 0.25 MGD. This value reflects a 90% flow return through septic systems for houses in the subbasin and does not include those areas sewered out of basin. Net loss in general from Mine Brook by municipal use amount to approximately 1.15 MGD or 1.78 cfs (refer to Appendix B, 9.5B).

Hydrology

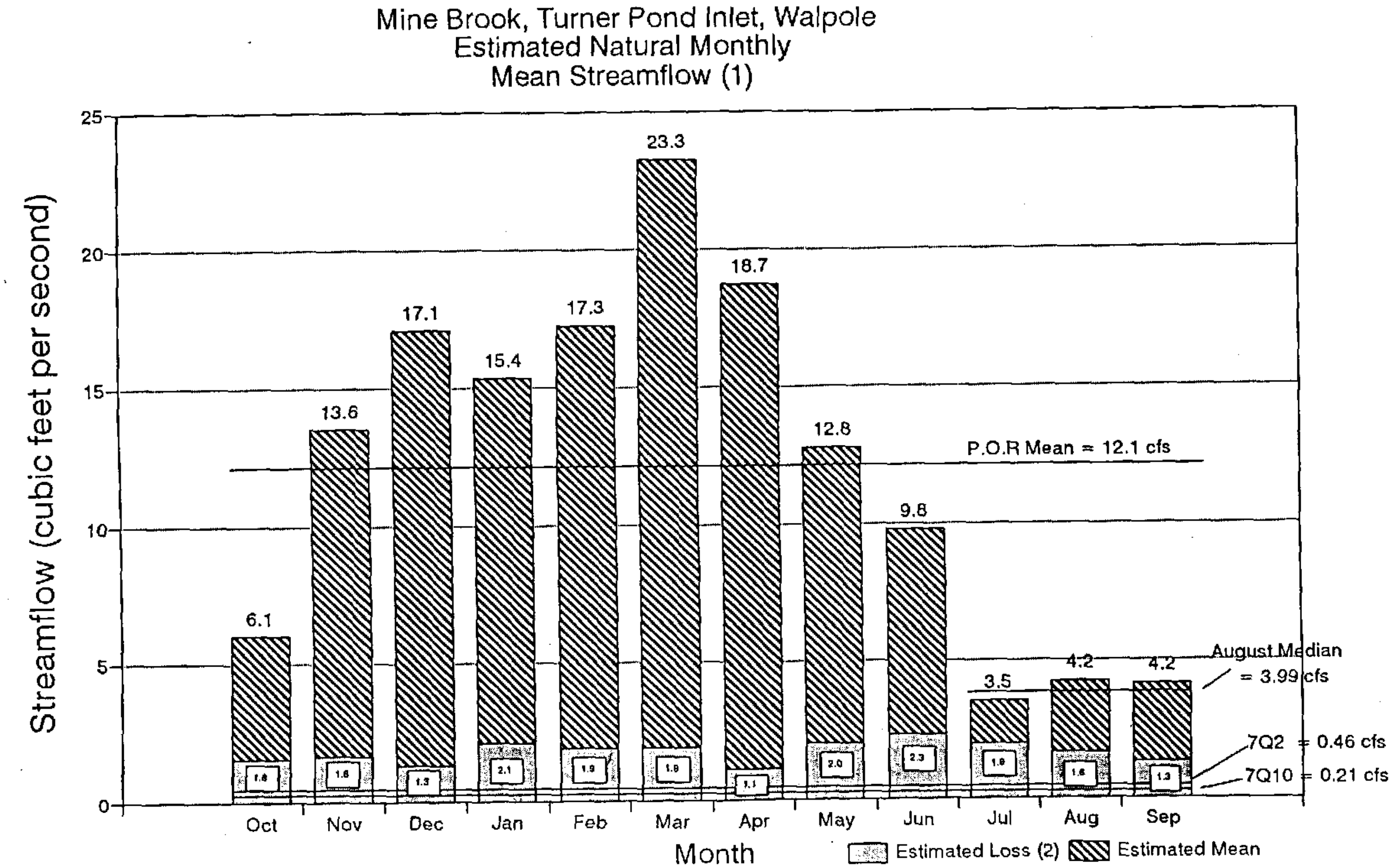
A very good correlation exists between Mine Brook and the Neponset River, Norwood gage adjusted flows, albeit both flows are highly regulated (refer to Appendix F--Mine Brook Walpole/Neponset River Norwood Relationship).

The correlation between the Mine Brook stream flow and the unregulated, Old Swamp River stream flow was too poor to produce usable results due to severe regulation occurring in Mine Brook. Adjustment of daily flows for withdrawals and returns was not possible due to the complex nature of intercepted groundwater recharge to the stream and daily pumping variations. The other methodologies employed produced varying results (Appendix B, 9.5B).

DISCUSSION

Pump data analysis for all three towns with sources in the Mine Brook aquifer generally indicate that the towns do not favor wells located in the Mine Brook subbasin over other wells located outside the subbasin. In fact, Medfield relies more heavily on out-of-basin wells to meet most of the increases from summer demand. Total withdrawal from the Mine Brook subbasin by these three communities, on an annual basis, amounts to approximately 1.4 MGD.

Flows in Mine Brook are reduced by a significant amount through water supply withdrawal by the towns of Dover, Walpole, and Medfield. A small percentage of that water is returned to the subbasin through onsite septic systems and the filter backwash water from the Harold E. Willis WTF. Partial flow data collected on Mine Brook (Turner Pond inlet) makes it possible to employ several different methodologies to calculate both regulated and unregulated values; however, different methodologies may yield different results. Figure 9.2 illustrates the relationship between the stream hydrology (estimated natural monthly mean streamflow using the drainage area ratio method with Old Swamp River, South Weymouth, gage no. 01105600, period of record = 1966-1993), and the monthly average estimates of water transferred out of the subbasin. Well illustrated is the relationship between the critical low flow period (July through October) and the water supply usage (where 26 - 56 % of the streamflow is transferred out of basin to the MWRA sewer system)--assuming a direct relationship between water withdrawal and streamflow. Although this assumption is extremely conservative, environmental impacts due to reduced flow and changes in water quality (elevated temperatures) from water supply well withdrawal, combined with increases in residential developments, may be manifested in changes in the aquatic environment (loss of wild trout fisheries, impacts on significant wetlands). These changes in the aquatic biota due to reduced flow and water quality need further investigation, which in a general way are addressed in the biological assessment section of this report.



(1) Estimated by drainage area ratio method using *Old Swamp River*, South Weymouth, gage no. 01105600, Period of Record = 1966 - 1993.

(2) Monthly average day *estimated transfer* of water out of subbasin. Loss = water supply withdrawals - volume returned by septic disposal.

Fig. 9.2. 1994 Neponset River Basin Survey. Relationship between stream hydrology and water use in the Mine Brook subwatershed.

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APPENDIX A

QUALITY ASSURANCE AND QUALITY CONTROL

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2.2A	Water analysis, total metals field QA/QC data.
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Appendix A

A - 1. Introduction

Quality Assurance/Quality Control (QA/QC) activities were conducted to ensure the quality of the data collected, analyzed, and presented in this report. To achieve these goals, the following steps were taken:

- Development of data quality objectives

- Strict adherence to accepted field methods in accordance with Office of Watershed Management Standard Operating Procedures (TSB 1989) and accepted laboratory methods in accordance with the Wall Experiment Station Standard Operating Procedures (WES 1994). Accepted field and laboratory methods include but are not limited to the following:

    use of appropriate sample containers

    proper sample collection techniques

    proper preservation, labeling, storage, and transport of samples

- Laboratory QA/QC was conducted as is required by the EPA-approved methodologies and operating procedures detailed in the laboratory Standard Operating Procedures (WES 1994). Laboratory accuracy and precision are determined by the analysis of duplicate, spike, and EPA performance samples (Certified Reference Materials). Results are compared to laboratory data quality objectives and are not approved for release unless those objectives are achieved.

- Analysis of field and equipment blank samples (no less than 10% of the samples submitted to the analytical laboratory were field blanks)

    Trip blanks were prepared by filling a carboy with reagent water at the laboratory, transporting it to the sampling site, and filling appropriate sample containers with this reagent water.

    Field blanks were prepared by rinsing field sampling equipment with reagent water, then poured into sample bottles.

    All blanks were submitted to the laboratory "blind."

- Analysis of field split samples (no less than 10% of the samples submitted to the analytical laboratory were field split samples)

    Field split samples were prepared by splitting a larger volume (collected within the same sampling container) into two aliquots. Field split samples were then submitted to lab in separate sample bottles as discrete samples.

- Interpretation of results of analysis of field split and blank samples

    The results of analysis of field split and blank samples were compared to the following data quality objectives:

    Split samples: Relative percent difference $<=20\%$

    Blank samples: Not significantly different from detection limit (i.e. within an order of magnitude of detection limit)

    If the results of analysis of field split and blank samples did not meet the stated data quality objectives, the results were determined to be suspect and were censored (not included) in the report tables. The determination that data are suspect (do not meet data quality objectives) is sensitive to cases where results are reported at or near analytical detection limits; therefor, discretion is used when results of split and blank samples are inspected and compared to data quality objectives. Results of trip and field blanks are <u>not</u> subtracted from reported results for actual samples (as is sometimes the case for laboratory blanks).

The results of the laboratory analysis of field and laboratory QA/QC samples are provided in Section A - 2 of this Appendix.

TSB. 1989. *Basin planning section standard operating procedures.* Massachusetts Department of Environmental Protection, Division of Water Pollution Control, Technical Services Branch, Westborough, MA. 51 p.

WES. 1994. *Laboratory Quality Assurance Plan and Standard Operating Procedures.* Massachusetts Department of Environmental Protection, Division of Environmental Analysis. Wall Experiment Station, Lawrence.

Appendix A

A - 2. Results of Field and Laboratory QA/QC Sample Analysis

TABLE 2.1A. 1994 NEPONSET RIVER BASIN SURVEY. Physiochemical water column data. Field QA/QC data. (All units in mg/l unless otherwise noted.)

STATION	DATE	ALK	HARD	SUSP SOLIDS	TOTAL SOLIDS	TURB (NTU)	TKN	NH3-N	N03-N	TOT-P	CL
NE16	7/19	32	72	4.0	308	3.9	1.0	0.20	0.53	0.08	108
SPLIT		31	81	6.5	312	4.3	1.2	0.18	0.52	0.05	111
RPD		3.2%	11.8%	47.6%	1.3%	9.8%	18.2%	10.5%	1.9%	46.2%	2.7%
NE16	8/16	16	20	6.0	178	3.6	0.96	0.16	0.76	0.05	36
SPLIT		18	21	7.0	188	4.5	1.0	0.18	0.74	0.05	41
RPD		11.8%	4.9%	15.4%	5.5%	22.2%	4.1%	11.8%	2.7%	0.0%	13.0%
NE16	10/18	33	57	7.5	220	3.2	0.55	0.09	0.55	<0.05	92
SPLIT		32	58	3.5	242	3.0	0.56	0.06	0.55	<0.05	92
RPD		3.1%	1.7%	72.7%	9.5%	6.5%	1.8%	40.0%	0.0%	NA	0.0%
FIELD BLANK	8/16	--	<0.2	--	--	--	<0.1	<0.2	<0.02	<0.05	--
	10/18	7.0	<0.6	<2.5	<10	<0.1	<0.1	<0.2	0.08	<0.05	1.0
TRIP BLANK	7/19	--	<0.2	--	--	--	0.88	0.22	0.92	<0.05	--
	8/16	<1.0	<0.2	<2.5	<10	0.2	<0.1	<0.02	0.02	<0.05	<1
	10/18	2.0	<0.6	<2.5	<10	<0.1	<0.1	<0.02	<0.02	<0.05	<1.0

-- Data not collected
NA - not applicable
RPD - relative percent difference

TABLE 2.2A. 1994 NEPONSET RIVER BASIN SURVEY. Water analysis, total metals field QA/QC data. (All units in mg/l unless otherwise noted.)

		AG	AL	CD	CR	CU	FE	PB	HG	NI	ZN
NE16	July 19	<0.0003	0.05	<0.0002	<0.002	<0.002	0.55	<0.002	<0.0002	<0.002	<0.005
SPLIT		<0.0003	<0.03	<0.0002	<0.002	<0.002	0.57	<0.002	<0.0002	<0.002	<0.005
RPD		NA	50.0%	NA	NA	NA	3.6%	NA	NA	NA	NA
NE16	August 16	--	<0.05	0.0002	<0.002	0.034	0.43	<0.002	<0.0002	<0.002	<0.005
SPLIT		--	0.06	0.0012	<0.002	0.021	0.54	<0.002	<0.0002	<0.002	0.02
RPD			18.2%	142.9%	NA	47.3%	22.7%	NA	NA	NA	120.0%
NE16	October 18	--	<0.03	0.0004	<0.002	0.005	0.97	0.004	<0.0002	<0.002	0.016
SPLIT		--	<0.03	0.0006	<0.002	0.004	0.95	0.004	<0.0002	0.002	0.020
RPD			NA	40.0%	NA	22.2%	2.1%	0.0%	NA	0.0%	22.2%
FIELD BLANK	August 16	--	<0.05	<0.0002	<0.002	<0.002	<0.03	<0.002	<0.0002	<0.002	<0.005
	October 18	--	<0.03	0.0030	<0.002	0.008	<0.04	<0.002	<0.0002	<0.002	0.007
TRIP BLANK	July 19	<0.0003	<0.03	<0.0002	<0.002	<0.002	<0.01	<0.002	<0.0002	<0.002	<0.005
	August 16	--	<0.05	<0.0002	<0.002	0.006	<0.03	<0.002	<0.0002	<0.002	<0.005
	October 18	--	<0.03	0.0003	<0.002	<0.001	<0.04	0.003	<0.0002	<0.002	0.006

-- no data
RPD - relative percent difference
NA - not applicable

TABLE 2.3A. 1994 NEPONSET RIVER SURVEY. Water analysis, total metals lab QA/QC data. (All units in mg/l unless otherwise noted.)

ANALYTE	SAMPLE ID	COLLECTION DATE	PRECISION			ACCURACY			MDL mg/l	METHOD
			Sample	Duplicate	RPD	LFM	SPIKE AMOUNT	% RECOVERY		
Hg	94-2366	7/19/94	<MDL	<MDL	NA	0.0022	0.002	105	0.0002	EPA245.1
	94-3395	8/16/94	<MDL	<MDL	NA	0.0020	0.002	95	0.0002	EPA245.1
	94-4770	10/18/94	0.0062	0.0054	13.8%	0.0075	0.002	85	0.0002	EPA245.1
Fe	94-2393	7/19/94	0.02	0.02	0.0%	1.02	1.00	100	0.01	EPA200.7A
	94-3374	8/16/94	0.08	0.08	0.0%	0.98	1.00	90	0.03	EPA236.1
	94-4776	10/18/94	<MDL	<MDL	NA	0.85	1.00	83	0.04	EPA236.1
Zn	94-2393	7/19/94	<MDL	<MDL	NA	1.00	1.00	100	0.005	EPA200.7A
	94-3374	8/16/94	0.006	0.006	0.0%	0.97	1.00	94	0.005	EPA200.7A
	94-4776	10/18/94	0.007	0.006	15.4%	0.85	1.00	82	0.005	EPA200.7A
Al	94-2393	7/19/94	<MDL	<MDL	NA	1.01	1.00	99	0.03	EPA200.7A
	94-3374	8/16/94	<MDL	<MDL	NA	0.89	1.00	86	0.05	EPA200.7A
	94-4776	10/18/94	<MDL	<MDL	NA	0.84	1.00	82	0.03	EPA200.7A
Ni	94-2393	7/19/94	<MDL	<MDL	NA	1.10	1.00	109	0.03	EPA200.7A
	94-3391	8/16/94	<MDL	<MDL	NA	0.023	0.020	110	0.002	EPA249.2
	94-4776	10/18/94	0.002	<MDL	0.0%[1]	0.023	0.020	105	0.002	EPA249.2
Cu	94-2393	7/19/94	<MDL	<MDL	NA	0.041	0.040	102	0.002	EPA220.2
	94-3391	8/16/94	0.005	0.005	0.0%	0.027	0.020	110	0.002	EPA220.2
	94-4776	10/18/94	0.002	0.001	66.7%	0.032	0.030	102	0.001	EPA220.2
Cr	94-2393	7/19/94	<MDL	<MDL	NA	0.0033	0.0030	77	0.002	EPA218.2
	94-3374	8/16/94	<MDL	<MDL	NA	0.023	0.020	110	0.002	EPA218.2
	94-4776	10/18/94	<MDL	<MDL	NA	0.012	0.010	110	0.002	EPA218.2
Pb	94-2393	7/19/94	<MDL	<MDL	NA	0.97	1.00	95	0.03	EPA200.7A
	94-3391	8/16/94	<MDL	<MDL	NA	0.023	0.020	110	0.002	EPA239.2
	94-4776	10/18/94	0.003	0.003	0.0%	0.023	0.020	100	0.002	EPA239.2
Cd	94-2393	7/19/94	<MDL	<MDL	NA	0.019	0.020	95	0.0001	EPA213.2
	94-3391	8/16/94	<MDL	<MDL	NA	0.020	0.020	100	0.0002	EPA213.2
	94-4776	10/18/94	0.0004	0.0002	66.7%	0.009	0.010	87	0.0002	EPA213.2

NA - not applicable
RPD - relative percent difference, [1] note: RPD was calculated using the detection limit.
LFM - lab fortified matrix (result after spiking)

TABLE 2.4A. 1994 NEPONSET RIVER BASIN SURVEY. Water chemistry data. Volatile organic compound. Lab QA/QC data ($\mu g/l$).

Sample #	Station	Date	Surrogate Standards, % Recovery								
			1,2-Dichloroethane-D4			Fluorobenzene			1,4-Bromofluorobenzene		
			LFM	spike amount	% recovery	LFM	spike amount	% recovery	LFM	spike amount	% recovery
94-2356	NE02	7/19	9.6	10	96	8.8	10	88	8.6	10	86
94-2389	NE04	7/19	9.2	10	92	8.8	10	88	9.0	10	90
94-2385	6B01	7/19	8.2	10	82	8.0	10	80	8.6	10	86
94-2390	NE09	7/19	10.0	10	100	8.8	10	88	9.4	10	94
94-2370	NE10	7/19	9.2	10	92	8.8	10	88	9.2	10	92
94-2374	5B01	7/19	9.2	10	92	8.8	10	88	8.8	10	88
94-2378	NE12	7/19	8.8	10	88	8.8	10	88	9.2	10	92
94-2381	NE12A	7/19	10.4	10	104	8.8	10	88	9.0	10	90
94-2352	14B04	7/19	9.2	10	92	8.8	10	88	9.0	10	90
94-2363	NE16	7/19	10.0	10	100	8.8	10	88	9.2	10	92
94-2394	Trip Blank	7/19	10.4	10	104	9.8	10	98	9.2	10	92

LFM - lab fortified matrix (result after spiking)

TABLE 3.1A. 1994 NEPONSET RIVER SURVEY. Sediment metal analyses lab QA/QC data. (mg/kg, dry wt)

SAMPLE ID	ANALYTE	PRECISION			ACCURACY			MDL mg/kg	ANALYTICAL METHOD
		Sample	Duplicate	RPD	LFM	SPIKE AMOUNT	% RECOVERY		
94-5384	Hg	0.323	0.368	13.0%	0.724	0.390	91	0.020	EPA 7471
94-5370	Cd	780	670	15.2%	1074	380	92	7.6	EPA 6010
94-5370	Cu	2095	1860	11.9%	2394	380	109	7.6	EPA 6010
94-5370	Fe	2.13 pph	1.86 pph	13.5%			*	19.	EPA 6010
94-5370	Mn	355	305	15.2%	646	380	83	7.6	EPA 6010
94-5370	Pb	355	357	0.6%	684	380	86	19.	EPA 6010
94-5370	Ag	<MDL	<MDL	NA			**	3.8	EPA 6010
94-5370	As	3.38	2.80	18.8%	55.7	38.1	138	0.76	EPA7060
94-5370	Al	1.31 pph	1.23 pph	6.3%			*	19.	EPA 6010
94-5370	Cr	880	826	6.3%	1121	380	70	7.6	EPA 7190
94-5370	Zn	802	785	2.1%	1180	380	101	7.6	EPA 6010
94-5370	Ni	220	193	13.1%			**	11.	EPA 7520

REMARKS:
* - Spike conc. insignificant
** - Not spiked
RPD - relative percent difference
pph - parts per hundred (percent)
NA - not applicable
LFM - lab fortified matrix (result after spiking)

TABLE 4.1A. 1994 NEPONSET RIVER SURVEY. Fish tissue metal analyses. Lab QA/QC data.

SAMPLE ID	ANALYTE	PRECISION			ACCURACY			MDL mg/kg	ANALYTICAL METHOD
		SAMPLE	DUPLICATE	RPD	LFM	SPIKE AMOUNT	% RECOVERY		
94-3540	Hg	0.082	0.102	21.7%	0.268	0.200	88	0.020	EPA 245.1
94-3967	Se	0.203	0.178	13.1%	1.930	1.667	104	0.040	EPA 270.2
94-3967	As	0.041	<MDL	181.4%*	1.352	1.667	80	0.040	EPA 200.9
94-3967	Pb	<MDL	<MDL	NA	1.80	2.00	70	1.00	EPA 200.7A
94-3967	Cd	<MDL	<MDL	NA	2.20	2.00	95	0.60	EPA 200.7A

RPD - relative percent difference, * note: RPD calculated using detection limit.
NA - not applicable
LFM - lab fortified matrix (result after spiking)

Table 4.2A. 1994 Neponset River Basin Survey. Fish tissue analyses. Lab QA/QC data. Organics ($\mu g/l$).

ANALYTE	PRECISION Sample # 94-4164			PRECISION Sample # 94-4653			ACCURACY			MINIMUM DETECTION LIMIT (ug/g)
	SAMPLE	DUPLICATE	RPD	SAMPLE	DUPLICATE	RPD	EXPECTED	LFM	RECOVERY	
PCB A1242	ND	ND	NA	ND	ND	NA	--	--	--	0.06
PCB A1254	ND	ND	NA	ND	ND	NA	--	--	--	0.17
PCB A1260	ND	ND	NA	ND	ND	NA	0.39[1]	0.57[1]	146%[1]	0.16
Chlordane	ND	ND	NA	ND	ND	NA	--	--	--	0.11
Toxaphene	ND	ND	NA	ND	ND	NA	--	--	--	0.11
a-BHC	ND	ND	NA	ND	ND	NA	--	--	--	0.19
b-BHC	ND	ND	NA	ND	ND	NA	--	--	--	0.09
Lindane	ND	ND	NA	ND	ND	NA	0.032[2]	0.020[2]	63%[2]	0.16
d-BHC	ND	ND	NA	ND	ND	NA	--	--	--	0.02
Hexachlorocyclopentadiene	ND	ND	NA	ND	ND	NA	--	--	--	0.10
Trifluralin	ND	ND	NA	ND	ND	NA	--	--	--	0.11
Hexachlorobenzene	ND	ND	NA	ND	ND	NA	--	--	--	0.04
Heptachlor	ND	ND	NA	ND	ND	NA	0.032[2]	0.029[2]	91%[2]	0.08
Heptachlor Epoxide	ND	ND	NA	ND	ND	NA	--	--	--	0.59
Methoxychlor	ND	ND	NA	ND	ND	NA	--	--	--	1.07
DDD	ND	ND	NA	ND	ND	NA	--	--	--	0.13
DDE	ND	ND	NA	ND	ND	NA	--	--	--	0.39
DDT	ND	ND	NA	ND	ND	NA	0.064[2]	0.041[2]	64%[2]	0.25
Aldrin	ND	ND	NA	ND	ND	NA	0.032[2]	0.035[2]	109%[2]	0.15
% Lipid	1.1	1.1	0%	0.68	0.49	32.5%	--	--	--	

[1] Lab spike-29 [2] Lab spike-30 RPD - relative percent difference NA - not applicable ND - non detect -- no data

REMARKS: The samples were extracted and analyzed according to the modified AOAC 983.21 procedure for the analysis of PCBs and Organochlorine Pesticides.

Appendix A

A - 3. Analytical Laboratory Methods

Water Column Variables	Test Method
Alkalinity	2320 B *
Hardness	SM2340 B
Suspended Solids	2540 D
Total Solids	2540 B *
Turbidity	EPA 180.1
Total Kjeldahl Nitrogen	EPA 351.2 **
Ammonia Nitrogen	EPA 350.1
Nitrate Nitrogen	EPA 353.1
Total Phosphorus	4500-P E *
Chloride	4500-cl B *
Purgeable Organics	624-Purgeables
Hg (cold vapor technique)	EPA 245.1
Fe Inductively Coupled Plasma AAS	EPA 200.7 A
Zn " "	"
Al " "	"
Ni " "	"
Cu " "	"
Cr " "	"
Pb " "	"
Cu Furnace AAS	EPA 220.2
Cd Furnace AAS	EPA 213.2
Cr Furnace AAS	EPA 218.2
Pb Furnace AAS	EPA 239.2
Ni Furnace AAS	EPA 249.2
Fe Flame AAS	EPA 236.1
Si Furnace AAS	EPA 272.2

Sediment Variables	
Total Phosphorus	EPA 365.4
Total Kjeldahl Nitrogen	EPA 351.2
Hg	EPA 7471
As	EPA 7060
Cr	EPA 7190
Ni	EPA 7520
Cd	EPA 6010
Cu	"
Fe	"
Mn	"
Pb	"
Ag	"
Al	"
Zn	"

* Standard Methods, 17th Edition, 1989
** Methods for Chemical Analysis of Water and Waste, 1983

Appendix A

A - 3. Analytical Laboratory Methods (cont.)

Fish Tissue Variables	Test Method
Hg (cold vapor tecnique)	EPA 245.1
Se Furnace AAS	EPA 270.2
As "	EPA 200.9
Pb Inductively Coupled Plasma AAS	EPA 200.7 A
Cd " "	"

Extracted Organics	
PCB A1242	Modified AOAC 983.21 *
PCB A1254	"
PCB A1260	"
Chlordane	"
Toxaphene	"
a-BHC	"
b-BHC	"
Lindane	"
d-BHC	"
Hexachloroccyclopentadiene	"
Trifluralin	"
Hexachlorobenzene	"
Heptachlor	"
Heptachlor Epoxide	"
Methoxychlor	"
DDD	"
DDE	"
DDT	"
Aldrin	"

* PCBs and Organochlorine Pesticides in Biological Tissue, AOAC Official Methods of Analysis, 1990

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STREAM FLOW PROFILES - NEPONSET RIVER SUBBASINS

INTRODUCTION

The ability of the Neponset River and its tributaries to meet assigned water quality classifications is greatly influenced by the available streamflow. In the Neponset River Basin the Department of Environmental Protection measured fourteen locations for water quality parameters and/or aquatic biota. Streamflow estimates are given for the fourteen subbasins defined by these monitoring sites using several different methodologies. Each method and resultant value has limitations requiring the reader to fully understand their development before determining the appropriate use.

METHODS

For comparison among subbasins, estimates for monthly flows, a variety of flow durations, as well as several low flows (August median, 7Q2, 7Q10) were determined using a similar methodology. This methodology, the drainage area ratio method, was employed for each of the fourteen sites based on the USGS gaging station, Old Swamp River near South Weymouth (01105600). Old Swamp River was determined by USGS to be essentially unregulated (Ries 1994) and, of the several gaging stations investigated, established the closest relationship with unregulated stations located in the Neponset Basin (Traphole Brook, Germany Brook). In some subbasins, the estimated flows will be more accurately portrayed than in others based on similarities in subbasin characteristics (i.e. percent stratified drift, percent wetlands, subbasin relief, etc.).

In many subbasins, other methodologies were used to further refine estimates of the various flows (primarily low flows). The methods employed include development of moderate and low flows using a regression equation (Searcy 1959), development of low flows using a two parameter model (Risley 1994) and use and adjustment of generated flows (Ries 1994, Wandle 1984).

At main stem Neponset measuring points, flows have been estimated (utilizing both USGS gaging stations located in the basin; Neponset River at Norwood, East Branch Neponset at Canton) based on both the post-industrial decline era in the Neponset River basin (1975-present) and the full period of record which includes maximum regulation by industrial users and municipal water supply. From 1975 to present flows are only slightly affected by industrial withdrawals, and municipal water use has either declined or stabilized.

In the remaining subbasins, no additional flow data has been provided due to heavy regulation upstream (i.e., controlled reservoirs, extensively piped storm water drainage, etc.).

RESULTS

The following subbasin discussions provide background information for the flows generated by the above-referenced methodologies. Table 1.1B provides a summary of the drainage area ratio methodology for each subbasin. Information for all of the streamflows are presented in Tables 1.2B- 1.15B.

Neponset River, Outlet of Crackrock Pond, Foxborough, NE02

As with the Massapoag Brook subbasin, the drainage area ratio method based on Old Swamp River near South Weymouth was the only method used to establish a natural streamflow regimen. Regulation of the 268 acre Neponset Reservoir (23% of the subbasin area) occurs primarily in the summer and fall months for phosphate flushing to control algal blooms (Neponset Reservoir Corp, Town of Foxborough, personal communication). This regulation has been more prolific in the past and

TABLE 1.1B. 1994 NEPONSET RIVER BASIN SURVEY. Estimated monthly streamflows (cfs) based on drainage area ratio methodology at select stations in the Neponset River and tributaries.

MONTH	NE02[1]	NE04[2]	2B0B[1]	NE09[1]	NE10[3]	1B01[1]	5B01[1]	5B0B[1]	NE12[4]	9B0B[1]	NE12A[5]	14B04[1]	14B03B[1]	NE16[6]
OCTOBER	1.9	9.9	2.2	8.7	30.8	1.1	2.5	0.9	30.8	4.7	72.5	8.4	8.2	89.1
NOVEMBER	4.3	16.1	4.9	19.5	50.3	2.5	5.7	2.1	48.7	10.6	119.3	18.9	18.4	146.6
DECEMBER	5.0	22.4	6.3	24.8	69.9	3.2	7.2	2.6	67.6	13.5	161.1	24.0	23.3	197.9
JANUARY	5.0	25.9	5.7	22.3	80.9	2.8	6.5	2.3	70.8	12.1	177.7	21.5	21.0	218.3
FEBRUARY	5.5	26.5	6.3	24.9	82.7	3.2	7.3	2.6	70.7	13.6	184.8	24.1	23.5	227.0
MARCH	7.5	36.0	8.5	33.6	112.3	4.3	9.8	3.5	91.0	18.3	245.3	32.5	31.6	301.4
APRIL	6.0	35.3	6.9	27.0	110.2	3.4	7.9	2.8	87.1	14.7	263.4	26.1	25.4	290.5
MAY	4.1	19.8	4.7	18.5	61.9	2.4	5.4	1.9	50.3	10.1	138.3	17.9	17.4	170.0
JUNE	3.1	15.1	3.6	14.2	47.1	1.8	4.1	1.5	40.3	7.7	98.4	13.7	13.3	120.9
JULY	1.1	6.7	1.3	5.1	20.8	0.6	1.5	0.5	17.0	2.8	46.1	4.9	4.8	56.6
AUGUST	1.4	9.0	1.6	6.1	28.0	0.8	1.8	0.6	24.2	3.3	60.8	5.9	5.8	74.7
SEPTEMBER	1.3	6.3	1.5	6.0	19.5	0.8	1.8	0.6	19.3	3.3	48.9	5.8	5.7	60.1
ANNUAL MEAN	6.1	19.0	7.0	27.6	59.3	3.5	8.0	2.9	51.5	15.0	147.4	26.7	26.0	181.1
7Q2	0.1	2.4	0.2	0.7	7.2[7]	0.1	0.2	0.1	6.0	0.4	16.1	0.6	0.6	27.3
7Q10	0.1	1.4	0.1	0.3	4.5[7]	0.0	0.1	0.0	3.4	0.2	7.2	0.3	0.3	8.8
AUG MEDIAN	1.1	7.5	1.3	5.1	23.5	0.6	1.5	0.5	17.0	2.8	55.6	4.9	4.8	83.4
DRAINAGE AREA (mi^2)	1.92	11.13	2.19	8.63	34.7	1.1	2.51	0.91	27.9	4.7	82.2	8.35	8.13	101

1 Flows were estimated by drainage area ratio method using U.S.G.S. unregulated gaging station 01105600, Old Swamp River, near South Weymouth.
2 Flows were estimated by drainage area ratio method using U.S.G.S. gaging station 01105000, Neponset River at Norwood, period 1975-1994.
3 Flows were estimated using U.S.G.S. gaging station, 01105000, Neponset River at Norwood, period 1975-1994.
4 Flows were estimated using U.S.G.S. gaging station 01105500, East Branch Neponset River at Canton, period 1975-1994.
5 Flows were estimated by drainage area ratio method using U.S.G.S. gaging stations 01105000, Neponset River at Norwood, and 01105500 East Branch Neponset River at Canton.
6 Flows were estimated by drainage area ratio method using U.S.G.S. gaging station 01105500, East Branch Neponset River at Canton.
7 Flows from Gazatteer of Hydrologic Characteristics of Streams in Massachusetts, USGS WRI 84-4281,1984.

is most significant during times of low streamflow, invalidating flow relationships.

Neponset River, South Street, Walpole, NE04

Streamflows were estimated using the drainage area ratio method based on the Neponset River gage at Norwood (01105000) for the period 1975-1994. The index station method (Searcy 1959) was also used to calculate flows as well. A regression equation was developed between two regulated sites, the Norwood gage and the Neponset River at Main Street (01104840), and adjusted for drainage area in an attempt to improve upon the predicted low flows developed by the drainage area ratio method. The Neponset River flows at South Street are significantly impacted by regulation at the Neponset Reservoir, as well as by municipal wells in the Mine Brook and School Meadow Brook tributaries. Low flows are predominantly higher when calculated through regression equations, likely due in part to releases from Neponset Reservoir during low flow months. These releases may be significant enough to offset the reduction in flow during late summer/early fall months resulting from municipal well water withdrawals in the basin.

Mill Brook, Rt.109, Medfield, 2B0B

In addition to the drainage area ratio technique (Old Swamp River near South Weymouth), other methods were used to generate unregulated flow estimates. A streamflow relationship (Searcy 1959) was established between Old Swamp River and Mine Brook at Philips Street, Medfield (01104847) and adjusted for drainage area. Regulation of Mine Brook above Philips Street for public water supply well withdrawal may be inconsequential to streamflow in that much of the water returns upstream of the site. Flow estimates were also made for the seven-day, two-year and ten-year flows.

Hawes Brook, Washington Street, Norwood, NE09

In addition to the drainage area ratio method (Old Swamp River near South Weymouth), estimates were developed for other natural condition low flows. A regression equation was attempted to describe the relationship between Hawes Brook and Old Swamp River, however, the relationship was too poor to provide useful results. Impacts from regulation in the form of impoundments (Willet Pond) (Neponset Reservoir Corporation, Town of Norwood, personal communication) do not appear to be significant enough to cause the disparity in streamflow data.

Neponset River, Pleasant Street, Norwood, NE10

A full range of flows were calculated for this water quality monitoring site using the coincident USGS gaging station (Neponset River at Norwood, 01105000). Streamflow values were calculated for both the full period of record (1939-1994) and the post-industrial water use era of 1975 to present. In the latter period flow values, in general are higher throughout the range of flows, indicating an overall reduction in withdrawals by both municipalities and industries in the upper portion of the Neponset Basin. Regulation by industry, municipal water use, and reservoir management, however, continues to divert or retard a significant portion of water from the Neponset River.

Meadow Brook, Pleasant Street, Norwood, 1B01

The drainage area ratio method (Old Swamp River near South Weymouth) was the only technique used to estimate flows. Land use consists predominantly of high density residential properties with some commercial uses, both of which are municipally served by water and sewer. Extensive storm drainage systems channel most of the surface runoff to the subbasin outlet (quality and discharge measuring location). However, some flow is channeled into the subbasin from outside, while additional flow is drained via storm water piping from inside the basin to outside the topographic drainage divide. No other realistic estimates for natural condition flows are made.

Traphole Brook, Cooney Street, Walpole, 5B01
Traphole Brook, High Plains Street, Sharon, 5B0B

In addition to the drainage area ratio method (Old Swamp River near South Weymouth) to estimate the streamflow series, other techniques were used to estimate unregulated (natural) flows. Twenty-seven miscellaneous measurements have been recorded by USGS from 1959 to the present at the Traphole Brook, Summer Street, Norwood gage,(01105100). Regression equations using these data points to generate flow exceedence under natural conditions (Searcy 1959) and adjusted for drainage area provide realistic results for the naturally flowing Traphole Brook (Ries 1993). Seven-day, two-year and ten-year low flows were also calculated for unregulated conditions.

East Branch, Neponset River, Neponset Street, Norwood, NE12

Flows were estimated using streamflow data measured at the USGS gaging station East Branch, Neponset River (01105500) just upstream from the water quality measuring site. The difference in drainage area of 0.5mi^2 (2% of the subbasin) was not significant enough to warrant a flow adjustment for drainage area difference. Monthly flows, a range of flow exceedences, and low flows were calculated for both the full period of record and the post-industrial water use era in the Neponset Basin of 1975 to present.

Analysis of the data does not show significant differences between the two different classes of data. Flows are slightly less during low flows in the 1975 to present period than for the full period of record. The trend is reversed for the moderate to high flows. The Neponset River Basin Plan (MA DEM OWR 1991) indicated a minor net inflow to this subbasin which is presumed to have diminished as water use in the region has decreased.

Massapoag Brook, Deb Sampson Street, Sharon, 9B0B

The drainage area ratio method based on Old Swamp River near South Weymouth was the only method used to establish a streamflow regimen. Regulation of the 353 acre Massapoag Lake prohibits other valid streamflow estimates. The town of Sharon maintains the reservoir elevation and regulates flows for a variety of uses. A minimum flow release is maintained at 1-1.5cfs for aquatic habitat. Releases also occur for water quality and temperature maintenance through pond flushing. On occasion additional flash boards have been temporarily installed, restricting flow out of the reservoir in anticipation of predicted heavy rainfall (Sharon Conservation Commission, personal communication). Throughout the years various measures have been taken to address flow needs or lake elevations, making downstream flow measurements invalid for streamflow analysis.

Neponset River, Dedham Street, Canton, NE12A
Neponset River, Adams Street Bridge, Milton, NE16

Flow statistics were estimated for both the Neponset River at Dedham Street and the Neponset River at Adams Street water quality sites using similar techniques. The 75 through 95 percent flow durations were calculated using regression equations developed from measurements taken at each site and daily measurements at the Neponset River, Norwood and East Branch, Canton streamflow gages. These partially regulated flows were developed using the post-industrial era (1975 to present) flows for the Neponset River at Norwood, and the full period of record flows at the East Branch Neponset gage. (As mentioned previously statistics indicate only a slight change in flows due to regulation over the years at the East Branch Neponset gage.)

For the Neponset River at Dedham Street, the regression equation was developed from instantaneous flow measurements and the average of the daily cubic foot per second per square mile (cfsm) for the Neponset River, Norwood and East Branch, Canton gages, where the flow at the Neponset, Norwood gage exceeded 0.20cfsm. Below 0.20cfsm, only the East Branch Neponset, Canton gage was used. The 0.20cfsm limit was based on the fact that the Neponset River, Norwood flows are somewhat regulated by dams below 0.20cfsm and the East Branch, Canton gage is less regulated.

The regression equation for the Adams Street site uses only the East Branch Neponset, Canton gage cfsm with no adjustments for flows below 0.20cfsm.

A comparison of East Branch, Canton and the Neponset River, Norwood flows shows that using the equation derived from daily and instantaneous measurements was valid for calculating low flow duration statistics at the Dedham Street and Adams Street sites. However, monthly and high flow durations were more accurately estimated from averaging the flows per square mile for the two stream gages, and extending them by a drainage area ratio to the other two sites. Weighted averages reflecting the contribution of flow from each gage did not prove to be accurate predictors of flow at the other sites.

Flow anomalies may occur at these two sites (Dedham St. and Adams St.) as has been measured in the past. Under certain conditions flows at the downstream location may be less than flows at the upstream site following a precipitation event. It is theorized that the Fowl Meadow wetland system may retard significant volumes of water from a rain event which follows several days of dry weather condition. In conjunction with urbanization in the lower reaches of the basin where runoff is rapidly discharged into the river following a storm event, wetland flow retardation may alter the timing of stream discharge peaks. In effect, the peak flow at the Adams Street site may have already been experienced when high flows are just beginning to be release from the wetlands upstream (Dedham Street site).

Pine Tree Brook, Central Avenue, Milton, 14B04
Pine Tree Brook, Ruggles Lane/School Street, Milton, 14B03B

Both of these subbasins maintain similar flow characteristics because their drainage areas differ by only 0.22mi^2. The drainage area ratio method (Old Swamp River near South Weymouth) was the primary technique used to estimate flows as it is presumed to be a fairly accurate representation of natural flows in the Pine Tree Brook subbasins. Other low flows (Risley 1994) are shown for comparison. There are several impoundments in the subbasin, the largest of which is the Pine Tree Brook flood control site. Operation of this structure will impede only the flood flows in the subbasin, and in general the flows displayed in this report should not be affected (MA DEM OWR personal communication 1995). Other land uses in the subbasin should not have significant impacts on flow response.

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TABLE 1.2B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Neponset River, outlet of Crackrock Pond, Foxborough; station # NE02 (Office of Water Resources, DEM, March 1995).

Station: NE02
Drainage Area: 1.92 mi. sq.

ESTIMATED UNREGULATED FLOWS (cfs)[1]

Monthly Flows

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1.9	4.3	5.0	5.0	5.5	7.5	6.0	4.1	3.1	1.1	1.4	1.3

Flow Duration Data

99%	98%	95%	90%	82%	75%	61%	50%	41%	25%	10%	5%
0.1	0.1	0.2	0.3	0.7	0.9	1.7	2.3	2.9	4.3	8.4	12.9

Aug Median	1.1	Seven day, two year	0.1
Annual Mean	6.1	Seven day, ten year	0.1

[1] Flows were estimated by drainage area ratio method using U.S.G.S. unregulated gaging station 01105600, Old Swamp River, near So. Weymouth.

TABLE 1.3B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Neponset River, South Street, Walpole; station # NE04 (Office of Water Resources, DEM, March 1995).

Station: NE04											
Drainage Area: 11.13 mi. sq.											
ESTIMATED PARTIALLY REGULATED FLOWS (cfs)[1]											
Monthly Flows											
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
9.9	16.1	22.4	25.9	26.5	36.0	35.3	19.8	15.1	6.7	9.0	6.3
Flow Duration Data											
99%	98%	95%	90%	84%	75%	60%	50%	43%	25%	10%	5%
1.2	1.4	2.0	2.5	3.8	5.5	9.3	12.8	15.7	25.5	42.6	59.2
Aug Median		7.5		Seven day, two year[2]				2.4			
Annual Mean		19.0		Seven day, ten year[2]				1.4			
ESTIMATED PARTIALLY REGULATED FLOWS(cfs)[3]											
(Other Methods)											
Monthly Flows											
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
10.9	---	---	---	---	---	---	---	---	8.3	10.2	8.0
Flow Duration Data											
		99%	98%	95%	90%	84%	75%	60%	50%		
		4.0	4.2	4.7	5.0	6.1	7.4	10.5	13.2		
Aug Median		9.0		Seven day, two year[4]				4.8			
				Seven day, ten year[4]				4.2			

[1] Flows were estimated by drainage area ratio method using U.S.G.S. gaging station 01105000, Neponset River at Norwood, period 1975 - 1994.

[2] 7Q2 and 7Q10 flows estimated from Gazetteer of Hydrologic Characteristics of Streams in Massachusetts, USGS WRI 84-4281, 1984 and adjusted for drainage area.

[3] Flows estimated utilizing the index station method (Searcy 1959) using USGS gaging station 01105000, Neponset River at Norwood and adjusted for drainage area.

[4] 7Q2 and 7Q10 flows estimated from Gazetteer of Hydrologic Characteristics of Streams in Massachusetts, USGS WRI 84-4281, 1984.

TABLE 1.4B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Mill Brook, Route 109, Medfield; station # 2B0B (Office of Water Resources, DEM, March 1995).

Station: 2B0B
Drainage Area: 2.19 mi. sq.

ESTIMATED UNREGULATED FLOWS (cfs)[1]											
Monthly Flows											
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
2.2	4.9	6.3	5.7	6.3	8.5	6.9	4.7	3.6	1.3	1.6	1.5
Flow Duration Data											
99%	98%	95%	90%	82%	75%	61%	50%	41%	25%	10%	5%
0.1	0.1	0.2	0.4	0.8	1.0	2.0	2.7	3.3	4.9	9.6	14.7
Aug Median		1.3		Seven day, two year				0.2			
Annual Mean		7.0		Seven day, ten year				0.1			
ESTIMATED UNREGULATED FLOWS(cfs)											
(Other Methods)											
Flow Duration Data[2]											
		99%	98%	95%	90%	82%	75%	61%	50%		
		0.3	0.3	0.4	0.6	1.1	1.4	2.6	3.4		
Aug Median[2]		1.5		Seven day, two year[3]				0.09			
				Seven day, ten year[3]				0.03			

[1] Flows were estimated by drainage area ratio method using U.S.G.S. unregulated gaging station 01105600, Old Swamp River, near So. Weymouth.

[2] Flow data for the lower half of the flow duration curve was estimated using the index station method (Searcy 1959) using USGS gaging station 01105600 Old Swamp River near South Weymouth and Mine Brook, Philip St., Medfield, gage 01104847 and adjusted for drainage area to Mill Brook, Route 109, Medfield.

[3] 7Q2 and 7Q10 flows were estimated by using a two parameter low-flow model developed in Estimating the Magnitude and Frequency of Low Flows of Streams in Massachusetts, USGS, WRI 94-4100, 1994.

TABLE 1.5B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Hawes Brook, Washington Street, Norwood; station # NE09 (Office of Water Resources, DEM, March 1995).

Station: NE09
Drainage Area: 8.63 mi. sq.

ESTIMATED UNREGULATED FLOWS (cfs)[1]

Monthly Flows

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
8.7	19.5	24.8	22.3	24.9	33.6	27.0	18.5	14.2	5.1	6.1	6.0

Flow Duration Data

99%	98%	95%	90%	82%	75%	61%	50%	41%	25%	10%	5%
0.3	0.4	0.7	1.5	3.1	3.8	7.9	10.5	12.8	19.2	38.0	57.9

Aug Median	5.1	Seven day, two year	0.7
Annual Mean	27.6	Seven day, ten year	0.3

ESTIMATED UNREGULATED FLOWS(cfs)

(Other Methods)

Flow Duration Data[2]

99%	98%	95%
0.32	0.4	0.68

Seven day, two year[3]	0.52
Seven day, ten year[3]	0.19

[1] Flows were estimated by drainage area ratio method using U.S.G.S. unregulated gaging station 01105600, Old Swamp River, near So. Weymouth.

[2] Physically based mathematical models were used to estimate the natural yields for these flow durations from Estimation of Low-Flow Duration Discharges in Massachusetts, USGS, Open-File 93-38, 1993.

[3] 7Q2 and 7Q10 flows were estimated by using a two parameter low-flow model developed in Estimating the Magnitude and Frequency of Low Flows of Streams in Massachusetts, USGS, WRI 94-4100, 1994.

TABLE 1.6B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Neponset River, Pleasant Street, Norwood; station # NE10 (Office of Water Resources, DEM, March 1995).

Station: NE10											
Drainage Area: 34.7 mi. sq.											
ESTIMATED PARTIALLY REGULATED FLOWS (cfs)[1]											
Monthly Flows											
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
30.8	50.3	69.9	80.9	82.7	112.3	110.2	61.9	47.1	20.8	28.0	19.5
Flow Duration Data											
99%	98%	95%	90%	84%	75%	60%	50%	43%	25%	10%	5%
3.7	4.4	6.2	7.9	12.0	17.0	29.0	39.9	48.9	79.5	132.9	184.6
Aug Median		23.5									
Annual Mean		59.3									
ESTIMATED REGULATED FLOWS(cfs)[2]											
Monthly Flows											
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
27.3	47.4	62.2	68.4	77	110	101	62.6	40.3	20.7	24.2	21.5
Flow Duration Data											
99%	98%	95%	90%	82%	75%	63%	50%	44%	25%	10%	5%
2.1	4.7	6.7	9.1	13	16.1	24	37.4	45	75	123.6	164.5
Aug Median		16.3			Seven day, two year[3]			7.2			
Annual Mean		55.1			Seven day, ten year[3]			4.5			

[1] Flows were estimated using U.S.G.S. gaging station, 01105000, Neponset River at Norwood, period 1975 - 1994.

[2] Flows were estimated using U.S.G.S. gaging station, 01105000, Neponset River at Norwood, period 1939 - 1994.

[3] 7Q2 and 7Q10 flows from Gazetteer of Hydrologic Characteristics of Streams in Massachusetts, USGS WRI 84-4281,1984.

TABLE 1.7B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Meadow Brook, Pleasant Street, Norwood; station # 1B01 (Office of Water Resources, DEM, March 1995).

Station: 1B01
Drainage Area: 1.1 mi. sq.

ESTIMATED UNREGULATED FLOWS (cfs)[1]

Monthly Flows

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1.1	2.5	3.2	2.8	3.2	4.3	3.4	2.4	1.8	0.6	0.8	0.8

Flow Duration Data

99%	98%	95%	90%	82%	75%	61%	50%	41%	25%	10%	5%
0.0	0.0	0.1	0.2	0.4	0.5	1.0	1.3	1.6	2.4	4.8	7.4

Aug Median	0.6	Seven day, two year	0.1
Annual Mean	3.5	Seven day, ten year	0.0

[1] Flows were estimated by drainage area ratio method using U.S.G.S. unregulated gaging station 01105600, Old Swamp River, near So. Weymouth.

TABLE 1.8B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Traphole Brook, Cooney Street, Walpole; station # 5B01 (Office of Water Resources, DEM, March 1995).

Station: 5B01 Drainage Area: 2.51 mi. sq.											
				ESTIMATED UNREGULATED FLOWS (cfs)[1]							
				Monthly Flows							
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
2.5	5.7	7.2	6.5	7.3	9.8	7.9	5.4	4.1	1.5	1.8	1.8
				Flow Duration Data							
99%	98%	95%	90%	82%	75%	61%	50%	41%	25%	10%	5%
0.1	0.1	0.2	0.4	0.9	1.1	2.3	3.1	3.7	5.6	11.0	16.8
Aug Median		1.5		Seven day, two year				0.2			
Annual Mean		8.0		Seven day, ten year				0.1			
				ESTIMATED UNREGULATED FLOWS(cfs)[2]							
				(Other Methods)							
				Flow Duration Data							
		99%	98%	95%	90%	82%	75%	61%	50%		
		0.98	1.03	1.12	1.27	1.66	1.86	2.91	3.6		
Aug Median		2.1		Seven day, two year[3]				0.14			
				Seven day, ten year[3]				0.06			

[1] Flows were estimated by drainage area ratio method using U.S.G.S. unregulated gaging station 01105600, Old Swamp River, near So. Weymouth.

[2] Flows estimated utilizing the index station method (Searcy 1959) using USGS gaging station 01105600, Old Swamp River Near South Weymouth and adjusted for drainage area.

[3] 7Q2 and 7Q10 flows are estimated using a two parameter low-flow model devloped in Estimating the Magnitude and Frequency of Low Flows of Streams in Massachusetts, USGS, WRI 94-4100, 1994.

TABLE 1.9B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Traphole Brook, High Plain Street, Sharon; station # 5B0B (Office of Water Resources, DEM, March 1995).

Station: 5B0B Drainage Area: 0.91 mi. sq.											
ESTIMATED UNREGULATED FLOWS (cfs)[1]											
Monthly Flows											
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
0.9	2.1	2.6	2.3	2.6	3.5	2.8	1.9	1.5	0.5	0.6	0.6
Flow Duration Data											
99%	98%	95%	90%	82%	75%	61%	50%	41%	25%	10%	5%
0.0	0.0	0.1	0.2	0.3	0.4	0.8	1.1	1.4	2.0	4.0	6.1
Aug Median		0.5		Seven day, two year				0.1			
Annual Mean		2.9		Seven day, ten year				0.0			
ESTIMATED UNREGULATED FLOWS(cfs)[2]											
(Other Flows)											
Flow Duration Data											
		99%	98%	95%	90%	82%	75%	61%	50%		
		0.36	0.37	0.4	0.46	0.6	0.68	1.05	1.3		
Aug Median		0.75		Seven day, two year[3]				--			
				Seven day, ten year[3]				--			

[1] Flows were estimated by drainage area ratio method using U.S.G.S. unregulated gaging station 01105600, Old Swamp River, near So. Weymouth.

[2] Flows estimated utilizing the index station method (Searcy 1959) using USGS gaging station 1105600, Old Swamp River near South Weymouth and adjusted for drainage area.

[3] 7Q2 and 7Q10 flows using USGS,WRI 94-4100 low-flow model were not calculated. Input data (Ad.) is outside the limits of the model.

TABLE 1.10B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at East Branch Neponset River, Neponset Street, Canton; station # NE12 (Office of Water Resources, DEM, March 1995).

Station: NE12 Drainage Area: 27.9 mi. sq.											
ESTIMATED PARTIALLY REGULATED FLOWS (cfs)[1]											
Monthly Flows											
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
30.8	48.7	67.6	70.8	70.7	91.0	87.1	50.3	40.3	17.0	24.2	19.3
Flow Duration Data											
99%	98%	95%	90%	83%	75%	60%	50%	46%	25%	10%	5%
4.3	5.2	6.6	8.4	12.3	16.7	27.7	37.1	41.0	69.5	111.5	147.9
Aug Median		17.0		Seven day, two year				6.0			
Annual Mean		51.5		Seven day, ten year				3.4			
ESTIMATED REGULATED FLOWS(cfs)[2]											
Monthly Flows											
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
30.4	50.4	66.1	69.1	73.3	94.8	89.4	54.9	36.0	18.1	23.3	21.8
Flow Duration Data											
99%	98%	95%	90%	84%	75%	61%	50%	45%	25%	10%	5%
3.7	4.6	6.2	7.8	11.3	16.4	27.7	38.2	43.1	71.0	114.4	150.3
Aug Median		15.2		Seven day, two year				6.4			
Annual Mean		52.4		Seven day, ten year				3.5			

[1] Flows were estimated using U.S.G.S. gaging station 01105500, East Branch Neponset River at Canton, period 1975 - 1994.

[2] Flows were estimated using U.S.G.S. gaging station 01105500, East Branch, Neponset River at Canton, period 1952 - 1994.

TABLE 1.11B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Massapoag Brook, Deb Sampson Street, Sharon; station # 9B0B (Office of Water Resources, DEM, March 1995).

Station: 9B0B
Drainage Area: 4.7 mi. sq.

ESTIMATED UNREGULATED FLOWS (cfs)[1]

Monthly Flows

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
4.7	10.6	13.5	12.1	13.6	18.3	14.7	10.1	7.7	2.8	3.3	3.3

Flow Duration Data

99%	98%	95%	90%	82%	75%	61%	50%	41%	25%	10%	5%
0.2	0.2	0.4	0.8	1.7	2.1	4.3	5.7	7.0	10.4	20.7	31.5

Aug Median	2.8	Seven day, two year	0.4
Annual Mean	5.0	Seven day, ten year	0.2

[1] Flows were estimated by drainage area ratio method using U.S.G.S. unregulated gaging station 01105600, Old Swamp River, near So. Weymouth.

TABLE 1.12B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Neponset River, Dedham Street, Canton; station # NE12A (Office of Water Resources, DEM, March 1995).

Station: NE12A
Drainage Area: 82.2 mi. sq.

ESTIMATED PARTIALLY REGULATED FLOWS (cfs)

Monthly Flows[1]

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
72.5	119.3	161.1	177.7	184.8	245.3	236.4	138.3	98.4	46.1	60.8	48.9

Flow Duration Data[2]

99%	98%	95%	90%	83%	75%	61%	50%	45%	25%	10%	5%
7.2	10.2	16.2	19.6	31.9	48.3	75.2	103.5	121.4	198.8	325.9	440.1

Aug Median	55.6	Seven day, two year[3]	16.1
Annual Mean	147.4	Seven day, ten year[3]	7.2

[1] Flows were estimated by drainage area ratio method using U.S.G.S. gaging stations 01105000, Neponset River at Norwood, and 01105500 East Branch Neponset River at Canton.

[2] Flows (75%-99%) above 0.2 cfsm estimated utilizing the index station method (Searcy, 1959) using USGS gaging stations (averaged) 01105000, Neponset River Norwood and 01105500, East Branch Neponset River at Canton and adjusted for drainage area. Flows below 0.2 cfsm were estimated using only the East Branch Neponset River at Canton with the index station method. Flows above the 75% flow duration estimated by drainage area ratio method using data from the East Branch Neponset and Neponset at Norwood.

[3] 7Q2 and 7Q10 flows estimated utilizing index station method (Searcy 1959) using USGS gaging station, 01105500, East Branch Neponset River at Canton and adjusted for drainage area.

TABLE 1.13B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Pine Tree Brook, Central Avenue, Milton Village; station # 14B04 (Office of Water Resources, DEM, March 1995).

Station: 14B04
Drainage Area: 8.35 mi. sq.

ESTIMATED UNREGULATED FLOWS (cfs)[1]											
Monthly Flows											
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
8.4	18.9	24.0	21.5	24.1	32.5	26.1	17.9	13.7	4.9	5.9	5.8
Flow Duration Data											
99%	98%	95%	90%	82%	75%	61%	50%	41%	25%	10%	5%
0.3	0.4	0.7	1.5	3.0	3.7	7.6	10.2	12.4	18.6	36.7	56.0

Aug Median	4.9	Seven day, two year[2]	0.6	0.6
Annual Mean	26.7	Seven day, ten year[2]	0.3	0.2

[1] Flows were estimated by drainage area ratio method using U.S.G.S. unregulated gaging station 01105600, Old Swamp River, near So. Weymouth.

[2] 7Q2 and 7Q10 flows were estimated by using a two parameter low-flow model developed in Estimating the Magnitude and Frequency of Streams in Massachusetts, USGS, WRI 94-4100, 1994.

TABLE 1.14B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Pine Tree Brook, Ruggles Lane/School Street, Milton; station # 14B03B (Office of Water Resources, DEM, March 1994).

Station: 14B03B
Drainage Area: 8.13 mi. sq.

ESTIMATED UNREGULATED FLOWS (cfs)[1]											
Monthly Flows											
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
8.2	18.4	23.3	21.0	23.5	31.6	25.4	17.4	13.3	4.8	5.8	5.7
Flow Duration Data											
99%	98%	95%	90%	82%	75%	61%	50%	41%	25%	10%	5%
0.3	0.3	0.7	1.4	2.9	3.6	7.4	9.9	12.1	18.1	35.8	54.6

Aug Median	4.8	Seven day, two year[2]	0.6	0.6
Annual Mean	26.0	Seven day, ten year[2]	0.3	0.2

[1] Flows were estimated by drainage area ratio method using U.S.G.S. unregulated gaging station 01105600, Old Swamp River, near So. Weymouth.

[2] 7Q2 and 7Q10 flows were estimated by using a two parameter low-flow model developed in Estimating the Magnitude and Frequency of Low Flows of Streams in Massachusetts, USGS, WRI 94-4100, 1994.

TABLE 1.15B. 1994 NEPONSET RIVER BASIN SURVEY. Stream flow statistics at Neponset River, Adams Street Bridge, Milton; station NE16 (Office of Water Resources, DEM, March 1995).

Station: NE16
Drainage Area: 101 mi. sq.

ESTIMATED PARTIALLY REGULATED FLOWS (cfs)[1]

Monthly Flows

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
89.1	146.6	197.9	218.3	227.0	301.4	290.5	170.0	120.9	56.6	74.7	60.1

Flow Duration Data[2]

99%	98%	95%	90%	83%	75%	61%	50%	45%	25%	10%	5%
10.1	15.8	26.0	36.2	58.5	91.1	92.3	127.2	149.2	244.2	400.5	540.7

Aug Median	83.4	Seven day, two year[3]	27.3
Annual Mean	181.1	Seven day, ten year[3]	8.8

[1] Flows were estimated by drainage area ratio method using U.S.G.S. gaging stations 01105500, East Branch Neponset River at Canton.

[2] Flows below the 75% flow duration estimated utilizing the index station method (Searcy 1959) using USGS gaging station 01105500, East Branch Neponset River at Canton and adjusted for drainage area. Flows above the 75% flow duration were estimated by drainage area ratio method using the East Branch Neponset River at Canton gage only.

[3] 7Q2 and 7Q10 flows estimated utilizing index station method (Searcy, 1959) using USGS gaging station, 01105500, East Branch Neponset River at Canton and adjusted for drainage area.

TABLE 1.16B. 1994 NEPONSET RIVER BASIN SURVEY. Results of USGS discharge measurements.

STATION	LOCATION	DATE	DISCHARGE (cfs)
6B01	Spring Brook, Off Route 27, near playground, Walpole	7-19-94	1.35
NE09	Hawes Brook, Washington Street, Norwood	7-19-94	0.76
		8-16-94	1.00
		10-18-94	1.2
1B01	Meadow Brook, off Meadow Brook Road/Pleasant Street, Norwood	8-16-94	0.94
		10-18-94	0.65
NE12A	Neponset River, Dedham Stret Bridge, Canton	7-19-94	16.8
		8-16-94	32.6
		10-18-94	22.9
NE16	Neponset River downstream Baker Dam, Adams Street, Milton/Boston line	7-19-94	28.3
		8-16-94	16.7
		10-18-94	151

TABLE 2.1B 1994 NEPONSET RIVER BASIN SURVEY. Time, temperature, dissolved oxygen, percent saturation, pH and fecal coliform bacteria data.

STATION	DATE	TIME (h)	TEMP (°C)	DO (mg/l)	PERCENT SATURATION (%)	pH (SU)	Fecal Coliform (cfu/100ml)
NE02	19-Jul	900	24.0	8.6	102.2	6.7	120
	15-Aug	400	19.0	6.8	73.3	--	--
	16-Aug	857	19.0	6.9	74.4	6.9	20
	01-Sep	250	21.0	5.2	58.3	--	--
	09-Sep	240	20.0	5.0	55.0	--	--
	18-Oct	900	9.0	10.2	88.3	6.6	20
NE02A	16-Aug	925	19.0	7.4	79.8	6.9	340
	12-Dec	--	--	--	--	--	300
NE03	19-Jul	935	22.0	6.8	77.8	6.4	960
	15-Aug	410	18.0	8.1	85.6	--	--
	16-Aug	936	19.0	8.3	89.5	7.1	840
	01-Sep	305	20.0	7.3	80.3	--	--
	09-Sep	230	18.0	7.0	74.0	--	--
	18-Oct	930	6.0	11.0	88.4	5.8	16000
	12-Dec	--	--	--	--	--	440
NE04	19-Jul	950	23.0	6.2	72.3	6.5	20
	16-Aug	1000	19.0	7.8	84.1	6.9	260
	01-Sep	355	20.0	8.4	92.4	--	--
	09-Sep	210	17.0	7.4	76.6	--	--
	18-Oct	1010	10.0	10.6	93.9	5.6	20
NE05	15-Aug	445	17.0	6.5	67.3	--	--
	01-Sep	345	19.0	7.8	84.1	--	--
	09-Sep	202	17.0	6.4	66.2	--	--
2B02	19-Jul	1027	26.0	3.2	39.4	6.4	<20
	15-Aug	500	20.0	5.1	56.1	--	--
	16-Aug	1044	23.0	5.9	68.8	6.9	<20
	01-Sep	335	22.0	5.4	61.8	--	--
	09-Sep	156	19.0	5.8	62.5	--	--
	18-Oct	1030	10.0	7.8	69.1	5.5	<20
2B01	19-Jul	1015	22.0	4.9	56.1	6.4	200
	16-Aug	1026	17.0	6.2	64.2	6.9	300
	18-Oct	1055	5.0	9.6	75.2	5.5	<20
6B01	19-Jul	--	29.0	8.6	111.8	--	30
	15-Aug	515	19.0	7.2	77.6	--	--
	16-Aug	1309	24.0	9.0	106.9	8.5	<20
	01-Sep	320	20.0	6.7	73.7	--	--
	09-Sep	144	19.0	8.1	87.3	--	--

-- = no data

TABLE 2.1B (cont.)

STATION	DATE	TIME (h)	TEMP (°C)	DO (mg/l)	PERCENT SATURATION (%)	pH (SU)	Fecal Coliform (cfu/100ml)
6B01	18-Oct	1415	12.7	11.0	103.7	8.4	20
6B02	19-Jul	--	27.0	7.2	90.4	6.8	<20
	16-Aug	1323	23.0	8.1	94.4	6.7	100
	18-Oct	1404	13.6	10.3	99.1	7.3	<20
NE07	15-Aug	540	20.0	7.0	77.0	--	--
	01-Sep	415	20.0	7.8	85.8	--	--
	09-Sep	235	18.0	7.6	80.3	--	--
NE08	15-Aug	600	20.0	7.9	86.9	--	--
	01-Sep	430	20.0	8.2	90.2	--	--
	09-Sep	306	18.0	7.4	78.2	--	--
NE09	19-Jul	1120	23.0	6.2	72.3	6.0	740
	15-Aug	610	17.0	7.9	81.8	--	--
	16-Aug	1159	20.0	7.5	82.5	7.1	320
	01-Sep	445	20.0	8.3	91.3	--	--
	09-Sep	311	17.0	7.0	72.4	--	--
	18-Oct	1145	10.0	9.9	87.7	6.2	40
4B01	19-Jul	1100	21.0	6.6	74.0	5.8	820
	16-Aug	1121	17.0	8.0	82.8	7.5	840
	18-Oct	1130	9.0	10.3	89.1	6.1	100
1B02	19-Jul	1048	20.0	6.8	74.8	4.8	160
	16-Aug	1105	16.0	7.6	77.0	7.3	60
	18-Oct	1110	10.0	11.2	99.2	5.5	80
NE10	19-Jul	1140	23.0	5.6	65.3	6.4	520
	15-Aug	620	19.0	7.3	78.7	--	--
	16-Aug	1310	22.0	8.0	91.5	7.3	600
	01-Sep	500	20.0	8.3	91.3	--	--
	09-Sep	317	18.0	7.3	77.1	--	--
	18-Oct	1200	11.0	9.0	81.6	5.8	2000
1B01	19-Jul	1200	20.0	5.0	55.0	6.3	184000
	15-Aug	635	19.0	7.0	75.5	--	--
	16-Aug	1250	20.0	5.2	57.2	6.9	224000
	09-Sep	325	19.0	5.4	58.2	--	--
	18-Oct	1215	15.0	7.6	75.4	5.9	40000
	12-Dec	--	--	--	--	--	32000
NE11	15-Aug	703	20.0	7.7	84.7	--	--
	01-Sep	550	20.0	7.5	82.5	--	--

-- = no data

TABLE 2.1B (cont.)

STATION	DATE	TIME (h)	TEMP (°C)	DO (mg/l)	PERCENT SATURATION (%)	pH (SU)	Fecal Coliform (cfu/100ml)
NE11	09-Sep	400	18.0	7.0	74.0	--	--
5B03	15-Aug	645	13.5	9.2	88.3	--	--
	01-Sep	520	17.0	8.9	92.1	--	--
	09-Sep	340	15.0	7.8	77.4	--	--
5B01	19-Jul	1330	18.0	8.5	89.8	7.1	1700
	16-Aug	1233	15.0	8.8	87.3	6.4	260
	18-Oct	1340	9.9	9.6	84.9	6.9	60
12B01	19-Jul	1250	21.0	6.9	77.4	6.8	60
	16-Aug	1213	18.0	6.9	72.9	5.8	800
	18-Oct	1300	9.3	7.5	65.4	6.5	<20
13B01	19-Jul	1345	20.0	7.8	85.8	7.2	160
	16-Aug	1250	17.0	8.4	86.9	6.6	400
	18-Oct	1327	10.6	8.9	80.0	7.2	<20
11B01	18-Oct	1312	9.7	8.8	77.4	7.3	<20
NE12	19-Jul	1135	27.0	7.0	87.9	6.9	300
	15-Aug	655	17.5	6.3	65.9	--	--
	16-Aug	1044	23.0	7.6	88.6	6.3	320
	01-Sep	540	22.0	8.4	96.1	--	--
	09-Sep	350	--	6.0	--	--	--
	18-Oct	1108	12.2	9.4	87.6	7.2	280
9B02	19-Jul	1155	25.0	7.3	88.4	7.0	20
	16-Aug	1117	21.0	7.5	84.1	5.5	20
	18-Oct	1056	10.4	9.0	80.5	7.0	<20
10B01	19-Jul	1230	23.0	7.0	81.6	7.3	200
	16-Aug	1154	19.0	6.9	74.4	6.3	120
	18-Oct	1240	10.5	2.3	20.6	5.9	20
9B01	19-Jul	1215	28.0	7.3	93.3	7.7	100
	16-Aug	1139	25.0	8.1	98.0	6.4	100
	18-Oct	1220	13.9	9.1	88.1	7.2	<20
7B02	19-Jul	1115	24.0	5.9	70.1	6.3	280
	16-Aug	1109	18.0	7.2	76.1	6.6	500
	18-Oct	1134	7.9	6.8	57.3	6.8	60
7B01	18-Oct	1005	5.2	4.7	37.0	6.0	40

-- = no data

TABLE 2.1B (cont.)

STATION	DATE	TIME (h)	TEMP (°C)	DO (mg/l)	PERCENT SATURATION (%)	pH (SU)	Fecal Coliform (cfu/100ml)
8B02	19-Jul	1105	24.0	6.3	74.9	6.6	100
	16-Aug	1029	21.0	7.4	83.0	6.1	80
	18-Oct	1042	8.8	9.0	77.5	6.7	20
8B01	19-Jul	1025	19.0	5.7	61.5	6.7	600
	16-Aug	1010	15.0	6.9	68.4	6.9	2000
	18-Oct	1020	7.1	6.4	52.9	6.4	20
3B01	19-Jul	1215	21.0	6.8	76.3	6.1	540
	15-Aug	715	14.0	7.1	68.9	--	--
	16-Aug	1405	18.0	7.8	82.4	6.8	340
	01-Sep	635	17.0	8.6	89.0	--	--
	09-Sep	432	16.0	7.1	71.9	--	--
	18-Oct	1225	10.0	11.8	104.6	6.5	20
NE12A	19-Jul	950	22.0	4.3	49.2	6.6	360
	16-Aug	900	21.0	6.3	70.7	5.8	880
	01-Sep	610	19.0	7.0	75.5	--	--
	09-Sep	420	17.0	6.9	71.4	--	--
	18-Oct	910	8.0	6.1	51.5	--	300
18B01	19-Jul	950	21.0	6.7	75.2	7.1	20
	16-Aug	932	15.0	6.0	59.5	6.5	40
	01-Sep	705	17.0	7.8	80.7	--	--
	09-Sep	520	16.0	7.2	73.0	--	--
	18-Oct	941	7.8	9.2	77.3	6.8	100
17B02	19-Jul	935	19.0	6.3	67.9	6.5	160
	16-Aug	947	18.0	4.8	50.7	5.9	620
	01-Sep	655	17.0	7.5	77.6	--	--
	09-Sep	510	15.0	7.0	69.4	--	--
	18-Oct	930	8.5	7.6	65.0	6.3	80
17B01	19-Jul	910	22.0	7.1	81.2	6.8	30
	16-Aug	907	18.0	6.2	65.5	6.4	300
	18-Oct	915	9.3	9.7	84.5	6.5	<20
NE12B	01-Sep	710	19.0	6.9	74.4	--	--
	09-Sep	455	17.0	7.0	72.4	--	--
16B02	19-Jul	1430	25.0	5.6	67.8	--	120
	15-Aug	805	19.0	3.8	41.0	--	--
	16-Aug	1042	22.0	4.0	45.8	6.7	100
	01-Sep	745	21.0	6.5	72.9	--	--
	09-Sep	600	18.0	6.7	70.8	--	--

-- = no data

TABLE 2.1B (cont.)

STATION	DATE	TIME (h)	TEMP (°C)	DO (mg/l)	PERCENT SATURATION (%)	pH (SU)	Fecal Coliform (cfu/100ml)
16B02	18-Oct	1000	10.0	8.2	72.7	--	1200
	12-Dec	--	--	--	--	--	120
16B01	16-Aug	940	19.0	5.1	55.0	10.0	2500
	18-Oct	945	9.0	8.5	73.5	--	220
NE13	15-Aug	800	19.0	4.2	45.3	--	--
	01-Sep	730	19.0	6.9	74.4	--	--
	09-Sep	540	17.0	6.9	71.4	--	--
NE14	15-Aug	808	19.0	4.9	52.8	--	--
	01-Sep	750	20.0	6.8	74.8	--	--
	09-Sep	550	17.0	6.7	69.3	--	--
14B04	19-Jul	1235	20.0	8.4	92.4	6.6	1240
	16-Aug	1250	18.0	7.6	80.3	6.2	500
	18-Oct	1131	8.0	9.6	81.1	--	120
14B03	19-Jul	1215	21.0	4.5	50.5	--	700
	15-Aug	820	16.0	6.1	61.8	--	--
	16-Aug	1215	20.0	5.6	61.6	7.1	3600
	01-Sep	815	21.0	8.3	93.1	--	--
	09-Sep	620	16.0	6.9	69.9	--	--
	18-Oct	1119	8.0	8.2	69.3	--	180
14B02	19-Jul	1200	20.0	5.0	55.0	--	90
	16-Aug	1150	20.0	5.8	63.8	6.5	400
	18-Oct	1107	8.0	8.5	71.8	--	40
14B01	19-Jul	1135	21.0	9.6	107.7	--	260
	16-Aug	1120	20.0	7.2	79.2	6.2	140
	18-Oct	1057	6.0	6.0	48.2	--	20
NE16	19-Jul	1051	22.0	7.1	81.2	6.7	900
	15-Aug	835	18.5	7.2	76.9	--	--
	16-Aug	1315	23.0	7.1	82.8	6.1	340
	01-Sep	825	20.0	8.8	96.8	--	--
	09-Sep	630	17.0	7.2	74.5	--	--
	18-Oct	1028	8.0	6.1	51.5	--	680
15B04	19-Jul	1400	18.0	8.8	93.0	--	540
	15-Aug	850	19.0	6.8	73.3	--	--
	16-Aug	1440	19.0	7.5	80.9	8.2	780
	01-Sep	835	18.0	9.3	98.3	--	--
	09-Sep	640	15.0	7.7	76.4	--	--

-- = no data

TABLE 2.1B (cont.)

STATION	DATE	TIME (h)	TEMP (°C)	DO (mg/l)	PERCENT SATURATION (%)	pH (SU)	Fecal Coliform (cfu/100ml)
15B04	18-Oct	1218	12.0	9.2	85.4	--	320
15B03	19-Jul	1330	18.0	6.9	72.9	--	220
	18-Oct	1210	10.5	9.6	86.1	--	300
15B02	19-Jul	1315	19.0	9.4	101.4	--	540
	16-Aug	1410	19.0	7.3	78.7	5.9	1100
15B01	18-Oct	1150	6.0	6.2	49.8	--	60

-- = no data

TABLE 2.2B. 1994 NEPONSET RIVER BASIN SURVEY. Physicochemical data (mg/l). (-- Data not collected)

STATION	DATE	ALK	HARD	SUSP SOLIDS	TOTAL SOLIDS	TURB (NTU)	TKN	NH3-N	N03-N	TOT-P	CL
NE02	7/19	20	36	14	150	12	2.3	0.37	0.10	0.23	36
	8/16	16	16	18	132	27	1.9	<0.02	<0.02	0.15	39
	10/18	19	38	7.5	84	2.2	0.9	0.15	0.22	0.09	36
NE04	7/19	31	56	<2.5	224	0.8	0.47	<0.02	0.58	<0.05	58
	8/16	18	23	9.0	118	12	1.3	<0.02	0.09	0.10	42
	10/18	25	43	4.0	168	1.5	0.52	<0.02	0.46	<0.05	56
NE10	7/19	31	62	<2.5	214	3.1	0.45	0.06	0.35	<0.05	64
	8/16	27	35	3.0	192	6.1	0.64	0.02	0.13	<0.05	68
	10/18	30	46	31	142	1.7	0.54	0.05	0.38	<0.05	49
NE12A	7/19	31	64	10	246	8.1	1.4	0.12	0.29	0.06	73
	8/16	25	29	8.5	178	8.0	0.77	0.04	0.31	0.07	60
	10/18	32	57	6.0	192	3.7	0.56	0.1	0.49	<0.05	72
NE16	7/19	32	72	4.0	308	3.9	1.0	0.20	0.53	0.08	108
	8/16	16	20	6.0	178	3.6	0.96	0.16	0.76	0.05	36
	10/18	33	57	7.5	220	3.2	0.55	0.09	0.55	<0.05	92
1B01	7/19	--	--	--	--	--	--	--	--	--	--
	8/16	48	43	4.0	320	3.2	4.6	2.8	1.3	0.65	121
	10/18	67	89	8.0	196	2.2	5.5	4.3	2.2	0.68	170
5B01	7/19	18	77	<2.5	128	1.1	0.17	0.05	0.67	<0.05	111
	8/16	18	43	<2.5	300	0.4	0.17	<0.02	0.73	<0.05	39
	10/18	21	71	<2.5	298	0.4	<0.1	<0.02	0.66	<0.05	115
6B01	7/19	24	71	3.0	332	5.3	0.60	<0.02	<0.02	0.08	121
	8/16	--	--	--	--	--	--	--	--	--	--
	10/18	--	--	--	--	--	--	--	--	--	--
NE09	7/19	29	51	<2.5	194	3.4	0.39	0.04	0.45	<0.05	63
	8/16	27	27	<2.5	158	1.2	1.3	0.02	0.43	<0.05	52
	10/18	26	44	3.0	150	0.6	0.43	0.05	0.47	<0.05	66
NE12	7/19	34	49	<2.5	168	3.4	0.48	0.05	0.23	<0.05	41
	8/16	27	26	<2.5	106	3.5	0.55	0.12	0.29	<0.05	37
	10/18	29	46	8.5	126	1.6	0.34	0.04	0.57	<0.05	50
14B04	7/19	34	72	<2.5	226	0.9	0.20	0.20	<0.02	<0.05	70
	8/16	26	30	<2.5	192	1.2	0.42	0.03	0.69	<0.05	32
	10/18	23	51	3.5	188	0.6	0.31	<0.02	0.67	<0.05	63

TABLE 2.3B. 1994 NEPONSET RIVER BASIN SURVEY. Total metals data (mg/l).

		AG	AL	CD	CR	CU	FE	PB	HG	NI	ZN
NE02	July 19	<0.0003	<0.03	<0.0002	<0.002	<0.002	0.65	<0.002	<0.0002	<0.002	<0.005
	August 16		<0.05	0.0004	<0.002	0.002	0.66	<0.002	<0.0002	<0.002	<0.005
	October18		<0.03	0.0008	<0.002	0.006	0.34	0.002	<0.0002	<0.002	0.023
NE04	July 19	<0.0003	<0.03	<0.0002	<0.002	<0.002	0.25	<0.002	<0.0002	0.06	<0.005
	August 16		0.01	<0.0002	0.006	0.005	1.0	<0.002	<0.0002	<0.002	0.005
	October 18		<0.03	<0.0002	<0.002	0.002	0.53	<0.002	<0.0002	<0.002	0.014
NE10	July 19	<0.0003	<0.03	<0.0002	<0.002	<0.002	0.87	<0.002	<0.0002	<0.002	<0.005
	August 16		0.06	<0.0002	0.004	0.005	0.77	<0.002	<0.0002	<0.002	<0.005
	October 18		<0.03	<0.0002	<0.002	0.016	0.60	0.003	0.0002	0.033	0.011
NE12A	July 19	<0.0003	0.04	<0.0002	<0.002	<0.002	1.4	<0.002	<0.0002	0.07	<0.005
	August 16		0.10	0.0003	0.004	0.010	0.92	0.003	<0.0002	0.003	0.026
	October 18		<0.03	0.0002	<0.002	0.005	1.2	0.003	0.0011	0.003	0.014
NE16	July 19	<0.0003	0.05	<0.0002	<0.002	<0.002	0.55	<0.002	<0.0002	<0.002	<0.005
	August 16		<0.05	0.0002	<0.002	0.034	0.43	<0.002	<0.0002	<0.002	<0.005
	October 18		<0.03	0.0004	<0.002	0.005	0.97	0.004	<0.0002	<0.002	0.016
5B01	July 19	<0.0003	<0.03	<0.0002	0.03	<0.002	0.12	<0.002	<0.0002	<0.002	<0.005
	August 16		<0.05	<0.0002	<0.002	<0.002	0.08	<0.002	<0.0002	<0.002	0.006
	October 18		<0.03	0.0020	<0.002	0.006	0.10	0.008	0.0010	<0.002	0.010
6B01	July 19	<0.0003	<0.03	<0.0002	<0.002		<0.01	<0.002	<0.0002	0.002	<0.005
1B01	August 16		<0.05	<0.0002	0.005	0.010	0.46	<0.002	0.0003	<0.002	0.009
	October 18		<0.03	<0.0002	<0.002	0.011	0.60	<0.002	0.0011	<0.002	0.025
NE09	July 19	<0.0003	<0.03	<0.0002	<0.002	<0.002	0.39	<0.002	<0.0002	<0.002	<0.005
	August 16		<0.05	<0.0002	0.006	0.004	0.44	<0.002	0.0006	<0.002	<0.005
	October 18		<0.03	<0.0002	<0.002	0.021	0.14	0.004	<0.0002	0.060	0.013
NE12	July 19	<0.0003	<0.03	<0.0002	<0.002	<0.002	1.1	<0.002	<0.0002	0.03	<0.005
	August 16		0.05	<0.0002	0.006	0.008	0.89	<0.002	<0.0002	<0.002	<0.005
	October 18		<0.03	0.0004	<0.002	0.011	0.64	0.002	0.0004	0.018	0.012
14B04	July 19	<0.0003	<0.03	<0.0002	0.07	<0.002	0.18	<0.002	<0.0002	<0.002	<0.005
	August 16		<0.05	<0.0002	<0.002	0.100	0.22	<0.002	<0.0002	<0.002	<0.005
	October 18		<0.03	0.0010	<0.002	0.002	0.14	0.003	0.0058	<0.002	0.011

TABLE 2.4B. 1994 NEPONSET RIVER BASIN SURVEY. Water chemistry data. Volatile organic compounds.

Station	Date	Result
NE02	7/19	ND*
NE04	7/19	ND
6B01	7/19	ND
NE09	7/19	**
NE10	7/19	ND
5B01	7/19	ND
NE12	7/19	ND
NE12A	7/19	ND
14B04	7/19	ND
NE16	7/19	ND

* ND - Not Detected - EPA "Method 624 - Purgeables"
** Unidentified Compound

TABLE 2.5B. 1994 NEPONSET RIVER SURVEY. *Summary of four-day average water quality criteria for selected metals.*

PARAMETER	CRITERION* fresh water (mg/l)	CRITERION salt water (mg/l)	REFERENCE
Aluminum	0.087 (between pH 6.5 and 9.0)	--	EPA. 1988. Ambient water quality criteria for Aluminum - 1988. U.S. Environmental Protection Agency. Washington, DC. EPA 440/5-86-008. 47 p.
Iron	1.0	--	EPA. 1976. Quality criteria for water. U.S. Environmental Protection Agency. Washington, DC. 256 p.
Mercury	0.000012	0.000025	EPA. 1985b. Ambient water quality criteria for mercury - 1984. U.S. Environmental Protection Agency. Washington, DC. EPA 440/5-84-026. 136 p.
Copper	$e^{(0.8545[\ln(\text{hardness})]-1.465)}$	0.0029	EPA. 1985c. Ambient water quality criteria for copper - 1984. U.S. Environmental Protection Agency. Washington, DC. EPA 440/5-84-031. 142 p.
Zinc	$e^{(0.8473[\ln(\text{hardness})]+0.7614)}$	0.086	EPA. 1987a. Ambient water quality criteria for zinc - 1987. U.S. Environmental Protection Agency. Washington, DC. EPA 440/5-87-003. 158 p.
Lead	$e^{(1.273[\ln(\text{hardness})]-4.705)}$	0.0056	EPA. 1985d. Ambient water quality criteria for lead - 1984. U.S. Environmental Protection Agency. Washington, DC. EPA 440/5-84-027. 81 p.
Nickel	$e^{(0.8460[\ln(\text{hardness})]+1.1645)}$	0.0083	EPA. 1986b. Ambient water quality criteria for nickel - 1986. U.S. Environmental Protection Agency. Washington, DC. EPA 440/5-86-004. 93 p.
Silver	0.00012	0.00092	EPA. 1987b. Draft 9/24/87. Ambient aquatic life water quality criteria for silver. U.S. Environmental Protection Agency. Office of Research & Development. Envirnomental Research Laboratories. Duluth, Minnesota. Narragansett, Rhode Island. 104p.
Cadmium	$e^{(0.7852[\ln(\text{hardness})]-3.490)}$	0.0093	EPA. 1985e. Ambient water quality criteria for cadmium-1984. U.S. Environmental Protection Agency. Washington DC. EPA 440/5-84-032. 127 P.
Chromium (VI)	0.011	0.050	EPA. 1985f. Ambient water quality criteria for chromium-1984. U.S. Environmental Protection Agency. Washington DC. EPA 440/5-84-029. 99 p.

* Where appropriate, formulas are presented when the criterion is hardness dependent. In cases where the instream hardness levels were below 25 mg/l as $CaCO_3$, a hardness of 25 mg/l as $CaCO_3$ was used to calculate the criterion as recommended in the guidance published in the Federal Register (Vol. 57; No. 246) on December 22, 1992. The criteria have been calculated according to their respective formulas, using the hardness values (H) obtained during the survey.

-- No criterion

TABLE 2.6B. 1994 NEPONSET RIVER BASIN SURVEY. Use support determinations based on water column monitoring data.

STATION SUBWATERSHED	NEPONSET RIVER AND TRIBUTARY USE ATTAINMENT				
	1° CONTACT RECREATION	2° CONTACT RECREATION	AQUATIC LIFE	AESTHETICS	IMPAIRMENT CAUSE(S)
NE02	S	S	NS	NS	DO, Cd, Cu, Pb, Turbidity, Total phosphorus
NE02A	PS	S	S	NA	Fecal coliform
NE03	NS	NS	PS	NA	Fecal coliform, pH
NE04	PS	S	NS	NS	Fecal coliform, pH, Cu, Turbidity
NE05	NA	NA	S	NA	None
2B02	S	S	NS	NA	Temperature, DO, pH
2B01	PS	S	PS	NA	DO, pH
6B01	S	S	NS	PS	Temperature, DO, pH, Turbidity
6B02	S	S	NS	NA	Temperature
NE07	NA	NA	S	NA	None
NE08	NA	NA	S	NA	None
NE09	PS	S	NS	S	Fecal coliform, Cu, Pb
4B01	NS	S	PS	NA	Fecal coliform, pH
1B02	S	S	NS	NA	pH
NE10	NS	PS	NS	PS	Fecal coliform, pH, Cu, Pb, Hg, Suspended Solids, Turbidity

TABLE 2.6B (cont.)

STATION SUBWATERSHED	NEPONSET RIVER AND TRIBUTARY USE ATTAINMENT				
	1° CONTACT RECREATION	2° CONTACT RECREATION	AQUATIC LIFE	AESTHETICS	IMPAIRMENT CAUSE(S)
1B01	NS	NS	NS	NS	Fecal coliform, DO, Ammonia-Nitrogen, Cu, Hg, Total phosphorus
NE11	NA	NA	S	NA	None
5B03	NA	NA	S	NA	None
5B01	NS	PS	NS	S	Fecal coliform, Cd, Cr, Pb, Hg
12B01	PS	S	PS	NA	pH
13B01	PS	S	S	NA	Fecal coliform
11B01	S	S	S	NA	None
NE12	PS	S	NS	S	Fecal coliform, Temperature, Cu, Pb, Hg
9B02	S	S	PS	NA	pH
10B01	S	S	NS	NA	DO, pH
9B01	S	S	NS	NA	Temperature
7B02	PS	S	PS	NA	Fecal coliform, DO
7B01	S	S	NS	NA	DO
8B02	S	S	S	NA	None

TABLE 2.6B (cont.)

STATION SUBWATERSHED	NEPONSET RIVER AND TRIBUTARY USE ATTAINMENT				
	1° CONTACT RECREATION	2° CONTACT RECREATION	AQUATIC LIFE	AESTHETICS	IMPAIRMENT CAUSE(S)
8B01	NS	PS	PS	NA	Fecal coliform, DO
3B01	PS	S	PS	NA	Fecal coliform, DO
NE12A	NS	S	NS	PS	Fecal coliform, DO, pH, Cu, Pb, Hg, Turbidity
18B01	S	S	PS	NA	DO
17B02	PS	S	PS	NA	Fecal coliform, DO, pH
17B01	PS	S	S	NA	Fecal coliform
NE12B	NA	NA	S	NA	None
16B02	PS	PS	NS	NA	Fecal coliform, DO
16B01	NS	PS	NS	NA	Fecal coliform, DO, pH
NE13	NA	NA	NS	NA	DO
NE14	NA	NA	PS	NA	DO
14B04	NS	PS	NS	S	Fecal coliform, DO, Cd, Cr, Cu, Pb, Hg
14B03	NS	PS	PS	NA	Fecal coliform, DO
14B02	PS	S	PS	NA	Fecal coliform, DO

TABLE 2.6B (cont.)

STATION SUBWATERSHED	NEPONSET RIVER AND TRIBUTARY USE ATTAINMENT				
	1° CONTACT RECREATION	2° CONTACT RECREATION	AQUATIC LIFE	AESTHETICS	IMPAIRMENT CAUSE(S)
14B01	PS	S	NS	NA	Fecal coliform, DO
NE16	NS	S	NS	S	Fecal coliform, DO, Cu
15B04	NS	S	S	NA	Fecal coliform
15B03	PS	S	S	NA	Fecal coliform
15B02	NS	PS	PS	NA	Fecal coliform, DO, pH
15B01	S	S	PS	NA	Fecal coliform, DO

TABLE 3.1B. 1994 NEPONSET RIVER BASIN SURVEY. Mean results of sediment oxygen demand of Neponset River Basin sediments based on analysis of five replicate samples per station in g/m^2-d and standard deviation.

STATION	LOCATION	MEAN SOD	STD. DEV.
SNE02	Neponset River, outlet of Crackrock Pond, Foxborough	1.81	1.23
SNE05	Neponset River, Bird Pond, East Walpole	1.55	0.45
SNE10	Neponset River, downstream from Pleasant Street Bridge, behind Industrial Park, Norwood	1.25	0.38
SNE11	Neponset River, Fowl Meadow ACEC, Neponset Street, MWRA Construction Yard, Canton	2.08	0.79
SNE12	East Branch Neponset River, Factory Pond, Neponset Street, Canton	2.30	1.38
SNE13	Neponset River, Fowl Meadow ACEC, Green Lodge Street, Canton/Norwood	1.98	0.29
SNE14	Neponset River, Fowl Meadow ACEC, upstream of Truman Highway, Hyde Park/Milton	1.71 (1.83)*	1.04 (0.90)*
SNE16	Neponset River, upstream of Baker Dam, Milton	2.40	0.83

* Data in parenthesis based on a four hour analysis rather than the 2.5 hour run noted above.

TABLE 3.2B. 1994 NEPONSET RIVER BASIN SURVEY. Sediment toxicity test results of unpaired t-test analysis for % survival using Saw Mill Brook, Concord as reference at (*) $P \leq 0.05$ level of statistical significance for *Hyallela azteca* and *Chironomus tentans* exposed to whole sediment from the Neponset River Basin.

STATION	ORGANISM											
	Hyallela azteca						Chironomus tentans					
	Mean Diff.	DF	t-Value	P-Value	95% Lower	95% Upper	Mean Diff.	DF	t-Value	P-Value	95% Lower	95% Upper
SNE01	98.350	5	50.376	<.0001*	93.331	103.369	<5.000	6	<.311	.7663	<44.329	34.329
SNE02	12.000	5	2.390	.0624	<.904	24.904	58.333	5	3.136	.0258*	10.510	106.157
SNE05	53.250	5	9.545	.0002*	38.910	67.590	20.000	6	1.022	.3464	<27.908	67.908
SNE10	12.000	5	2.028	.0983	<3.208	27.208	45.000	6	2.635	.0388*	3.211	86.789
SNE11	37.000	5	2.006	.1012	<10.413	84.413	25.000	6	1.000	.3559	<36.173	86.173
SNE12	68.250	5	11.599	<.0001*	53.125	83.375	20.000	6	.943	.3822	<31.907	71.907
SNE13	30.000	5	2.678	.0439*	1.199	58.801	20.000	6	.880	.4128	<35.619	75.619
SNE14	16.750	5	2.067	.0936	<4.079	37.579	<5.000	6	<.311	.7663	<44.329	34.329
SNE16	70.100	5	4.789	.0049*	32.473	107.727	15.000	6	.832	.4372	<29.112	59.112

TABLE 3.3B. 1994 NEPONSET RIVER BASIN SURVEY. Bioaccumulation factors for *Lumbriculs variegatus* exposed to Saw Mill Brook, Concord (reference station) and Neponset Reservoir and Neponset River station sediments for a 28-day period. Calculation of BAFs follow a blank correction for concentration of $metal_x$ in the culture test organisms ($tissue_{rx}$) from the tissue concentration ($tissue_{tx}$), the product of which was divided by the concentration of $metal_x$ in the sediment [or ($tissue_{tx}$)- $tissue_{rx}$]/[$sediment_x$] using wet weight concentrations (mg/kg). These ratios, or BAFs,were calculated using both the mean concentration (when available) and the highest concentration of tissue and sediment contamination at each station from which estimates of average and worst-case bioaccumulation potential can be determined.

METAL	SM	SNE01[1]	SNE01[2]	SNE02[2]	SNE05[2]	SNE13[2]	SNE14[2]
Cd	0 0	0.098 0.197	0.219 0.440	0.122 0.145	0	0	0
Cr	0 0	0.03 0.066	0.098 0.216	0 0	0 0	0 0	0
Cu	0 0	0.040 0.086	0.076 0.165	0.040 0.065	0 0	0 0.039	0.341
Zn	0 0	0 0.217	0 0.581	0 0	0 0	0 0	0

[1] Sediment data from EPA laboratory analysis (mg/kg wet weight).
[2] Sediment data from WES laboratory where wet weight concentration was calculated as follows:
dry weight x total solids content = mg/gk wet weight
[3] Bioaccumulation factors based on two methods: average and worst case and appear in that order for each metal at each station.

TABLE 3.4B. 1994 NEPONSET RIVER BASIN SURVEY. Sediment quality data (expressed as mg/kg dry weight unless otherwise noted) for sediment from the Neponset River Basin. Threshold levels (*) extracted from Persaud et. al. 1992, are also reported where the L-EL represents the concentration of a contaminant where no adverse impacts would be expected as well as the S-EL where the concentrations would cause severe detrimental impacts to the biota.

STATION	TS (%)	TP	TKN	Al	Ag	As	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn	Hg
L-EL* S-EL*	NA	600 2000	550 4800	NA	NA	6 33	0.6 10	26 110	16 110	2% 4%	460 1100	16 75	31 250	120 820	0.2 2
SNE01	10.9	3800	12100	1.32%	<3.8	3.38	725	880	1978	2.00%	355	220	356	802	1.89
SNE02	7.1	3400	19700	8535	<3.8	3.05	110	110	690	1.45%	455	110	138	552	1.93
SNE05	12	4000	9700	2.2%	<3.8	11.6	<7.6	74	168	2.70%	587	70	430	493	1.51
SNE10	74.5	400	135	2381	<3.8	1.19	<7.6	7.6	12	7880	239	15	32	60	0.146
SNE11	21.8	2000	5800	8802	<3.8	7.98	<7.6	103	138	1.95%	460	50	240	425	2.12
SNE12	17.6	1600	6100	8653	<3.8	7.17	13	287	319	2.39%	1000	48	745	649	0.942
SNE13	26.1	1300	4800	9601	<3.8	6.97	<7.6	94	117	1.50%	88	36	244	297	3.33
SNE14	51.7	490	1400	3110	<3.8	1.20	<7.6	17	17	4520	113	13	33	73	0.323
SNE16	32.7	1600	4400	9925	<3.8	8.97	<7.6	55	155	9600	268	31	310	316	2.67

NA - Not Applicable

Table 3.5B 1994 NEPONSET RIVER BASIN SURVEY. Sediment Enrichment Ratios .

Station	Al	As	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn	Hg
Crustal (mg/kg)	82,300	1.8	0.2	100	55	56,300	950	75	12.5	70	0.08
Normalized to Al (ratio)											
SNE01	1.0	11.7	22,601.3	54.9	224.2	2.2	2.3	18.3	177.6	71.4	147.3
SNE02	1.0	16.3	5,303.5	10.6	121.0	2.5	4.6	14.1	106.5	76.0	232.6
SNE05	1.0	24.1	<142.2	2.8	11.4	1.8	2.3	3.5	128.7	26.3	70.6
SNE10	1.0	22.9	<1,313.5	2.6	7.5	4.8	8.7	6.9	88.5	29.6	63.1
SNE11	1.0	41.5	<355.3	9.6	23.5	3.2	4.5	6.2	179.5	56.8	247.8
SNE12	1.0	37.9	618.2	27.3	55.2	4.0	10.0	6.1	566.9	88.2	112.0
SNE13	1.0	33.2	<325.7	8.1	18.2	2.3	0.8	4.1	167.3	36.4	356.8
SNE14	1.0	17.6	<1,005.6	4.5	8.2	2.1	3.1	4.6	69.9	27.6	106.8
SNE16	1.0	41.3	<315.1	4.6	23.4	1.4	2.3	3.4	205.6	37.4	276.8
Normalized to Iron (ratio)											
SNE01	0.5	5.3	10,204.4	24.8	101.2	1.0	1.1	8.3	80.2	32.3	66.5
SNE02	0.4	6.6	2,135.5	4.3	48.7	1.0	1.9	5.7	42.9	30.6	93.7
SNE05	0.6	13.4	<79.2	1.5	6.4	1.0	1.3	1.9	71.7	14.7	39.4
SNE10	0.2	4.7	<271.5	0.5	1.6	1.0	1.8	1.4	18.3	6.1	13.0
SNE11	0.3	12.8	<109.7	3.0	7.2	1.0	1.4	1.9	55.4	17.5	76.5
SNE12	0.2	9.4	153.1	6.8	13.7	1.0	2.5	1.5	140.4	21.8	27.7
SNE13	0.4	14.5	<142.6	3.5	8.0	1.0	0.3	1.8	73.3	15.9	156.2
SNE14	0.5	8.3	<473.3	2.1	3.8	1.0	1.5	2.2	32.9	13.0	50.3
SNE16	0.7	29.2	<222.9	3.2	16.5	1.0	1.7	2.4	145.4	26.5	195.7

TABLE 3.6B. 1994 NEPONSET RIVER BASIN SURVEY. Results of the sediment quality ranking assignments for the Neponset River Basin sediment samples. Assignment of rank is as follows: 1 = low or no degradation, 2 = moderate degradation, 3 = severe degradation, and 4 = very severe degradation.

CATEGORY	UPPER NEPONSET RIVER STATIONS				MIDDLE NEPONSET RIVER STATIONS				EAST BRANCH
	SNE01	SNE02	SNE05	SNE10	SNE11	SNE13	SNE14	SNE16	SNE12
INDIVIDUAL METALS As	1	1	2	1	2	2	1	2	2
Cd	4	4	1	1	1	1	1	1	3
Cr	4	3	2	1	2	2	1	2	4
Cu	4	4	3	1	3	3	2	3	4
Ni	4	3	2	1	2	2	1	2	2
Pb	3	2	3	2	2	2	2	3	4
Zn	2	2	2	1	2	2	1	2	2
Hg	2	2	2	1	3	3	2	3	2
TOTAL METALS	4	4	3	2	3	3	2	3	4
NUTRIENTS TP	3	3	4	1	3	2	1	2	2
TKN	4	4	4	1	3	3	2	2	3
TOXICITY TESTING	4	3	3	3	2	2	1	3	3
NORMALIZATION TO AL and FE	AL FE	AL FE	AL FE	AL FE	AL FE	AL FE	AL FE	AL FE	AL FE
As	3 2	3 2	3 3	3 2	3 3	3 3	3 2	3 3	3 2
Cd	4 4	4 4	1 1	2 1	1 1	1 1	2 2	1 1	4 4
Cr	3 3	3 2	2 2	2 1	2 2	2 2	2 2	2 2	3 2
Cu	4 4	4 3	3 2	2 2	3 2	3 2	2 2	3 3	3 3
Ni	3 2	3 2	2 2	2 2	2 2	2 2	2 2	2 2	2 2
Pb	4 3	4 3	4 3	3 3	4 3	4 3	3 3	4 4	4 4
Zn	3 3	3 3	3 3	3 2	3 3	3 3	3 3	3 3	3 3
Hg	4 3	4 3	3 3	3 3	4 3	4 4	4 3	4 4	4 3
STATION BASED ON NORMALIZATION	4	4	4	3	4	4	4	4	4
BIOACCUMULATION Cd	3	3	1	-	-	1	1	-	-
Cr	3	1	1	-	-	1	1	-	-
Cu	3	3	1	-	-	3	3	-	-
Zn	3	1	1	-	-	1	1	-	-
TOTAL BIOACCUMULATION	3	3	1			3	3		

TABLE 4.1B. 1994 NEPONSET RIVER BASIN SURVEY. Summary of Habitat Evaluations and Stream Discharge Information.

Habitat Parameter[1]	NE04	2B0B	NE09	NE10	5B01	5B0B	NE12	9B0B	14B03B
Bottom substrate	E	E	G	E	E	G	E	E	G
Available cover	G	F	F	G	G	F	G	G	F
Embeddedness	G	E	G	E	F	E	E	F	E
Velocity/depth	G	G	G	E	G	F	E	G	F
Channel alteration	E	E	E	E	F	F	E	F	E
Bottom scouring/deposition	G	F	G	E	F	G	E	F	G
Pool/Riffle Run/Bend Ratio	G	F	F	F	G	F	E	G	F
Bank stability	G	G	G	E	G	F	E	E	F
Bank vegetative stability	E	E	E	E	E	E	E	E	G
Streamside cover	G	E	G	E	G	F	G	E	G
Overall Habitat Assessment Score	102.5	90	93	114.5	82	77	116	80.5	80.5
Percentage of Reference Condition	110	97(R_c)[2] 110(R_w)[2]	100(R_w)	123	100(R_c)	94	125	87	87
Mean velocity (fps)	1.2	0.2 (0.1)[3]	0.1	0.3	0.5	0.1	0.3	0.2	0.4
Discharge (cfs)	0.9	0.2 (0.3)[3]	0.5	3.7	1.2	0.1	3.8	1.3	0.2
cfs/mi^2	0.08	0.09	0.06	0.11	0.48	0.11	0.14	0.28	0.02

[1] Ranked as follows:
E = Excellent
G = Good
F = Fair
P = Poor

[2] (R^c) 5B01 used as cold water station reference
(R_w) NE09 used as warm water station reference

[3] Stream discharge measurements taken at the inlet to Turner Pond, Walpole noted in parentheses

TABLE 4.2B. 1994 NEPONSET RIVER BASIN SURVEY. Station descriptions and habitat assessments.

NE04	This section of the Neponset River upstream from South Street in Walpole was characterized as having excellent substrates including scattered boulders with cobble, gravel and sand. The area was partially shaded by maple and birch. Shallow riffles, and runs made up the majority of the stream reach sampled, although several quiet pools were also noted. The stream width was fairly uniform at 5m, while depth in the riffles ranged between 0.05 and 0.15m up to 0.6m in the pools. Some slight watershed erosion was noted evidenced by slightly undercut banks. Stormwater runnoff from roof drains into a riprap BMP and South Street were potential sources of nonpoint source pollution. At the downstream end of the reach, and below the stormwater BMP, some deposits of sand and muck were noted. The predominant surrounding land use was comprised of commercial/industrial and forest. Iron floc and orange/yellow sediments were visible at the outlet of the pipe from the factory property.
2B0B	The habitat and cover provided in Mill Brook off of Route 109 in Medfield was considered fair. The reach sampled was comprised primarily of shallow riffles and runs. Instream cover was not good. Lots of sand deposition was noted below the shallow riffle areas, indicating the potential for nonpoint source pollution and/or local watershed erosion. The stream width varied from 2 to 5m, while depth varied from 0.03 to 0.10m in the riffle, 0.10 to 0.25m in the riffles/runs to 0.25 to 0.46m in the pool. The stream reach sampled was partially shaded by hemlock, oak and maple, as well as jewelweed, honeysuckle and grape. The water temperature, however, was surprisingly high (26°C). Storm water runnoff from Route 109 had recently been diverted from Mill Brook into a detention basin. However, other potential nonpoint sources of pollution threaten Mill Brook from the large residential communities under development in the immediate vicinity of the stream.
NE09	The substrates of Hawes Brook consisted primarily of gravel mixed with cobble and sand. Overall, the habitat was considered good, although deep/fast habitat was not present. Stream depth ranged from 0.15 in the riffles and runs to 0.61m in the pools. Stream width varied from 5 to 10m. Rooted submergent vegetation was present and provided some additional instream cover. The stream was 85% shaded by willow, alder and maple; juniper lined the top stream bank edge above the rip rap. A small dam located just upstream of the sampling reach is utilized by the town park to divert water into two small fishing ponds. The park, combined with a mixed industrial/commercial/residential area comprised the surrounding land use. Runoff from the surrounding area, as well as swimming pool backwash are potential sources of nonpoint source pollution. Sand was noted at the base of stormdrains.
NE10	Excellent substrates of cobble and boulder and good available instream cover characterize the habitat of the Neponset River near Pleasant Street Bridge in Norwood, although anthropogenic pollution (i.e., large pieces of iron and other items) were also present. The upper section of the stream reach was defined by a 0.3m ledge dam at the downstream side of an old stone bridge. The stream reach was comprised primarily of a long stretch of riffle/run type habitat which presented deep as well as shallow sections. The streambanks were stabilized with riprap (even pavement in one small section); potential sources of point and nonpoint sources of pollution were evident. Several old pipes, not observed to be flowing, were found along the steeply sloped streambanks. The water column was slightly turbid; a septic/wastewater odor also was detected. Complete shade was provided to the upper end of the stream reach sampled while the lower segment, approaching the Pleasant Street Bridge was more open to solar radiation. Willow tree roots formed a blanket over a small section of the streambed. Additional canopy cover was also provided by speckled alder, japanese bamboo and buckthorn.
5B01	The physical habitat present in Traphole Brook at Cooney Street in Walpole was considered good. The streambed consisted primarily of gravel with a few scattered boulders and cobble. Instream cover was considered good. The deposition of sand, however, was found to be embedding the stream substrates, which lowered the overall habitat assessment score. Depth ranged from 0.12 to 0.15m in the riffles, 0.30m in the runs and up to 0.16m in the pool. The stream was partly open to solar radiation. Canopy cover was provided by red maple, purple loosestrife, jewelweed, grape, and various grasses, among others. Beds of watercress were also present. Potential sources of nonpoint source pollution included road and highway runnoff, as well as local watershed erosion. The stream temperature was much cooler than any of the other tributaries sampled during the Neponset River Watershed Project (15.26°C), indicating the influence of groundwater recharge to the system.
5B0B	The substrates of the headwaters of Traphole Brook, near High Plain Street, Sharon, were considered good, while available instream cover was considered fair. The stream reach was characterized as having very shallow riffles and runs, as well as some quiet shallow pools. Stream depth ranged from 0.02 to 0.05m in the riffles, 0.02 to 0.10m in the runs and 0.45m in the pool. Stream width varied between 1 to 1.5m. Undercut banks were also present and provided additional instream cover. Surrounding vegetative cover included Jewelweed, Bur-reed, various grasses (0.30-0.91m), on one side of the stream, while a lawn made up the other side. The few willow and maple trees provided very little shading. There was evidence of some nonpoint source pollution from road runoff, noted in sand deposits at the base of the culverts as well as stream bends. The sediments in the lower section of the stream reach were observed to release a slight oil sheen when disturbed. Local watershed erosion was also noted.

TABLE 4.2B (continued)

NE12	The bottom substrates of the East Branch of the Neponset River were comprised of 85% boulder, the remaining made up of cobble and gravel. Instream cover was considered good. Stream width was fairly uniform at 5m, while depth ranged from 0.10 to 0.15m in the riffle, 0.20 to 0.46m in the run and 0.61 to 0.76m in the pool. The stream reach was 90% shaded by maple and ash, however, the stream temperature was 31°C. Various grasses and poison ivy were prevalent. The streambanks were well stabilized, although potential sources of nonpoint source pollution included road and parking lot runoff from the predominantly commercial/industrial areas surrounding the stream. One pipe was also observed discharging just downstream from Neponset Street. Other notes included the presence of an oil boom across the top of the dam at the upper end of the stream reach sampled.
9B0B	The habitat of Massapoag Brook was found to be good, although the stream reach sampled was very embedded with fine sediment. Although three of the four velocity/depth habitats were present, channel alteration due to deposition was evident by the presence of sand bars, as well as the noticable filling of pools. Quicksand was present in the upstream end of the run. The substrates consisted of a mix of 60% cobble and gravel, while the remainder was comprised of sand. A silt fence was also present which appeared to be blocking block wet/clay type soils from entering the stream. Slight sediment oils appeared as flecks in the kick area, while brown floc covering the streambed also caused turbidity when disturbed. Stream width varied from 3.20 to 6.10m with backwaters present. Stream depth was 0.05 to 0.15m in the riffles, 0.15 to 0.30m in the runs and 0.30 to 0.61m in the pools.
14B03B	The substrate components of Pine Tree Brook in Milton consisted of a mix of cobble and gravel with a few scattered boulders provided a good habitat, although the stream was channelized. Broken glass was also prevalent. The canopy consisted of shagbark hickory, American beech and oak which provided shade to approximately 90% of the stream. The stream width varied from 1 to 5m, while depth ranged between 0.03 to 0.05m in the riffles, up to 0.51m in the pool. The stream bank was fairly well stabilized with either vegetation or rip rap. Road runoff from the predominantly residential surrounding land use is a potential source of nonpoint source pollution.

TABLE 4.3B. 1994 NEPONSET RIVER BASIN SURVEY. List of predominant aquatic and riparian vegetation at biological monitoring stations located in the Neponset River Basin.

NEPONSET RIVER - NE04

TAXA	HABITAT	OCCURANCE
Sparganium americanum Eastern Bur-reed	instream, shoreline	common
Potamogeton sp. "Pondweed"	instream	uncommon
Elodea canadensis Canadian Waterweed	instream	common
Glyceria canadensis Manna grass	shoreline	common
Phragmites australis Common Reed	floodplain	common
Phalaris arundinacea Reed Canary Grass	floodplain	uncommon
Eleocharis sp. "Spike rush"	shoreline	uncommon
Scirpus sp. "Bulrush"	floodplain	uncommon
Peltandra virginica Arrow Arum	shoreline	uncommon
Pontederia cordata Heart-Shaped Pickerelweed	shoreline	uncommon
Juncus effusus Soft Rush	floodplain	uncommon
Salix sp. "Willow"	floodplain	uncommon
Quercus alba White Oak	floodplain	uncommon
Rumex obtusifolius Bitter Dock	floodplain	uncommon
Ceratophyllum demersum Coontail	instream	uncommon
Thalictrum polygamum Tall Meadow Rue	floodplain	uncommon
Berberis sp. "Barberry"	floodplain	uncommon
Nasturtium officinale Water Cress	instream, shoreline	common
Rorippa islandica Marsh Yellow Cress	floodplain	uncommon
Toxicodendron radicans Poison Ivy	floodplain	common
Acer saccharum Sugar Maple	floodplain	uncommon
A. rubrum Red Maple	floodplain	common
Impatiens capensis Jewelweed	shoreline, floodplain	common
Parthenocissus quinquefolia Virginia Creeper	floodplain	uncommon
Vitis labrusca Fox Grape	floodplain	common
Hypericum spp. "St. John's Wort"	floodplain	uncommon
Lythrum salicaria Purple Loosestrife	floodplain	common
Ludwiga palustris Water Purslane	shoreline	uncommon
Clethra alnifolia Sweet Pepperbush	floodplain	uncommon
Lysimachia terrestris Yellow Loosestrife	floodplain	uncommon
Verbena hastata Blue Vervain	floodplain	uncommon
Myosotis Scorpioides True Forget-me-not	shoreline	common
Solanum dulcamara Bittersweet Nightshade	floodplain	uncommon
Galium palustre Northern Bedstraw	shoreline, floodplain	uncommon
Lonicera sp. "Honeysuckle"	floodplain	uncommon
Viburnum recognitum Northern Arrowwood	floodplain	uncommon
Eupatorium perfoliatum Boneset	floodplain	uncommon
Aster divaricatus White Wood Aster	floodplain	uncommon
Bidens sp. "Bur Marigold"	floodplain	uncommon

TABLE 4.3B (cont.)

MILL BROOK - 2B0B

TAXA	HABITAT	OCCURANCE
Polypodiaceae "various ferns"	floodplain	common
Tsuga canadensis Hemlock	floodplain	common
Gramineae "various grasses"	floodplain	common
Symplocarpus foetidus Skunk Cabbage	floodplain	uncommon
Polygonatum biflorum Solomon's Seal	floodplain	uncommon
Quercus sp. "Oak"	floodplain	common
Nasturtium officinale Water Cress	instream	common
Toxicodendron radicans Posion Ivy	floodplain	abundant
Acer sp. "Maple"	floodplain	common
Impatiens capensis Jewelweed	floodplain	common
Vitis sp. "Grape"	floodplain	uncommon
Vaccinium sp. "Blueberry"	floodplain	uncommon
Lonicera sp. "Honeysuckle"	floodplain	common

TABLE 4.3B (cont.)

HAWES BROOK - NE09

TAXA	HABITAT	OCCURANCE
Juniperus sp. "Juniper"	floodplain	common
Gramineae "various grasses"	floodplain	common
Salix sp. "Willow"	floodplain	common
Alnus sp. "Alder"	floodplain	common
Nasturtium officinale Water Cress	instream	common
Acer sp. "Maple"	floodplain	common
Lythrum salicaria Purple Loosestrife	floodplain	uncommon
Dacus carota Queen Anne's Lace	floodplain	uncommon
Asclepias sp. "Milkweed"	floodplain	uncommon
Catalpa sp. "Catalpa"	floodplain	uncommon
Tanacetum sp. "Tansy"	floodplain	uncommon

TABLE 4.3B (cont.)

NEPONSET RIVER - NE10

TAXA	HABITAT	OCCURANCE
Potamogeton sp. "Pondweed"	instream	uncommon
Phalaris arundinacea Reed Canary Grass	floodplain	uncommon
Peltandra virginica Arrow Arrum	shoreline	uncommon
Smilax rotundifolia Common Greenbrier	floodplain	uncommon
Salix sp. "Willow"	floodplain	uncommon
Ostrya virginiana Hop Hornbeam	floodplain	uncommon
Alnus rugosa Speckled Alder	shoreline	common
Polygonum cuspidatum Japanese Knotweed	floodplain	common
Nasturtium officinale Water Cress	instream, shoreline	uncommon
Cardamine pennsylvanica Pennsylvania Bitter Cress	shoreline	uncommon
Prunus sp. "Cherry"	floodplain	uncommon
Toxicodendron radicans Poison Ivy	floodplain	common
Impatiens capensis Jewelweed	shoreline, floodplain	uncommon
Vitis labrusca Fox Grape	floodplain	uncommon
Hypericum sp. "St. John's Wort"	floodplain	uncoomon
Decodon verticillatus Water Willow	shoreline	uncommon
Lythrum Salicaria Purple Loosestrife	shoreline, floodplain	uncommon
Myriophyllum sp. "Water Milfoil"	instream, shoreline	uncommon
Cornus sp. "Dogwood"	floodplain	common

TABLE 4.3B (cont.)

TRAPHOLE BROOK - 5B01

TAXA	HABITAT	OCCURANCE
Osmunda regalis Royal Fern	floodplain	uncommon
Sparganium americanum Eastern Bur-reed	instream, shoreline	common
Gramineae "various grasses"	shoreline, floodplain	abundant
Symplocarpus foetidus Skunk Cabbage	floodplain	uncommon
Rumex obtusifolius Bitter Dock	shoreline, floodplain	uncommon
Ranunculus Septentrionalis Swamp Buttercup	shoreline	uncommon
Nasturtium officinale Water Cress	instream, shoreline	common
Toxicodendron radicans Poison Ivy	floodplain	common
Celastrus sp. "Bittersweet"	floodplain	uncommon
Acer rubrum Red Maple	floodplain	abundant
Impatiens capensis Jewelweed	shoreline, floodplain	common
Rhamnus alnifolia Alder-leaved Buckthorn	floodplain	uncommon
Vitis labrusca Fox Grape	floodplain	common
Lythrum salicaria Purple Loosestrife	shoreline, floodplain	common
Clethra alnifolia Sweet Pepperbush	shoreline, floodplain	uncommon
Vaccinium corymbosum Highbush Blueberry	floodplain	uncommon
Myosotis scorpioides True Forget-me-not	shoreline	uncommon
Solanum dulcamara Bittersweet Nightshade	floodplain	uncommon
Lonicera sp. "Honeysuckle"	floodplain	uncommon

TABLE 4.3B (cont.)

TRAPHOLE BROOK - 5BOB

TAXA	HABITAT	OCCURANCE
Equisetum fluviatile Horsetail	floodplain	uncommon
Onoclea sensibilis Sensitive Fern	floodplain	uncommon
Typha latifolia Common Cattail	floodplain	uncommon
Sparganium americanum Eastern Bur-reed	instream, shoreline	common
Sagittaria latifolia Big-leaved Arrowhead	shoreline	uncommon
Glyceria canadensis Manna Grass	shoreline	uncommon
Dichanthelium clandestinum Deer-Tongue Grass	floodplain	uncommon
Gramineae "various grasses"	*shoreline, floodplain*	*common*
Carex stricta Tussock Sedge	shoreline	uncommon
Carex tribuloides Bristlebract Sedge	floodplain	uncommon
Symplocarpus foetidus Skunk Cabbage	floodplain	uncommon
Juncus effusus Soft Rush	floodplain	uncommon
Smilax rotundifolia Common Greenbrier	floodplain	common
Salix nigra Black Willow	floodplain	uncommon
Salix sp. "Willow"	floodplain	uncommon
Alnus rugosa Speckled Alder	shoreline, floodplain	common
Urtica dioica Stinging Nettle	floodplain	uncommon
Polygonum punctatum Water Smartweed	floodplain	uncommon
Thalictrum polygamum Tall Meadow Rue	floodplain	uncommon
Nasturtium officinale Water Cress	instream, shoreline	common
Rubus allegheniensis Common Blackberry	floodplain	uncommon
Rosa multiflora Multiflora Rose	floodplain	uncommon
Acer saccharum Sugar Maple	floodplain	uncommon
Acer rubrum Red Maple	floodplain	uncommon
Impatiens capensis Jewelweed	shoreline, floodplain	common
Rhamnus alnifolia Alder-leaved Buckthorn	floodplain	uncommon
Vitis labrusca Fox Grape	floodplain	common
Hypericum mutilum Dwarf St. John's Wort	floodplain	uncommon
Prunella vulgaris Selfheal	floodplain	uncommon
Mentha piperita Peppermint	floodplain	uncommon
Chelone glabra Turtlehead	floodplain	uncommon
Solanum dulcamara Bittersweet Nightshade	floodplain	uncommon
Viburnum recognitum Northern Arrowwood	floodplain	uncommon
Sambucus canadensis Common Elder	floodplain	uncommon
Lobelia cardinalis Cardinal Flower	floodplain	uncommon
Eupatorium perfoliatum Boneset	floodplain	uncommon
Aster sp. "Aster"	floodplain	uncommon

TABLE 4.3B (cont.)

EAST BRANCH NEPONSET RIVER - NE12

TAXA	HABITAT	OCCURANCE
Dryopteris sp. "Wood Fern"	floodplain	uncommon
Symlocarpus foetidus Skunk Cabbage	shoreline, floodplain	uncommon
Betula populifolia White Birch	floodplain	common
Rosa Multiflora Multiflora Rose	floodplain	uncommon
Thalictrum polygamum Tall Meadow Rue	shoreline, floodplain	uncommon
Toxicodendron radicans Poison Ivy	shoreline, floodplain	common
Acer saccharum Sugar Maple	floodplain	common
Impatiens capensis Jewelweed	shoreline, floodplain	uncommon
Vitis labrusca Fox Grape	floodplain	common
Parthenocissus quinquefolia Virginia Creeper	floodplain	uncommon
Clethra alnifolia Sweet Pepperbush	floodplain	uncommon
Fraxinus americana White Ash	floodplain	common
Viburnum recognitum Northern Arrowwood	floodplain	uncommon
Aster divaricatus White Wood Aster	floodplain	uncommon

TABLE 4.3B (cont.)

MASSAPOAG BROOK - 9B0B

TAXA	HABITAT	OCCURANCE
Equisetum fluviatile Horsetail	floodplain	uncommon
Osmunda regalis Royal Fern	floodplain	uncommon
Onoclea sensibilis Sensitive Fern	floodplain	uncommon
Elodea canadensis Canadian Waterweed	instream	uncommon
Carex sp. "Sedge"	shoreline	uncommon
Symplocarpus foetidas Skunk Cabbage	floodplain	uncommon
Pontederia cordata Heart-Shaped Pickerelweed	shoreline	uncommon
Smilax rotundifolia Common Greenbrier	floodplain	common
Ostrya virginiana Hop Hornbeam	floodplain	uncommon
Betula lutea Yellow Birch	floodplain	uncommon
B. populifolia White Birch	floodplain	uncommon
Quercus alba White Oak	floodplain	uncommon
Quercus rubra Red Oak	floodplain	uncommon
Rumex obtusifolius Bitter Dock	shoreline	common
Polygonum sp. "Smartweed"	shoreline, floodplain	common
Thalictrum polygamum Tall Meadow Rue	floodplain	uncommon
Nasturtium officinale Water Cress	instream, shoreline	uncommon
Rubus allegheniensis Common Blackberry	floodplain	uncommon
Toxicodendron radicans Poison Ivy	floodplain	common
Acer saccharum Sugar Maple	floodplain	uncommon
A. rubrum Red Maple	floodplain	common
Impatiens capensis Jewelweed	shoreline, floodplain	common
Rhamnus alnifolia Alder-leaved Buckthorn	floodplain	common
Vitis labrusca Fox Grape	floodplain	common
Viola sp. "Violet"	floodplain	uncommon
Lythrum alatum Winged Loosestrife	floodplain	uncommon
L. salicaria Purple Loosestrife	shoreline, floodplain	uncommon
Aralia nudicaulis Wild Sarsaparilla	floodplain	uncommon
Clethra alnifolia Sweet Pepperbush	floodplain	uncommon
Chimaphila maculata Striped Wintergreen	floodplain	uncommon
Myosotis scorpioides True Forget-me-not	shoreline	uncommon
Chelone glabra Turtlehead	floodplain	uncommon
Viburnum sassinoides Witherod	floodplain	uncommon
V. recognitum Northern Arrowwood	floodplain	uncommon
Sambucus canadensis Common Elder	floodplain	uncommon
Aster divaricatus White Wood Aster	floodplain	uncommon

TABLE 4.3B (cont.)

PINE TREE BROOK - 14B03B

TAXA	HABITAT	OCCURANCE
Gramineae "various grasses"	floodplain	common
Carya Ovata Shagbark Hickory	floodplain	common
Fagus grandifolia American Beech	floodplain	common
Quercus sp. "Oak"	floodplain	common
Rosa multiflora Multiflora Rose	floodplain	common

TABLE 4.4B. 1994 NEPONSET RIVER BASIN SURVEY. Site description and relative abundance (VA = Very Abundant, C = Common, and R = Rare) of non-diatom algae in the Neponset River Watershed.

STATION	LOCATION	DATE	SITE DESCRIPTION	NON-DIATOM ALGAE GENERA/ABUNDANCE
NE04	Neponset River South Street, Walpole	7/21/94	-canopy coverage: approximately 50% open -some filamentous algae present but not prevalent -substrate: scattered boulders, gravel and sand clumps -some moss present	*Mougeotia*/VA
2B0B	Mill Brook Route 109, Medfield	7/20/94	-canopy coverage: approximately 30% open -substrate: sediment, rocks, submerged log -comments: sewage fungus	*Scenedesmus*/R *Closteriopsis*/R
NE09	Hawes Brook Washington St., Norwood	7/20/94	-canopy coverage: approximately 70% open -located below input from reservoir -all rocks slippery and covered with loose floc, perhaps diatoms -substrate: rocks and vegetation	*Spirulina*/R *Hormidium*/R *Staurastrum*/R *Closterium*/R *Scenedesmus*/R *Pediastrum*/R
NE10	Neponset River Pleasant St., Norwood	7/21/94	-canopy coverage: approximately 20% open -water hue: grey -odors: sewage and chlorine -substrate: rocks and boulders -very slippery sediment/rocks -comments: some sewage fungus (*Spharerotilus*)	*Sparerotilus* *Haematococcus/R*
5B01	Traphole Brook Cooney Road, Walpole	7/18/94	-canopy coverage: approximately 100% open -substrate: rocks, sand and *Sparganium* -long streamers of algae -comments: a little *Sphaerotilus* on edge of bridge	*Mougeotia*/VA *Hormidium*/C *Closterium*/VR
5B0B	Traphole Brook High Plain St., Sharon	7/18/94	-canopy coverage: approximately 20-30% open -substrate: cobbles -comments: *Sphaerotilus* present	*Sphaerotilus*/C unidentified green filament/R

TABLE 4.4B. (cont.)

STATION	LOCATION	DATE	SITE DESCRIPTION	NON-DIATOM ALGAE GENERA/ABUNDANCE
NE12	East Branch Neponset River, Neponset Street, Canton	7/21/94	-canopy coverage: approximately 20% open -substrate: small rocks,cobbles and boulders -comments: slime covered rocks	unidentified green/R flagellate/VR *Lyngbya*/R organic floc
9B0B	Massapoag Brook Deb Sampson St., Sharon	7/18/94	-substrate:sediment and small stones -sampled at end of pipe draining the adjacent parking lot	*Oscillatoria*/R *Lyngbya*/R *Euastrum*/R *Closterium*/R *Staurastrum*/R
14B03B	Pine Tree Brook School/ Ruggles' St., Milton	7/20/94	-canopy coverage: approximately 100% open -substrate: small stones, gravel, moss and sediments	unidentified green filament/VR

TABLE 4.5B. 1994 NEPONSET RIVER BASIN SURVEY. Diatom Community Assemblage (%) at select stations in the Neponset River Watershed.

TAXA	NE04	NE09	NE10	5B01	NE12
Bacillariophyta Centrobacillariophyceae Eupodiscales Coscinodiscaceae *Melosira*	3	14	24	13	17
Stephanod' cus	-	-	-	1	-
Cyclotella	14	13	2	9	2
Pennatibacillariophyceae Fragilariales Fragilariaceae *Tabellaria*	9	7	6	2	7
Meridion	3	-	1	3	-
Diatoma	-	3	-	1	1
Fragilaria	3	3	16	4	25
Synedra	7	9	6	6	1
Eunotiales Eunotiaceae *Eunotia*	5	3	-	-	7
Achnanthales Achnanthaceae *Cocconeis*	15	18	7	1	5
Naviculales Naviculaceae *Mastogloia*	-	1			
Frustulia			1	1	
Stauroneis	-	-	-	-	2
Capartogramma crucicula	-	-	-	-	2
Navicula	23	13	14	35	13
Pinnularia	2	3	8	5	5
Cymbellaceae *Cymbella*	9	6	8	4	7
Amphora	4	-	-	-	-
Gomphonemaceae *Gomphonema*	2	3	2	1	-
Bacillariales Bacillariaceae *Nitzschia*	-	-	4	10	2
Sururellales Surirellaceae *Surirella*	1	4	1	4	4
Total	100	100	100	100	100

TABLE 4.6B. 1994 NEPONSET RIVER BASIN SURVEY. Macroinvertebrate Sampling Data, 18-21 July 1994.

TAXA	FFG[1]	FBI[2]	STATIONS									
			NE04	2B0B	NE09	NE10	NE10B	5B01	5B0B	NE12	9B0B	14B03B
Annelida												
Oligochaeta (aquatic earthworms)	CG	8										
Lumbriculida												
Lumbriculidae	CG	8	7	5	4		5	8	33	8	3	5
Haplotaxida												
Naidiae	CG	8			1		3					
Tubificidae	CG	10			2							
Lumbricina	CG	8	1		6	1	1					
Hirudinea (leeches)												
Rhynchobdellida												
Glossophoniidae	PR	7	2									
Pharyngobdellida												
Erpobdellidae	PR	8	3		4							
Arthropoda												
Crustacea												
Isopoda (sow bugs)												
Asellidae	CG	8		4								
Amphipoda												
Hyalellidae	CG	8		1								
Gammaridae	CG	4					3					
Arachnida												
Acari Hydracarina (water mites)	PR	6	8		11			4				2
Insecta												
Ephemeroptera (mayflies)												
Baetidae	CG	4	2				11	5	3			
Heptageniidae	SC	4		4			5		21	1	4	2
Ephemerellidae	CG	1						2				

TABLE 4.6B. (cont.)

TAXA	FFG[1]	FBI[2]	STATIONS									
			NE04	2B0B	NE09	NE10	NE10B	5B01	5B0B	NE12	9B0B	14B03B
Odonata (dragonflies and damselflies) Anisoptera (dragonflies) Cordulegastridae	PR	3						1				
Gomphidae	PR	1		1								
Aeschinidae	PR	3	2		1							
Zygoptera (damselflies) Calopterygidae	PR	5			3							
Plecoptera (stone flies) Peltoperlidae	SH	0						4				
Leuctridae	SH	0						33	1			
Perlodidae	PR	2						1				
Megaloptera (dobsonflies and alderflies) Sialidae (alderflies)	PR	4			1							
Corydalidae (dobsonflies)	PR	0	1	5					5		4	
Trichoptera (caddisflies) Philopotamidae	CF	3	21	33	1			3			70	
Hydropsychidae	CF	4	54	38	47	113	66	27	26	91	22	95
Rhyacophilidae	PR	0						2				
Glossosomatidae	SC	0			1							
Limnephilidae	SH	4						1				
Odontoceridae	SC	0		3								
Leptoceridae	CG	4	5		4							

TABLE 4.6B. (cont.)

TAXA	FFG[1]	FBI[2]	STATIONS									
			NE04	2B0B	NE09	NE10	NE10B	5B01	5B0B	NE12	9B0B	14B03B
Coleoptera (beetles)												
Gyrinidae (whirligigs)	PR	4	2									
Elmidae (riffle beetles)	CG	4	9	11	1	1	1	4	2			4
Diptera (true flies)												
Tipulidae (crane flies)	CG	3		2	2		1	2	3			
Ceratopogonidae (biting midges)	PR	6						1				
Simuliidae (black flies)	CF	6		1				1	1		1	
Chironomidae (midges)	CG	6	9	26	16	1	1	4	15	1	4	2
Tanypodinae	PR	6	0	5	0		0	1	5			
Empididae	PR	6						51	1			
Mollusca												
Gastropoda (snails)												
Basomatophora												
Lymnaeidae	CG	6	1									
Physidae	CG	8	1							2		
Planorbidae	SC	8			1							
TOTAL			128	139	106	116	97	155	116	103	108	110

[1] Functional Feeding Groups (FFG) defined as follows:

CG = Collector-Gatherer
PR = Predator
SC = Scraper
SH = Shredder
CF = Collector-Filterer

[2] Family Biotic Index (FBI) tolerance values

TABLE 4.7B. 1994 NEPONSET RIVER BASIN SURVEY. RBP II data summary sheet.

Parameter	NE04	2B0B	NE09	NE10	NE10B	5B01	5B0B	NE12	9B0B	14B03B
Taxa richness	16	13	17	4	10	18	11	5	7	6
FBI (modified)	4.49	4.24	5.22	4.05	4.38	3.91	5.28	4.41	3.41	4.25
Functional Feeding Groups Riffle Community Scrapers/Filt. Collect.	0	0.10	0.04	0	0.08	0	0.78	0.01	0.04	0.02
EPT/Chironomidae	9.11	2.52	3.31	113	82.0	13.0	2.04	92.0	24.0	48.5
% Contribution (dom. family)	42	27	44	97	68	33	28	88	65	86
EPT Index	4	4	4	1	3	9	4	2	3	3
Community Similarity Index (% Sim.)*	69	49 32	(R_w)	47	53	(R_c)	35	49	28	53

* % sim = Σ min(a,b) where a = % of taxon in sample A and b = % of taxon in sample B.
where NE09 (R_w) warm water reference for NE04, 2B0B, NE10, NE10B, NE12, 9B0B, 14B03B
where 5B01 (R_c) cold water reference for 5B0B, 2B0B

TABLE 4.8B. 1994 NEPONSET RIVER BASIN SURVEY. RBP II Scoring Sheet.

Parameter	NE04	2B0B[1]		NE09	NE10	NE10B	5B01	5B0B	NE12	9B0B	14B03B
Taxa richness	6	3	3	6	0	3	6	3	0	3	0
FBI (modified)	6	6	6	6	6	6	6	3	6	6	6
Functional Feeding Groups Riffle Community Scrapers/Filt. Collect.	0	6	0	6	0	6	6	0	3	6	3
EPT/Chironomidae	6	6	0	6	6	6	6	0	6	6	6
% Contribution (dom. family)	3	6	6	3	0	0	3	6	0	0	0
EPT Index	6	6	0	6	0	3	6	0	0	3	3
Community Similarity Index (% Sim.)	3	3	3	--	3	3	--	3	3	0	3
Total Score	30	36	18	39	15	27	39	15	18	24	21
% Comparability to Reference Station	77	92	46	--	38	69	--	38	46	62	54
OVERALL ASSESSMENT	NI[2]	NI	MI	(R_w)	MI	MI	(R_c)	MI	MI	MI	MI

[1] First column utilizes station NE09 (R_w) as reference, second column utilizes station 5B01 (R_c) as reference.
NI Non Impaired
MI Moderately Impaired
[2] borderline Non Impaired/Moderately Impaired

TABLE 4.9B. 1994 NEPONSET RIVER BASIN SURVEY. Fish population and density data.

Station	Species Code[1]															
	AE	BT	EBT	B	GS	CC	RFP	C	SS	FF	WS	YB	BB	P	LMB	YP
NE04	2		1	14(1)[2]			1				8					
2B0B					5		33							1		
NE09	10			4(1)	1		1			16(?)[3]	19(?)	2	1	10(2)	3(2)	2
NE10	9			2					61(?)	19(?)	1				4	11
5B01		9(4)	10(20)								1					
5B0B		2						2								
NE12	7			4						7				1		20
9B0B	1			13(5)		1					3(2)			4(3)	3(1)	
14B03B	31	1					3				28(?)		1(1)			

[1] Species Code	Common Name	Scientific Name
AE	American eel	*Anguilla rostrata*
BT	brown trout	*Salmo trutta*
EBT	brook trout	*Salvelinus fontinalis*
GS	golden shiner	*Notemigonus crysoleucas*
SS	spottail shiner	*Notropis hudsonius*
C	Common Carp	*Cyprinus carpio*
CC	Creek chubsucker	*Erimyzon oblongus*
RFP	Redfin Pickerel	*Esox americanus americanus*
FF	fallfish	*Semotilus corporalis*
WS	white sucker	*Catostomus commersoni*
YB	yellow bullhead	*Ameiurus natalis*
BB	brown bullhead	*Ameiurus nebulosus*
P	pumpkinseed	*Lepomis gibbosus*
B	bluegill	*Lepomis macrochirus*
LMB	largemouth bass	*Micropterus salmoides*
YP	yellow perch	*Perca flavescens*

[2] (number of young-of-the-year counted).

[3] (?) large numbers of young-of-the-year fish observed but not counted.

TABLE 4.10B. 1994 NEPONSET RIVER BASIN SURVEY. Fish toxics monitoring data (mg/kg wet wt.) for largemouth bass (LMB) - *Micropterus salmoides*, common carp (C) - *Cyprinus carpio*, brown bullhead (BB) - *Ameiurus nebulosus*, and black crappie (BC) - *Pomoxis nigromaculatus*, in Willet Pond and the mainstem Neponset River in the headwaters of Fowl Meadow.

Station	Sample # and code	Species code	Collection date	Length (cm)	Weight (g)	% Lipids	Hg	As	Pb	Se	Cd	PCB ($\mu g/g$) A1254	Pesticides ($\mu g/g$)
Willet Pond	94-3065	LMB	7/26/94			0.24	0.58	<0.040	<1.0	0.09	<0.20	ND	ND
	WPF94-1			38.0	720								
	WPF94-2			36.4	680								
	WPF94-3			41.0	940								
	WPF94-4			37.1	850								
	WPF94-5			35.9	630								
Willet Pond	94-3967	BB	8/19/94			0.53	0.11	<0.040	<1.0	0.191	<0.20	ND	ND
	WPF94-11			36.0	560								
	WPF94-12			34.0	380								
Neponset River	94-3539	LMB	7/27/94			0.18	0.372	<0.040	<1.0	<0.040	<0.20	0.17	ND
	NRF94-1			31.0	530								
	NRF94-2			34.1	670								
Neponset River	94-3537	BC	7/27/94			0.06	0.425	<0.040	<1.0	0.12	<0.20	ND	ND
	NRF94-11[1]		8/12/94	20.4	120								
	NRF94-12[1]			19.8	110								
	NRF94-13[1]			18.3	110								
	NRF94-14			22.5	120								
	NRF94-15			18.5	80								
Neponset River	94-3538	C	8/12/94			0.30	0.175	<0.040	<1.0	0.16	<0.20	ND	ND
	NRF94-16			61.0	2920								
	NRF94-17			60.9	2800								
	NRF94-18			53.2	2100								
	NRF94-19			55.1	2350								
	NRF94-20			52.5	2170								
Neponset River	94-3540	BB	8/12/94			0.56	0.092	<0.040	<1.0	<0.040	<0.20	1.4	ND
	NRF94-21			23.5	160								
	NRF94-22			22.9	120								
	NRF94-23			22.8	140								
	NRF94-24			24.0	170								
	NRF94-25			22.5	120								

[1] collected on 7-27-94

TABLE 4.11B. 1994 NEPONSET RIVER BASIN SURVEY. Summary of records from Massachusetts Department of Fisheries and Wildlife and Environmental Law Enforcement records of electroshocking/monitoring at select locations on Mine Brook subwatershed between 1979 and 1987.

STATION (length/width stream sampled (ft.))	DATE	SPECIES (total # collected)	TOTAL WEIGHT (lbs.)	LENGTH RANGE (inches)	WATER TEMP. °C	pH
Mine Brook [1] below Elm St., Walpole (330/13)	7-19-79	CP (6)	0.6	1.75-10.6	21	6.5
		AE (1)	1.8	28		
		RP (22)	2.6	2.2-7.1		
		EBT (2)	0.6	7.5-9.5		
		BB (1)	0.2	6.0		
		P (8)	0.5	3.1-4.6		
		CC (57)	0.5	0.6-2.5		
Mine Brook [2] below Elm St., Medfield (300/13)	8-13-81	P (4)	0.13	3.6-4.1	21	6.3
		BS (1)	--	2.8		
		RP (44)	1.28	3.2-8.9		
		BT (8)	3.03	8.5-10.1		
Tubwreck Brook Hartford St., Dover (--)	7-31-87	EBT	--	3-7	20	7.38
		CP	--	--		
		GS	--	--		
		LMB	--	--		

[1] This is the only area which is not swamp on the stream. Sample represents only 15% of stream.

[2] No eels seen. Stocked brown trout holding well.

-- no data

Species Code	Common Name	Scientific Name
AE	American eel	*Anguilla rostrata*
BT	brown trout	*Salmo trutta*
EBT	brook trout	*Salvelinus fontinalis*
CP	chain pickerel	*Esox niger*
GS	golden shiner	*Notemigonus crysoleucas*
RP	redfin pickerel	*Esox americanus americanus*
BS	banded sunfish	*Enneacanthus obesus*
CC	Creek chubsucker	*Erimyzon oblongus*
BB	brown bullhead	*Ameiurus nebulosus*
P	pumpkinseed	*Lepomis gibbosus*
LMB	largemouth bass	*Micropterus salmoides*

TABLE 9.1. 1994 NEPONSET RIVER BASIN SURVEY. 1991 Mine Brook Subbasin sources (all units mgd).

1991	DOVER WALPOLE ST.	MEDFIELD ELM ST. #3	MEDFIELD ELM ST. #4	WALPOLE MINE BR. #3	WALPOLE* MINE BR. #5	MINE BR. TOTAL
JANUARY (31)	0.06	0.55	0.003	0.22	0.15	0.98
FEBRUARY (28)	0.06	0.39	0.04	0.14	0.25	0.88
MARCH (31)	0.06	0.45	0.03	0.08	0.24	0.86
APRIL (30)	0.05	0.32	0.09	0.27	0.24	0.97
MAY (31)	0.05	0.58	0.10	0.49	0.36	1.58
JUNE (30)	0.05	0.62	0.14	0.53	0.39	1.73
JULY (31)	0.10	0.47	0.32	0.59	0.36	1.84
AUGUST (31)	0.10	0.52	0.12	0.36	0.29	1.39
SEPTEMBER (30)	0.10	0.59	0.11	0.54	0.26	1.60
OCTOBER (31)	0.08	0.65	0.00	0.39	0.30	1.42
NOVEMBER (30)	0.08	0.68	0.00	0.38	0.30	1.44
DECEMBER (31)	0.08	0.82	0.00	0.33	0.29	1.52
TOTAL	0.07	0.55	0.08	0.36	0.29	1.35

* Walpole Mine Brook Well #5 is located on sub-basin divide

TABLE 9.2. 1994 NEPONSET RIVER BASIN SURVEY. 1992 Mine Brook Subbasin sources (all units in mgd).

1992	DOVERWALP OLE ST.	MEDFIELD ELM ST. #3	MEDFIELD ELM ST. #4	WALPOLE MINE BR. #3	WALPOLE* MINE BR. #5	MINE BR. TOTAL
JANUARY (31)	0.06	0.18	0.00	0.56	0.42	1.22
FEBRUARY (27)	0.06	0.91	0.00	0.31	0.27	1.55
MARCH (31)	0.06	0.84	0.00	0.07	0.12	1.09
APRIL (30)	0.06	0.80	0.00	0.00	0.13	0.99
MAY (31)	0.06	0.90	0.04	0.04	0.11	1.15
JUNE (30)	0.06	0.91	0.12	0.63	0.39	2.11
JULY (31)	0.09	0.69	0.13	0.64	0.38	1.93
AUGUST (31)	0.09	0.44	0.13	0.58	0.39	1.63
SEPTEMBER (30)	0.09	0.37	0.13	0.52	0.40	1.51
OCTOBER (31)	0.08	0.53	0.12	0.55	0.40	1.68
NOVEMBER (30)	0.08	0.52	0.13	0.52	0.39	1.64
DECEMBER (31)	0.08	0.42	0.12	0.53	0.35	1.50
TOTAL	0.07	0.62	0.08	0.41	0.31	1.49

* Walpole Mine Brook Well #5 is located on sub-basin divide

TABLE 9.3. 1994 NEPONSET RIVER BASIN REPORT. 1993 Mine Brook Subbasin sources (all units in mgd).

1993	DOVER WALPOLE ST.	MEDFIELD ELM ST. #3	MEDFIELD ELM ST. #4	WALPOLE MINE BR. #3	WALPOLE* MINE BR. #5	MINE BR. TOTAL
JANUARY (31)	0.06	0.55	0.13	0.53	0.34	1.61
FEBRUARY (28)	0.06	0.59	0.13	0.41	0.30	1.49
MARCH (31)	0.06	0.60	0.13	0.39	0.29	1.47
APRIL (30)	0.06	0.58	0.12	0.10	0.08	0.94
MAY (31)	0.06	0.04	0.76	0.39	0.31	1.56
JUNE (30)	0.06	0.87	0.02	0.39	0.39	1.73
JULY (31)	0.12	0.61	0.25	0.29	0.24	1.51
AUGUST (31)	0.12	0.51	0.19	0.33	0.15	1.30
SEPTEMBER (30)	0.12	0.32	0.27	0.35	0.28	1.34
OCTOBER (31)	0.10	0.47	0.18	0.31	0.20	1.26
NOVEMBER (30)	0.10	0.33	0.26	0.33	0.28	1.30
DECEMBER (31)	0.10	0.41	0.03	0.28	0.28	1.10
TOTAL	0.09	0.49	0.20	0.34	0.25	1.37

* Walpole Mine Brook Well #5 is located on sub-basin divide

TABLE 9.4. 1994 NEPONSET RIVER BASIN SURVEY. Public Water Supply Sources. Neponset River Basin - Mine Brook Subbasin. (all units million gallons per day (mgd) unless otherwise noted)

WATER SUPPLY AGENCY	NAME OF SOURCE	BASIN LOCATION (SUBBASIN MAP #)	PUMPING CAPACITY	PLANNING YIELD	1991 ADD[1]	1991 % ADD	1991 S-ADD[2]	1991 % S-ADD	1992 ADD	1992 % ADD	1992 S-ADD	1992 % S-ADD	1993 ADD	1993 % ADD	1993 S-ADD	1993 % S-ADD
DOVER	WALPOLE ST. WELL	NEPONSET (1104850)	0.08		0.07	86	0.10	88	0.07	88	0.09	87	0.09	88	0.12	90
	CHICKERING WELL	CHARLES	0.02		0.004	5	0.005	4	0.003	4	0.004	4	0.004	4	0.005	4
	KNOLLWOOD WELL	CHARLES	0.02		0.007	9	0.009	8	0.007	9	0.01	10	0.008	8	0.008	6
				TOTAL WITHDRAWAL VOLUME	0.08	100	0.11	100	0.08	100	0.10	100	0.10	100	0.13	100
MEDFIELD	ELM ST. WELL #3	NEPONSET (1104850)	1.29		0.55	50	0.54	38	0.62	62	0.68	55	0.49	45	0.66	45
	ELM ST. WELL #4	NEPONSET (1104850)	0.86		0.08	7	0.19	13	0.08	8	0.13	11	0.20	19	0.15	10
	RT.109 WELL #1 & #2	CHARLES	1.29		0.48	43	0.68	48	0.30	30	0.42	34	0.39	36	0.67	45
				TOTAL WITHDRAWAL VOLUME	1.11	100	1.41	100	1.00	100	1.23	100	1.08	100	1.48	100
WALPOLE W&S	MINE BR. WELL #3	NEPONSET (1104850)	1.00	1.00	0.36	15	0.49	17	0.41	16	0.61	21	0.34	13	0.34	11
	MINE BR. WELL #5	NEPONSET (1104850)	0.50	0.50	0.29	12	0.35	12	0.31	12	0.38	13	0.25	9	0.23	7
	MINE BR. WELL #1	NEPONSET (1105000)	0.50	0.50	0.25	10	0.33	11	0.30	12	0.34	12	0.17	6	0.06	2
	WASH.ST. WELL #2	NEPONSET (1104840)	0.50	0.72	0.22	9	0.27	9	0.26	10	0.29	10	0.20	7	0.25	8
	WASH.ST. WELL #3	NEPONSET (1104840)	0.57	0.50	0.19	8	0.25	8	0.18	7	0.18	6	0.21	8	0.26	8
	WASH.ST. WELL #4	NEPONSET (1104840)	0.50	0.72	0.28	11	0.26	9	0.29	11	0.31	11	0.29	11	0.30	10
	WASH.ST. WELL #5	NEPONSET (1104840)	0.75	0.72	0.51	21	0.60	20	0.39	15	0.39	13	0.36	13	0.66	21
	WASH.ST. WELL #6	NEPONSET (1104840)	0.75	0.72	0.34	14	0.40	14	0.25	10	0.20	7	0.40	15	0.40	13
	NEPONSET WELL #1								0.15	6	0.23	8	0.46	17	0.65	21
				TOTAL WITHDRAWAL VOLUME	2.44	100	2.95	100	2.54	100	2.93	100	2.68	100	3.15	100

[1] ADD = average day demand

[2] S-ADD = summer average day demand (June, July, August)

TABLE 9.5. 1994 NEPONSET RIVER BASIN SURVEY. Mine Brook discharge profiles (cfs).

Low Flows						
	95% duration		98% duration		99% duration	
	Natural[1]	Regulated[2]	Natural	Regulated	Natural	Regulated
Base period	0.83	0.2	0.57	0.0	0.48	0.0
80-81 drought[3]	0.22		0.0		0.0	
	Regression Equation[4]		Drainage Area Ratio[5]		Regulated Flow[6]	
7Q2 flows	0.30		0.46		0.97	
7Q10 flows	0.10		0.21		0.00	
Moderate Flows[7]						
		Natural			Regulated	
Median August[8]		3.99			3.87	
Mean		12.1				

Estimated Natural Flows												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
cfs	6.1	13.5	17.1	15.4	17.3	23.3	18.7	12.8	9.8	3.5	4.2	4.2
Average Day Estimated Transfer Out of Subbasin												
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
cfs	1.56	1.63	1.32	2.11	1.91	1.89	1.07	2.03	2.29	1.95	1.63	1.32
% of flow	26	12	8	14	11	8	6	16	23	56	39	31

[1] Physically based mathematical models were used to estimate the natural yields for these flow durations from Estimation of Low-Flow Duration discharges in Massachusetts, USGS, Open-File 93-38, 1993.
[2] All regulated flows were estimated utilizing the index station method (Searcy 1959) using USGS gaging station 0110500 Neponset River at Norwood. Flow data is regulated by Neponset Reservoir releases, industrial withdrawals and returns, and municipal water supply withdrawals.
[3] Estimation of duration discharges during water year 1980-81 were obtained by multiplying the estimates from the regression equations by averaged ratios of duration discharges for water years 1980-81 to those for the 25 year base period, from Estimation of Low-Flow Duration Discharges in Massachusetts, USGS, Open-File 93-38, 1993.
[4] 7Q2 and 7Q10 flows are estimated using a two parameter low-flow model developed in Estimating the Magnitude and Frequency of Low Flows of Streams in Massachusetts, USGS, WRI 94-4100, 1994.
[5] 7Q2 and 7Q10 flows were estimated by drainage area ratio using 7Q2/10 values estimated in Gazetteer of Hydrologic Characteristics of Streams in Massachusetts, USGS WRI 84-4281, 1984 and USGS unregulated gaging station 01105600, Old Swamp River near South Weymouth.
[6] Initial 7Q2/10 Neponset River, Norwood gage taken from Gazetteer of Hydrologic Characteristics of Streams in Massachusetts, USGS WRI 84-4281, 1984.
[7] Moderate natural flows were estimated by drainage area ratio using USGS unregulated gaging station 01105600, Old Swamp River near South Weymouth.
[8] Based on Old Swamp River near South Weymouth gage August median calculated using US Fish and Wildlife methodology which establishes the median from mean monthly August flows for the period of record.

APPENDIX C
WATER SUPPLY FACT SHEETS

FACT SHEET #	WATER SUPPLIER
6.1C	Foxboro Water Department, Foxborough
6.2C	Walpole Country Club, Walpole
6.3C	Walpole Water Department, Walpole
6.4C	Medfield Water Department, Medfield
6.5C	Dover Water Company, Dover
6.6C	Hollingsworth & Vose Company, East Walpole
6.7C	Lost Brook Golf Club, Norwood
6.8C	Canton Water Department, Canton
6.9C	Blue Hill Country Club, Canton
6.10C	Plymouth Rubber Company, Canton
6.11C	MDC Ponkapoag Golf Course, Canton
6.12C	Spring Valley Country Club, Sharon
6.13C	Sharon Water Division, Sharon
6.14C	A.A. Will Materials Corporation, Stoughton
6.15C	Charles A. Northrup, Sharon
6.16C	Stoughton Water Department, Stoughton
6.17C	Dedham/Westwood Water District, Dedham
6.18C	Bay State Paper Company, Hyde Park
6.19C	L. E. Mason Company, Hyde Park

FACT SHEET 6.1C

Name and Address and contact person at Water Supplier:
Foxborough Water Department
150 Emmons Street
Foxborough, MA 02035 Contact: Warren McKay, Superintendent

WMA registration number and volume:
4-19-099.01 Registration: 0.64 MGD

WMA permit number and volume (MGD) (if applicable):

9P-4-19-099.01	**1995**	**2000**	**2005**	**2010**
	0.62	**0.67**	**0.73**	**0.73**

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
STATION ONE Well #1 (01G)	0.58	R	Yes	N	Combined withdrawal was 0.83
Well #2A (02G)	0.50	R	Yes	N	
Station 5 Well #13 (13G)	0.50	P	Yes	N	0.25

Withdrawal Point Description

All three wells are located in Foxborough, along the southeastern banks of the Neponset Reservoir. Station #1 which includes Wells 1 and 2A is located off Chestnut Street. Station #5- Well 13 (Morse Well) is located approximately 1000' north of Station #1, off Mechanic Street.

System Information/Summary

In addition to their registered and permitted sources in the Boston Harbor Basin, Foxborough is also registered and permitted in the Taunton Basin and permitted in the Ten Mile Basin. The two permitted wells in the Ten Mile Basin have yet to be constructed. Withdrawals in 1994 were split fairly evenly between Boston Harbor and Taunton sources. An average of 2.27 MGD was withdrawn system-wide, 1.20 MGD from their Taunton sources and 1.08 MGD from the three Boston Harbor sources. Foxborough exceeded (0.83 MGD) their registered volume (0.64 MGD) in the Boston Harbor Basin. The Department will query this problem. Possible solutions include the amending of their permit to include Station 1, or the throttling back of water withdrawals from Station 1. Since Station 5 is being pumped below those volumes authorized in their permit through February 1995 (0.62 MGD), increased withdrawals may be necessary here.

Overall, system-wide withdrawals in 1994 (2.27 MGD) were considerably below those volumes projected by DEM for 1995 (2.82 MGD). Foxborough is registered and permitted for volumes sufficient to meet their DEM 2010 projected demand of 3.22 MGD. The following aspects of their conservation plan will need to be addressed: discuss the frequency of water audit/leak detection surveys in town; the retrofitting of public buildings with water savings devices; discussion of their 27% unaccounted-for water use.

FACT SHEET 6.2C

Name and Address and contact person at Water Supplier:
Walpole Country Club
P.O. Box 186
Walpole, MA 02081 **Contact: Mark D. Gagne, Superintendent**

WMA registration number and volume:
N/A

WMA permit number and volume (MGD) (if applicable):

9P-3-19-307.01	**1995**	**2000**	**2005**	**2010**
	0.10	**0.10**	**0.10**	**0.10**

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
Irrigation Pond	n/a	R	n/a	n/a	0.14

Withdrawal Point Description

The irrigation pond is actually an impounded section of Spring Brook near the Walpole/Sharon town line. Spring Brook eventually feeds Clark Pond approximately 1/2 mile downstream of the irrigation pond.

System Information/Summary

Permit authorizes a 0.10 MGD average daily withdrawal over 210 days from April to October. Actual withdrawal volumes have exceeded this volume over the past four years. Department will contact permittee about withdrawal volumes.

Conservation plan mentioned the supplier would be renovating the entire irrigation system in 1992. Department will request update of their status with regards to this plan.

FACT SHEET 6.3C

Name and Address and contact person at Water Supplier:
Walpole Water Department
Town Hall, School Street ,
Walpole, MA 02081 Contact: R. E. Mattson, Jr., Superintendent

WMA registration number and volume:
3-19-307.01 Registration Volume: 2.25 MGD

WMA permit number and volume (MGD) (if applicable):

9P-3-19-307.02	**1995**	**2000**	**2005**	**2010**
	0.76	**0.91**	**1.00**	**1.09**

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
Washington #2 (06G)	0.43	R/P	Yes	N	0.22
Washington #3 (05G)	0.43	R/P	Yes	N	0.25
Washington #4 (10G)	0.58	R/P	Yes	N	0.32
Washington #5 (08G)	Combined volumes not to	P	Yes	N	0.47
Washington #6 (09G)	exceed 1.60	R/P	Yes	N	0.28
Mine Brook #1 (01G)	Combined volumes	R/P	Yes	N	0.14
Mine Brook #2 (02G)	from the Mine Brook	R/P	Yes	N	-
Mine Brook #3 (03G)	wells are not to exceed	R/P	Yes	N	0.31
Mine Brook #5 (11G)	3.00	P	Yes	N	0.23
Neponset #1 (12G)	0.23	P	Yes	N	0.41
Neponset #2 (13G)	0.58	P	Yes	N	-

* Note Registered Volume is a combined total. Withdrawal volumes should not exceed the combined total of 2.25 MGD from the registered sources.

Withdrawal Point Description

The Washington Street Wells are located both east and west of Washington Street, all are adjacent to School Meadow Brook in Walpole. Neponset Wells 1 & 2 are located on the east side of the Neponset River, approximately 800' downstream from where School Meadow Brook meets the Neponset River.

Mine Brook Well #1 is located north of Mine Brook, approximately 800' downstream from Turner Pond. Mine Brook Wells 2 & 3 are located on the east side of Mine

FACT SHEET 6.3C (continued)

Brook, approximately 500' apart and 1/2 mile upstream from Turner Pond. Mine Brook Well #5 is located approximately 800' east of where Mine Brook enters Turner Pond. All of the Mine Brook Wells are located in Walpole.

System Information/Summary

Registered for 2.25 MGD from Washington Wells 2 (06G), 3 (05G), 4 (10G), 6 (09G); Mine Brook Wells 1 (01G), 2 (02G), 3 (03G). Permit includes all 7 of these sources plus the following sources: Washington Well 5 (08G); Mine Brook Well 5 (11G), and Neponset #1 (12G) and Neponset #2 (13G). All of the wells have approved rates and approved Zone II's. Walpole was required by 5/13/94 to have Wellhead Protection requirements in place for all of these sources. Department approved measures have not yet been put in place. Wetlands monitoring was also required around all of their wells. Their status with completing these requirements will be addressed in the 5 year review process. The following aspects of their conservation plan will need to be addressed: Walpole has not conducted a system wide water audit/leak detection survey every two years as required; educational conservation bill stuffers were required and have yet to be included; two municipal buildings need to be metered; discussion of their 27% unaccounted-for water use.

During 1994, Walpole was within their registered (2.25 MGD) and permitted (0.76 MGD) withdrawal volumes (Total authorized volume of 3.01 MGD). Actual system-wide withdrawal volumes for 1994 were 2.63 MGD. Walpole's permit authorizes the withdrawal of an additional 1.09 MGD in 2010, when combined with their 2.25 registered withdrawal volume, they should have sufficient capacity to meet their 2010 projected withdrawal volume of 3.34 MGD.

Walpole has also explored the development of another Mine Brook Well (#4). This source is currently in the Department's Division of Water Supply new source approval process. The Water Management Program has not received any requests to add this source to Walpole's permit.

FACT SHEET 6.4C

Name and Address and contact person at Water Supplier:
Medfield Water Department
P.O. Box 315
Medfield, MA 02052 **Contact: Kenneth Feeney, Superintendent**

WMA registration number and volume:
3-19-175.01 **Registration Volume: 0.92 MGD**

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
Well #3 (03G)	1.20	R	Yes	N	0.57
Well #4 (04G)	1.00	R	Yes	N	0.06

• Registered Volume is a combined total. Withdrawals should not exceed the combined total of 0.92 MGD.

Withdrawal Point Description

Wells 3 & 4 are both located adjacent to Mine Brook, near the Medfield/Walpole town line.

System Information/Summary

Medfield is also registered (Wells 1 & 2) and permitted in the Charles River Basin. Medfield has yet to bring on-line the well permitted in the Charles. Although the permit authorizes additional system-wide withdrawal volumes, the increased withdrawal volumes are authorized only from the proposed well. Therefore, to provide the additional water needed, Medfield has consistently withdrawn in excess of their registered volume (0.11 MGD) in the Charles Basin. When and if Medfield brings the new well on-line, they appear to have sufficient capacity to meet the DEM projected water need.

Medfield's projected water use for 1995 was 1.17 MGD. Actual system-wide withdrawals for 1994 were 1.16 MGD. Medfield's projected to need 1.30 MGD in 2010. Assuming the permitted source in the Charles Basin is brought on-line, Medfield will have the registered and permitted (0.27 MGD) capacity to meet their 2010 water needs.

FACT SHEET 6.5C

Name and Address and contact person at Water Supplier:
Dover Water Company
P.O. Box 125
Dover, MA 02030 **Contact: Joseph Fryer**

WMA registration number and volume:
N/A

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
Walpole St. (01G)	n/a	n/a	no	N	0.09
Draper Rd. Wells 1 & 2	.04 each	n/a	*	N	-

* Draper Road Wells are located within the approved Zone II of the Medfield Mine Brook Wells.

Withdrawal Point Description

The Walpole St. Well (01G) is located near a small wetland, at the headwaters of Mill Brook in Dover. The Draper Road Wells are located south of the Walpole St. Well, along Mill Brook, and adjacent to the Dover/Medfield town line.

System Information/Summary

The Dover Water Company (DWC) is not currently regulated by the Water Management Program. Although, they have sources in both the Boston Harbor and Charles River Basins (02G & 03G), they have not exceeded the permitting threshold in either basin. In 1993, they withdrew 31.44 mgy from the Walpole St. Well. The DWC is also very close to bringing on-line the Draper Road Wells 1 & 2 in the Boston Harbor Basin. Each Draper Road Well was approved for a maximum daily withdrawal of 39,800 gpd. These wells are located within the approved Zone II of the Medfield Mine Brook Wells. If in the future the combined withdrawal volumes from the Walpole St. Well and the Draper Road Wells exceeds 36.50 mgy then DWC will need a permit. Until such time, the Water Management Program can only continue to monitor the DWC withdrawal volumes.

FACT SHEET 6.6C

Name and Address and contact person at Water Supplier:
Hollingsworth & Vose Company
112 Washington Street
East Walpole, MA 02032 Contact: Lori Hanford, Env. Engineer

WMA registration number and volume:
3-19-307.02 Registration Volume: 1.02 MGD

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1993 Actual Use (MGD)
Neponset R./ Mill Pond	n/a	R	n/a	n/a	0.35

Withdrawal Point Description

Hollingsworth & Vose withdraws water from a dammed section of the Neponset River in East Walpole near the Norwood town line.

System Information/Summary

Actual withdrawal volumes have been significantly below their 1.02 MGD registration volume. According to the annual reports filed by H&V, metered withdrawal volumes have averaged 0.35 MGD from 1988-1993. H&V attribute their reduced water use to a number of factors including conservation, water re-use measures, and the type, number, and amount of product being manufactured.

FACT SHEET 6.7C

Name and Address and contact person at Water Supplier:
Lost Brook Golf Club
P.O. Box 772, 750 University Ave.
Norwood, MA 02062 Contact: W. J. Harrison, President

WMA registration number and volume:
3-19-220.01 Registration Volume: 0.22 MGD

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1993 Actual Use (MGD)
Irrigation Pond	n/a	R	n/a	n/a	0.02

Withdrawal Point Description

The irrigation pond is located north of Norwood airport, near a wetland, that has a stream named Purgatory Brook running through it.

System Information/Summary

Registration authorizes an average daily withdrawal volume of 0.22 MGD over 330 days from February to October. This volume was based on the registrant's estimated water-use between 1981-1985. Metered information submitted with their annual reports has shown water withdrawals significantly below these volumes. Withdrawals during even their highest three months of use are well below the registration volume. Since 1989, withdrawal volumes every year have been below the 100,000 gpd registration threshold. The Department will verify the existing registration, but also allow Lost Brook the option of rescinding their registration.

FACT SHEET 6.8C

Name and Address and contact person at Water Supplier:
Canton Water Department
1492 Washington Street
Canton, MA 02021 **Contact: Ronald Redquest, Superintendent**

WMA registration number and volume:
N/A

WMA permit number and volume (MGD) (if applicable):

9P-3-19-050.01	**1995**	**2000**	**2005**	**2010**
	1.22	**1.26**	**1.28**	**1.20**

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
Well #4 (06G)	0.80	P	Yes	Under review	-
Well #5 (07G)	0.40	P	Yes	Under review	0.37
Well #6 (08G)	0.20	P	Yes	under review	0.14

Withdrawal Point Description

Well #4 is located adjacent to Pecunit Brook, near Blue Hill Country Club, off Pecunit Street in Canton. Wells 5 & 6 are located on the southern end of Fowl Meadow, in the area between the East Branch of the Neponset River and the Canton/Sharon town line. A new source (Well #9/South Arm of the Neponset) is also in development in this area.

System Information/Summary

Canton withdrew 0.51 MGD from their own sources in 1994 which is substantially below the volume (1.22 MGD) authorized in their permit. In addition to their local sources Canton also purchases water from the MWRA. In 1994, Canton purchased an average daily withdrawal volume of 2.29 MGD. Their average daily use in 1994 (2.80 MGD) is significantly below those volumes projected by the Department of Environmental Management (DEM) for Canton in 1995 (3.41 MGD). All three wells have approved Zone II's.

With an approved system yield of 1.40 MGD from wells 4, 5, and 6, Canton is a long way from meeting their 2010 projected demand of 3.66 MGD. Although they have new well in development (South Arm of the Neponset/Well 9), Canton will in all likelihood continue to rely on water supplied by the MWRA. Finally, Canton will need to update the Department on the following aspects of their conservation plan: confirmation the entire system has been and will continue to be surveyed for leaks every two years; their status with regards to completing the retrofit of public buildings with water savings devices, and the date full cost pricing/enterprise system was adopted.

FACT SHEET 6.9C

Name and Address and contact person at Water Supplier:
Blue Hill Country Club
23 Pecunit Street
Canton, MA 02021 **Contact: David J. Barber, Superintendent**

WMA registration number and volume:
3-19-050.01 **Registration Volume: 0.37 MGD**

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1993 Actual Use (MGD)
Well #1	N/A	R	N/A	N/A	0.23

Withdrawal Point Description

Both Well #1 & #2 are located adjacent to Pecunit Brook on Pecunit Street in Canton.

System Information/Summary

Blue Hill's registration authorizes a 0.37 MGD average daily withdrawal over 148 days from April to October. Actual metered withdrawal volumes have been below their registered volume. Their reported water use in 1993 (0.23 MGD) was their highest to date. Registrant reported adding a second well in 1987. This new well will need to be addressed by the Water Management Program. The well will need to be added to their existing registration through a registration amendment or a Water Management Permit will be required.

FACT SHEET 6.10C

Name and Address and contact person at Water Supplier:
Plymouth Rubber Company
104 Revere Street
Canton, MA 02021 **Contact: Walter Woods, Director Operations**

WMA registration number and volume:
3-19-050.03 **Registration Volume: 4.33 MGD**

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
E. Branch of Neposnet R.	n/a	R	n/a	n/a	2.42

Withdrawal Point Description

Plymouth Rubber Company withdraws water from the East Branch of the Neponset River via Forge Pond and Reservoir Pond located adjacent to Pleasant Street in Canton.

System Information/Summary

Actual metered withdrawal volumes have been significantly below their 4.33 MGD registration volume. Actual withdrawals have averaged 2.24 MGD since installing the meter in January 1990. There is no information in their file explaining their reduced withdrawal volumes. In all likelihood, the original registered volume was overestimated. If metered information was not available, registrants were asked to estimate their water use. Typically, registrants did this by multiplying pump capacity by the hours and days of operation. Because pumps are not usually withdrawing at capacity this led to gross overestimates. Before verifying the Registration Statement the Department will explore whether Plymouth Rubber Company's withdrawal volumes have actually decreased or whether the actual metered withdrawal volumes are an accurate reflection of the registration period.

FACT SHEET 6.11C

Name and Address and contact person at Water Supplier:
MDC Ponkapoag Golf Course
Canton, MA 02021 Contact:

WMA registration number and volume:
3-19-050.04 Registration Volume: 0.17 MGD

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1993 Actual Use (MGD)
Ponkapoag Pond	n/a	R	n/a	n/a	0.17

Withdrawal Point Description

Ponkapoag Pond is located approximately 1/2 mile off Washington Street (Route 138) along the Canton/Randolph town line.

System Information/Summary

The registrant has failed to submit annual reports. The Department will contact the registrant and require the submission of annual reports to maintain this registration. The registration statement issued, was an estimated statement, authorizing the golf club to withdraw 0.17 MGD over 210 days per year. Ponkapoag will be required to verify their statement through the submission of at least three years of metered withdrawal records.

FACT SHEET 6.12C

Name and Address and contact person at Water Supplier:
Spring Valley Country Club
Tiot Street
Sharon, MA 02067 **Contact: Ronald Hansen, Superintendent**

WMA registration number and volume:
4-19-266.02 **Registration Volume: 0.31 MGD**

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
Irrigation Pond #16	N/A	R	N/A	N/A	-
Irrigation Well #5	N/A	R	N/A	N/A	-

Withdrawal Point Description

The withdrawal points are located near the southern end of the Fowl Meadow wetland, approximately 1/4 mile from Route 95, in the town of Sharon.

System Information/Summary

Spring Valley's registration authorizes a 0.31 MGD average daily withdrawal over 210 days from April to October. Actual withdrawal volumes are unknown because annual reports have not been submitted since 1988. The Department will contact registrant about missing information.

FACT SHEET 6.13C

Name and Address and contact person at Water Supplier:
Sharon Water Division
P.O. Box 517
Sharon, MA 02067 **Contact: John Sulik, Superintendent**

WMA registration number and volume:
4-19-266.01 **Registration: 0.55 MGD**

WMA permit number and volume (MGD) (if applicable):

9P-4-19-266.01	**1995**	**2000**	**2005**	**2010**
	0.35	**0.37**	**0.39**	**0.42**

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
Well #2 (01G)	N	R/P	N	N	0.26
Well #3 (02G)	N	R/P	N	N	0.14
Well #4 (03G)	N	R/P	N	N	0.41

Withdrawal Point Description

All three wells are located along Beaver Brook in Sharon. Well 3 is the southern most well, located off Farnham Road, on the east side of Beaver Brook, approximately 2000' upstream from Well 2. Well 2 is located off Moose Hill Parkway, along the west side of Beaver Brook, near Hobbs Hill. Well 4, the northern most source, is approximately 4000'-5000' downstream from Well 2 off Tree Lane.

System Information/Summary

Sharon is registered and permitted in both the Taunton and Boston Harbor basins. All of their sources are both registered and permitted. The Taunton registration also includes 3 wells and authorizes and average daily withdrawal volume of 0.55 MGD. Sharon's Boston Harbor permit authorized an additional 0.35 MGD through 2/28/95. Actual withdrawals in 1994 from the Boston Harbor sources was 0.81 MGD (below the 0.90 MGD authorized). However, Sharon did exceed the combined authorized volume (0.76 MGD) in the Taunton Basin. Actual withdrawals were 0.90 MGD, which contributed to their exceeding (1.71 MGD) the authorized system-wide withdrawal volume of 1.66 MGD. The Department will ask Sharon to address this issue.

Sharon was to have completed Zone II's for each well by June 1,1994. No Zone II's have been submitted to date. The Department will query the reasons for this delay. At the time of issuance, wellhead protection had yet to be adopted as a permit condition. The adoption of Wellhead Protection requirements will be required in any modified permit issued. The submission of a wetlands monitoring condition was required at the 5 Year Review of this permit. The Department will be requesting the submission of this monitoring data. DEM's Water Conservation questionnaire indicates the town has failed to conduct a Water audit/leak detection survey every two years, they need to address their efforts to set the water rate to reflect the full cost of supplying water, they should also discuss their 21% unaccounted-for water use.

FACT SHEET 6.14C

Name and Address and contact person at Water Supplier:
A.A. Will Materials Corp.
168 Washington Street
Stoughton, MA 02072 **Contact: Francis A. Will, President**

WMA registration number and volume:
4-19-285.01 **Registration Volume: 0.39 MGD**

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
Beaver Meadow Brook	n/a	R	n/a	n/a	0.02

Withdrawal Point Description

Withdrawals are occuring along Beaver Meadow Brook off Washington Street in Stoughton, near the Canton line, and downstream of Glen Echo Pond.

System Information/Summary

Actual withdrawal volumes for 1993 and 1994 have been significantly below the 0.39 MGD registration volume. Discussion with A.A. Will staff indicates that stone and gravel washing are no longer occurring on site. Water use at the facility is now limited to the washing of vehicles. The Department will suggest to the registrant that if their projected water needs are expected to remain below the permitting threshold they should rescind their registration.

FACT SHEET 6.15C

Name and Address and contact person at Water Supplier:
Charles A. Northrup
254 South Walpole Street
Sharon, MA 02067 **Contact: Charles A. Northrup**

WMA registration number and volume:
V4-19-266.01 **Registration Volume: 0.02 MGD**
(equals 2+ acres of cranberry bog)

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
Irrigation Pond	n/a	R	n/a	n/a	0.02 (2.23 acres of cranberry bog)

Withdrawal Point Description

Mr. Northrup's bog and irrigation pond are located south of South Walpole Street, adjacent to the southbound lane of Route 95, near the Walpole, Foxborough, and Sharon town lines. Irrigation water is provided via the on-site pond that eventually flows to School Meadow Brook in Walpole.

System Information/Summary

Mr. Northrup is a cranberry grower who voluntarily registered his cranberry acreage in 1991. The Water Management Act was amended in the early 1990's to briefly allow water users who did not meet the Water Management permitting threshold the opportunity to register their water uses. Mr. Northrup chose to register his 2.10 acres of cranberry acreage, despite being below the 4.66 acre permitting threshold. Voluntary registrants are subject to the same conditions and requirements of other registrants, including the annual reporting of their water use. Mr. Northrup has reported cultivating 2.23 acres the past several years. Although his reported acreage actually exceeds his registered acreage, Mr. Northrup is not considered out of compliance with the Water Management Program until he exceeds his registered acreage by more than 4.66 acres.

FACT SHEET 6.16C

Name and Address and contact person at Water Supplier:
Stoughton Water Department
950 Central Street
Stoughton, MA 02072 **Contact: Lawrence Barrett, Superintendent**

WMA registration number and volume:
4-19-285.02 **Registration: 1.08 MGD**

WMA permit number and volume (MGD) (if applicable):

9P-4-19-285.01	**1995**	**2000**	**2005**	**2010**
	0.00	**0.00**	**0.00**	**0.13**

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
Harris Pond Well (01G)	0.32	R	Y	N	0.45
Muddy Pond Well (05G)	0.40	R	Y	N	0.38
Pratts Court Well (06G)	0.50	P	Y	N	0.34

Withdrawal Point Description

Pratts Court Well is located off Pratts Court on the eastern shore of Town Pond. Harris Pond Well is at the southern end of Hillwood Ave, approximately 700'-900' east of Pinewood Pond. Muddy Pond Well is approximately 200'-300' southwest of Muddy Pond and east of the juncture of Deerfield Road and Bay Road. All three wells are located in Stoughton.

System Information/Summary

Stoughton is registered and permitted in the Taunton and Boston Harbor basins. Both permits include only one new source, no registered sources are permitted. Because Stoughton's water needs are not projected to exceed the permitting threshold until 2005, no additional volumes are authorized until that time. Beginning in 2005, Stoughton is authorized to withdraw an additional 0.13 MGD in each river basin. Until then, Stoughton is limited to the 1.14 MGD registered in the Taunton Basin and the 1.08 MGD registered in the Boston Harbor. Overall, system-wide volumes have been below the 2.31 MGD projected through 1995 for every year except 1992 (2.39 MGD). 1994 water-use was 2.24 MGD with 1.17 MGD being withdrawn from the Boston Harbor sources. Withdrawal volumes from the Boston Harbor sources historically have been near or at the 100,000 gpd permitting threshold. The combined safe yield from the three Boston Harbor sources is 1.17 MGD. The Department will contact Stoughton and remind them of their authorized withdrawal volumes in the Boston Harbor River Basin. In addition, Stoughton will need to address why they exceeded the safe yield of the Harris Pond Well in 1994.

Because actual withdrawal volumes have historically been at or near the system safe yield, Stoughton has been operating under a Department Declared Emergency since 1987. Conditions of the Emergency Declaration have required extensive water conservation measures. The town has gone so far as to require an applicant

FACT SHEET 6.16C (continued)

for a new tie in or increased usage must, prior to approval, secure a water savings of four times the amount requested from elsewhere within the system. Although little growth is expected, and despite the fact that Stoughton is permitted through 2010, they appear to have problems meeting peak withdrawal volumes. Stoughton has explored and actually received a favorable response, dated 7/20/94, from the MWRA relative to its formal application for MWRA membership and an associated request for 0.50 MGD. However, the Town voted against going the MWRA route and is pressing forward with the Development of a new source in the Taunton Basin.

Wellhead protection will need to be adopted within two years for Pratt's Court Well only. DEM's Water Conservation questionnaire indicates the town has addressed most of the conservation issues required in their permit.

FACT SHEET 6.17C

Name and Address and contact person at Water Supplier:
Dedham-Westwood Water District
536 Bridge Street
Dedham, MA 02026 **Contact: Robert M. Eiben, Manager**

WMA registration number and volume:
3-19-073.01 **Registration: 2.62 MGD**

WMA permit number and volume (MGD) (if applicable):

9P-3-19-073.01	**1995**	**2000**	**2005**	**2010**
	0.12	**0.26**	**0.38**	**0.49**

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1994 Actual Use (MGD)
White Lodge Well 1 (06G)	The Combined daily volume for the 4 White Lodge Wells is 3.78 MGD.	R/P	Y	under review	0.32
White Lodge Well 2 (07G)		R/P	Y	under review	0.76
White Lodge Well 3 (08G)		R/P	Y	under review	0.42
White Lodge Well 4 (09G)		R/P	Y	under review	0.85
Fowl Meadow Well	1.15	P	Y	under review	-

Withdrawal Point Description

All four Fowl Meadow Wells are located on the western side of the Neponset River, south of the Rt. 95/Rt. 128 interchange (interchange #62). The wells all appear to be located in an industrial park off University Ave, Dartmouth Street, and Yale Street in Dedham. The new Fowl Meadow Well will also be located on the western side of the Neponset River, approximately 3/4 of a mile from the same interchange, and adjacent to another interchange (#62).

System Information/Summary

In addition to being registered and permitted in the Boston Harbor Basin, Dedham-Westwood Water District is also registered in the Charles River Basin. The Charles registration authorizes an average daily withdrawal volume of 1.91 MGD. The new well (Fowl Meadow Well) included in the Boston Harbor permit has yet to be completed. An Interbasin Transfer Approval (ITA) from the Department of Environmental Management was required for the Fowl Meadow Well. The ITA required that extensive conservation conditions be met before approval was given. The ITA also required that a staff gage be installed at the Milton Lower Falls Dam that would provide information on water depths. When streamflow in the Neponset River falls below 0.15 cfsm, no withdrawals may occur from the Fowl Meadow well. In addition, no withdrawals are allowed from the Fowl Meadow Well during the months of March, April or May when the flow in the Neponset River is less than one foot in depth, or 95 cfs, whichever is greater. The Army Corps of Engineers Permit for the Fowl Meadow Well also requires extensive wetlands monitoring around the well. The Water District has been working with both the towns of Dedham and Westwood to adopt the appropriate wellhead protection measures.

Dedham-Westwood's actual system-wide withdrawal volume of 3.98 MGD in 1994 was below the 4.65 MGD projected through 1995 by the Department of Environmental Management. Assuming the Fowl Meadow Well is developed, Dedham-Westwood should have volumes sufficient to meet their average daily demand of 5.02 MGD in 2010.

FACT SHEET 6.18C

Name and Address and contact person at Water Supplier:
Bay State Paper Company
892 River Street
Hyde Park, MA 02136 **Contact: Pat Eramo**

WMA registration number and volume:
3-19-035.01 **Registration Volume: 2.06 MGD**

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1992 Actual Use (MGD)
Neponset R.@ Tilestone Dam	n/a	R	n/a	n/a	1.68

Withdrawal Point Description

Bay State Paper Company withdraws water directly from the Neponset River at the Tilestone Dam on River Street in Hyde Park.

System Information/Summary

Registration was recently (Feb.1,1995) transferred to Bay State Paper Company from a facility involved in a Chapter 7 Bankruptcy (Patriot Paper Company). Registration originally issued to the James River Company was transferred to the Patriot Paper Company (Aug.15,1990). Department never officially transferred the registration statement to Patriot Paper. 1992 was the last year in which withdrawals occurred consistently at the facility. According to the annual reports filed by the previous owner(s), the withdrawal point has been metered for a number of years. Reported volumes have been below the registered volume every year since 1985.

Information included in the recent registration transfer indicates that Bay State Paper is contemplating implementation of process changes that will significantly reduce water consumption at the facility.

FACT SHEET 6.19C

Name and Address and contact person at Water Supplier:
L.E. Mason Company
98 Business Street
Hyde Park, MA 02136 **Contact: John Mangassarian, Chief Engineer**

WMA registration number and volume:
3-19-035.02 **Registration Volume: 0.38 MGD**

WMA permit number and volume (MGD) (if applicable):
N/A

Source(s)/ (Source ID#)	Approved Yield (MGD)	Registered or Permitted	Approved Zone II	Wellhead Protection Measures	1993 Actual Use (MGD)
Well	n/a	R	n/a	n/a	0.22

Withdrawal Point Description

The L.E. Mason Company well is located at their facility on Business Street in Hyde Park, near the juncture of Mother Brook and the Neponset River.

System Information/Summary

The Department required that L.E. Mason Company stop withdrawing water from their well in February 1994. Groundwater contamination was the reason behind this decision. The Company has been purchasing water from the City of Boston since the well was closed. The water needs of the facility are likely to continue to be met by water purchased from the City.

APPENDIX D

WASTEWATER DISCHARGE FACT SHEETS

FACT SHEET #	WASTEWATER DISCHARGE FACILITY
7.1D	The Foxboro Company, Foxborough
7.2D	Foxborough State/Wrentham State Hospital, Foxborough
7.3D	Bird Machine Company, South Walpole
7.4D	Senior Flexonics Inc., Metal Bellows Division, Sharon
7.5D	Mobil Service Station, Walpole
7.6D	Harold E. Willis Water Treatment Plant, Walpole
7.7D	Hollingsworth & Vose Company, East Walpole
7.8D	Bird Roofing Company, Norwood
7.9D	Gibbs Service Station, Norwood
7.10D	Factory Mutual Engineering, Norwood
7.11D	Mobil Service Station, Norwood
7.12D	Sunoco Service Station, Norwood
7.13D	Grant Gear Inc., Norwood
7.14D	Plymouth Rubber Company, Canton
7.15D	Shield Packaging Company, Canton
7.16D	Devaney Oil Company, Dedham
7.17D	L.E. Mason Company, Hyde Park
7.18D	James G. Grant Recycling Facility, Hyde Park (Readville)
7.19D	Milton Academy, Milton
7.20D	Town of Milton, Milton
7.21D	US Army National Guard Armory, Dorchester

WASTEWATER DISCHARGE FACT SHEET 7.1D

NAME AND ADDRESS: The Foxboro Company
38 Neponset Avenue, Foxborough
(508) 549-3620

NPDES PERMIT #: MA0004120 MAJOR/MINOR: Major

NEW/RENEWAL: Renewal EXPIRATION DATE OF LAST PERMIT: 6/20/95

LOCATION AND TYPE OF DISCHARGES: Storm water discharge to Neponset Reservoir via Gudgeon Brook.

PERMITTED/CURRENT VOLUME OF DISCHARGES: Storm water was not previously permitted and current discharge volumes are not known.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: Current effluent quality is unknown.

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: Foxboro is a former metal plating and manufacturing company that now does light manufacturing and electronic assembly. The process discharge was connected to Mansfield in 1987, and the sanitary discharge was connected in 1989. The last cooling water discharge was closed-loop in May 1994.

1994 SITE VISIT: There is VOC (volatile organic compounds) contamination of the storm water discharging to Gudgeon Brook and sampling has been conducted upstream and downstream to pin point the problem. Foxboro Company will be hiring a Licensed Site Professional to evaluate the problem. In addition, high bacteria counts have been measured in the discharge to Gudgeon Brook.

SPECIAL ISSUES/RECOMMENDATIONS: The Neponset Reservoir sediments are contaminated with excessive levels of metals and phosphorous. There is evidence that under certain conditions these contaminants are washed downstream. Since the Foxboro Company discharged significant quantities of these contaminants over the years, DEP and EPA are working with the company to investigate the resulting impacts as well as remediation options.

A storm water permit should be issued that includes VOC and bacteria limits as well as the standard pollution prevention/best management practices requirements.

WASTEWATER DISCHARGE FACT SHEET 7.2D

<u>NAME AND ADDRESS</u>: Foxborough State/Wrentham State Hospital
Payson Road, Foxborough
(508) 384-3116

<u>NPDES PERMIT #</u>: MA0102199 <u>MAJOR/MINOR</u>: Minor

<u>NEW/RENEWAL</u>: Renewal <u>EXPIRATION DATE OF LAST PERMIT</u>: 6/2/91

<u>LOCATION AND TYPE OF DISCHARGES</u>: Sanitary wastewater discharged to Crack Rock Pond.

<u>PERMITTED/CURRENT VOLUME OF DISCHARGES</u>: 0.26 MGD/0.01 MGD

<u>RECEIVING STREAM 7Q10</u>: To be calculated.

<u>SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY</u>:

BOD & TSS = 30 mg/l avg
Fecal Coliform = 200/100 ml (April - Oct. 15)
TRC = monitor only (April - Oct. 15)

DMR Data
BOD & TSS compliance is good
TRC ranges from 0.2 - 1.3 mg/l

<u>BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT</u>: The hospital was closed in December, 1993. Flow to the wastewater treatment plant is from 66 units of low income and elderly housing adjacent to the hospital. The influent flow meter is broken but flow has been estimated at 10,000 gpd. The wastewater is treated with an aeration tank, clarifier, sand filters, and then chlorinated (manually controlled). Final effluent discharges to a point approximately 50 - 100 ft. from Crack Rock Pond.

<u>1994 SITE VISIT</u>: The facility appears to be understaffed and underfunded; many maintenance projects have not been completed. The clarifier had floating solids on top and the weirs were clogged with growth. The effluent was cloudy prior to discharge to the sand filters but is quite clear after going through the sand filters. The facility is scheduled to be tied into the Mansfield WWTP.

<u>SPECIAL ISSUES/RECOMMENDATIONS</u>: The facility tries to maintain residual chlorine at 0.2 mg/l, but with manual dosing and an intermittent discharge the residual must vary significantly. Chlorine monitoring is performed only once per day. The permit should be reissued if the connection to the Mansfield WWTP is not completed by the end of fiscal year 1996.

WASTEWATER DISCHARGE FACT SHEET 7.3D

NAME AND ADDRESS: Bird Machine Co.
100 Neponset Street, South Walpole
(508) 668-0400

NPDES PERMIT #: MA0000230 MAJOR/MINOR: Minor

NEW/RENEWAL: Renewal EXPIRATION DATE OF LAST PERMIT: 9/30/91

LOCATION AND TYPE OF DISCHARGES: Five storm water outfalls (001,002,003,005, & 006) discharging to the Neponset River were included in the 1986 permit. Three new discharges to the Neponset River, two storm water and one non-contact cooling water (nccw) plus storm water, were discovered and included in the 1991 application. The sanitary wastewater discharge was connected to the local sanitary sewer system in 1991.

PERMITTED/CURRENT VOLUME OF DISCHARGES: NA/unknown

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY:

Outfalls 001, 003, 005, and 006
TSS = 20/30 mg/l avg/max
Oil & Grease = 15 mg/l max

Outfall 002
TSS = 20/30 mg/l
Lead, zinc, copper, & phosphorus- report

DMR Data
002 - zinc = 90 ug/l, P = 130 ug/l, lead & copper = ND, and TSS is very low.

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: The company produces metal parts and casts/molds for a variety of machine parts. These molds are stored outdoors all around the property. There is no waste treatment system currently in operation.

1994 SITE VISIT: Small oil sheens were observed in the water near four of the outfalls, including the nccw outfall. Two storm water outfalls were discharging even though it hadn't rained in several days, and the discharges were iron colored. Large amounts of materials are stored outside and exposed to the weather. The nccw volume is 2-3 gpm - 24 hrs/day; no additives are used.

SPECIAL ISSUES/RECOMMENDATIONS: If the company can monitor the nccw separate from storm water and groundwater then they should be issued the general permit for the nccw discharge. An individual storm water permit should be issued that includes standard pollution prevention/best management practices requirements and an oil & grease limit. Verification is needed to insure that outfall 002 does not have any other discharges tied in.

WASTEWATER DISCHARGE FACT SHEET 7.4D

NAME AND ADDRESS: Metal Bellows
1075 Providence Highway, Sharon
(617) 784-1400

NPDES PERMIT #: MA0002305 MAJOR/MINOR: Minor

NEW/RENEWAL: Renewal EXPIRATION DATE OF LAST PERMIT: 8/18/91

LOCATION AND TYPE OF DISCHARGES: Discharge 001 is process wastewater and discharge 002 is a cooling water discharge. Both discharges combine in the same outfall which discharges to a tributary to School Meadow Brook.

PERMITTED/CURRENT VOLUME OF DISCHARGES: The permitted flow for 001 is 1,500 gpd and for 002 is 20,000 gpd. The actual flow, as measured from the combined outfall, ranges from 800 - 1000 gpd.

RECEIVING STREAM 7Q10: 0.07 MGD

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY:

	DMR Data
Outfall 001	Outfall 001
Copper = 0.45 mg/l avg	Copper = 0.04 - 0.18 mg/l
Nickel = 1.8/3.0 mg/l avg/max	Nickel = 0.06 - 0.14 mg/l
Chromium = 0.5/1.0 mg/l avg/max	Chromium = below detection limit (BDL)
Chromium VI = 0.05/0.1 mg/l avg/max	TSS = BDL
Chlorine = 0.91 mg/l	Chlorine = BDL
Cyanide = 0.25/0.65 mg/l avg/max	
Temperature = 80° F	
Total Toxic Organics = 2.13 mg/l	
Methylene Chloride = <10 mg/l	
Chloroform = <10 mg/l	
111 Trichloroethane = 0.2 mg/l	
Outfall 002	Outfall 002
Temperature = 83° F max	Temperature = 86° F max
Copper = monitor only	Copper = BDL - 0.06 mg/l

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: This company manufactures of stainless steel welded diaphragm bellows and metal deposited bellows for aerospace instrumentation. The discharges are from a small electroplating operation. Numerous holding tanks inside the plant are used for process deionization and metals removal.

1994 SITE VISIT: The tributary to School Meadow Brook that receives the discharge was dry at the time of the site visit. There was a good flow downstream in School Meadow Brook and the biota in School Meadow Brook appeared healthy. Chlorine is no longer used at the facility and no chemical additives are added to the cooling water. There is a groundwater drinking water supply for Walpole approximately two miles downstream.

SPECIAL ISSUES/RECOMMENDATIONS: Should visit this site again to determine if the discharge location should be School Meadow Brook or a tributary to School Meadow Brook. The 7Q10 flow should be checked, and the permit reissued with metals limits based on the 7Q10 flow only (30Q2 was used in the previous permit). The limits should reflect the fact that the process discharge is intermittent. Batch discharges occur approximately 17 - 25 times per day with the total discharge volume for the day ranging from 900 - 1400 gallons. The cooling water discharge is continuous.

WASTEWATER DISCHARGE FACT SHEET 7.5D

NAME AND ADDRESS: Mobile Service Station
751 Main Street, Walpole

NPDES PERMIT #: MA0033812 MAJOR/MINOR: Minor

NEW/RENEWAL: New EXPIRATION DATE OF LAST PERMIT: NA

LOCATION AND TYPE OF DISCHARGES: Remediated groundwater is discharged to the Neponset River.

PERMITTED/CURRENT VOLUME OF DISCHARGES: An application was submitted in 1992 but no permit has ever been issued. The discharge volume was estimated at 5 gpm in the application.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: NA/unknown

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: Contaminated groundwater is treated with an activated carbon system prior to discharge to the Neponset River.

1994 SITE VISIT: Did not conduct a site visit.

SPECIAL ISSUES/RECOMMENDATIONS: Should verify that the discharge is still active, and that it is in compliance with the emergency exclusion requirements. Unlikely that a permit is required. If the discharge is not still active then the file should be closed out.

WASTEWATER DISCHARGE FACT SHEET 7.6D

NAME AND ADDRESS: Harold E. Willis Water Treatment Plant
Leonard Road, Walpole
(508) 660-7310

NPDES PERMIT #: MA0025488 MAJOR/MINOR: Minor

NEW/RENEWAL: Renewal EXPIRATION DATE OF LAST PERMIT: 9/22/81

LOCATION AND TYPE OF DISCHARGES: Water treatment filter backwash discharge to a wetland that drains to Mine Brook.

PERMITTED/CURRENT VOLUME OF DISCHARGES: There is no flow limit in the permit but the current flow is estimated at 93,000 gpd.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: TSS is limited at 20 mg/l. Little is known of the current water quality since no DMRs have been submitted since 1980. Some effluent data submitted on March 7, 1995 indicates fairly high TSS and settleable solids levels.

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: Filter backwash goes to a settling lagoon prior to discharging to the wetland. Filters are backwashed for 2 - 2.5 hours every day using potable chlorinated water.

1994 SITE VISIT: Site visit has not been conducted yet. Spoke to Rick Mattson of the Walpole Water Department on the phone. He indicated that they will start submitting DMRs.

SPECIAL ISSUES/RECOMMENDATIONS: Should reissue permit with flow, TSS, settleable solids, and chlorine limits. The chlorine limit should reflect the intermittent nature of the discharge. Should also consider general permit coverage.

WASTEWATER DISCHARGE FACT SHEET 7.7D

NAME AND ADDRESS: Hollingsworth & Vose Co.
112 Washington Street, East Walpole

NPDES PERMIT #: MA0004570 MAJOR/MINOR: Major

NEW/RENEWAL: New EXPIRATION DATE OF LAST PERMIT: NA

LOCATION AND TYPE OF DISCHARGES: Proposed discharge of process wastewater to the Neponset River just below the Hollingsworth & Vose dam. This discharge is currently tied into the local sanitary sewer system, which is connected to the MWRA system. There is any existing discharge of backwash from the intake filter to the Neponset River.

PERMITTED/CURRENT VOLUME OF DISCHARGES: Process water: 0.7 MGD, Backwash water: 0.004 MGD

RECEIVING STREAM 7Q10: 1.38 cfs

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY:

Proposed effluent limits for process water: BOD & TSS = 20 mg/l avg. monthly and weekly, 30 mg/l max. daily, settleable solids = 0.1mg/l avg. weekly, 0.3 mg/l max. daily, phosphorous = 0.1 mg/l avg. monthly, zinc = 38.2 ug/l avg. monthly, 42.2 max. daily, LC_{50} = 100%, C-NOEC = 25%

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: This facility manufactures specialty papers (gaskets). Paper making process involves the dispersal of natural and synthetic fibers/fillers in water with latex chemicals added. Zinc is used in the process. The slurry is vulcanized onto a conventional paper machine. The existing pretreatment plant will be upgraded to advanced treatment, prior to discharge of the process wastewater to the Neponset River; this is scheduled for completion by late 1996.

1994 SITE VISIT: A site visit of the facility was conducted by EPA as part of the permit issuance process. The tour of the facility included the pretreatment system and the location of the proposed advanced treatment plant.

SPECIAL ISSUES/RECOMMENDATIONS: This constitutes a new discharge and requires stringent discharge limits to ensure that the discharge will not contribute to existing water quality problems. The limits are based in part on a water quality model developed by the company's consultant. The model will need to be updated to reflect recent water quality data collected by EPA and DEP as part of the Neponset River basin study.

WASTEWATER DISCHARGE FACT SHEET 7.8D

NAME AND ADDRESS: Bird Roofing Co.
1077 Pleasant Street, Norwood
(508) 551-0656

NPDES PERMIT #: MA0003531 MAJOR/MINOR: Minor

NEW/RENEWAL: Renewal EXPIRATION DATE OF LAST PERMIT: 5/1/80

LOCATION AND TYPE OF DISCHARGES: Outfall 001 discharges process wash water to the Neponset River; outfall 002 discharges non-contact cooling water and storm water to the river.

PERMITTED/CURRENT VOLUME OF DISCHARGES: Outfall 001 permitted volume is 300,000 gpd and a 1993 Administrative Order from EPA limits outfall 002 to a volume of 30,000 gpd. Actual flows at 001 range from 20,000 - <100,000 gpd and at 002 >50,000 gpd.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY:

	DMR Data
Outfall 001	Outfall 001
TSS = 90 lbs/day avg.	TSS = 2 to 6 lbs/day
Temperature = 90° F max.	Temperature = 83° F max.
Outfall 002	Outfall 002
Temperature = 92° F max.	Temperature = 83° F max.

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: This company makes asphalt roofing shingles at an approximate 45 acre site. A separate but integral rock crushing operation crushes/grinds the stone down to sand size pieces to be used on the surface of the shingles. The cooling water goes to a settling lagoon prior to discharging to the Neponset River. Storm water and cooling water from the rock crushing operation are discharged directly to the Neponset River. A detention basin is being put in to provide treatment for this discharge in accordance with a 1993 EPA administrative order.

1994 SITE VISIT: The process effluent appeared cloudy and produced a plume in the Neponset River. The Granule Plant cooling water discharge appeared clear. At least six storm water outfall locations were inspected. None were discharging at the time of the inspection. Five of the outfalls discharge directly to the Neponset without any detention. There is one detention basin in the middle of the property that collects runoff from approximately 50% of the property. Large quantities of stone and waste granules (off-spec) are stored on the Granule Plant property with direct exposure to the weather.

SPECIAL ISSUES/RECOMMENDATIONS: Permit should be reissued with updated flow limits. A TSS concentration based limit, and possibly a turbidity limit, should be included for outfall 001. A TSS limit should be included for outfall 002. The standard pollution prevention/best management practices language should be included for the storm water discharges as well as TSS monitoring requirements.

WASTEWATER DISCHARGE FACT SHEET 7.9D

NAME AND ADDRESS: Gibbs Service Station
469 Walpole Street, Norwood

NPDES PERMIT #: MA0034029 MAJOR/MINOR: Minor

NEW/RENEWAL: New EXPIRATION DATE OF LAST PERMIT: NA

LOCATION AND TYPE OF DISCHARGES: Groundwater remediation discharge to Hawes Brook.

PERMITTED/CURRENT VOLUME OF DISCHARGES: No permit has ever been issued and the current discharge volume is unknown.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: NA/unknown

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: Unknown

1994 SITE VISIT: White cement building, approximately 15' by 12', was closed and locked with no consultant/contact name on building.

SPECIAL ISSUES/RECOMMENDATIONS: Should verify that the discharge is still active and that it is in compliance with emergency exclusion requirements. Unlikely that a permit is necessary. If the discharge is not still active then the file should be closed out.

WASTEWATER DISCHARGE FACT SHEET 7.10D

NAME AND ADDRESS: Factory Mutual Engineering
1151 Boston-Providence Highway, Norwood
(508) 255-4320

NPDES PERMIT #: MA0003638 MAJOR/MINOR: Minor

NEW/RENEWAL: Renewal EXPIRATION DATE OF LAST PERMIT: 6/4/83

LOCATION AND TYPE OF DISCHARGES: Intermittent discharge from fire fighting safety equipment testing to a swale which drains to the Neponset River.

PERMITTED/CURRENT VOLUME OF DISCHARGES: The permitted volume is no longer applicable since operations have changed significantly. The current discharge is intermittent, and is estimated at several hundred gallons per day.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: Permitted limits are no longer applicable and there is no data on current effluent quality.

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: The facility mainly serves as an administrative support office (several hundred employees) for a larger research office in Rhode Island. The company develops/manufactures firefighting safety systems involving sprinkler release heads and gaskets. In a building on-site this equipment is tested in small scale lab conditions by setting various materials on fire and then dousing them. The test waters are discharged untreated into an adjacent swale.

1994 SITE VISIT: Testing is infrequent.

SPECIAL ISSUES/RECOMMENDATIONS: A new application should be submitted and a permit issued that limits solids and controls the discharge of fire retardant chemicals. This is not a high priority relative to other Neponset River Basin discharges.

WASTEWATER DISCHARGE FACT SHEET 7.11D

NAME AND ADDRESS: Mobil Service Station
971 Providence Highway, Norwood
(508) 381-4023

NPDES PERMIT #: MA0032905 MAJOR/MINOR: Minor

NEW/RENEWAL: New EXPIRATION DATE OF LAST PERMIT: NA

LOCATION AND TYPE OF DISCHARGES: Remediated groundwater discharged to a stormdrain to the Neponset River.

PERMITTED/CURRENT VOLUME OF DISCHARGES: Draft application was submitted in 1989 but was never finalized and a permit was never issued. The draft application estimated a discharge volume of 8.25 gpm.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: NA/unknown

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: Contaminated groundwater is treated with an activated carbon system.

1994 SITE VISIT: No one was available to conduct a site visit. The treatment system is housed in a 20' by 20' cement building. The treatment system is operated by Groundwater Technology (508 769-7602).

SPECIAL ISSUES/RECOMMENDATIONS: Should verify that the discharge is still active, that it is operating under an emergency exclusion, and that it is in compliance with the emergency exclusion requirements. Unlikely that a permit is necessary. If the discharge is not still active then the file should be closed out.

WASTEWATER DISCHARGE FACT SHEET 7.12D

NAME AND ADDRESS: Sunoco Service Station
960 Providence Highway, Norwood
(508) 392-3030

NPDES PERMIT #: MA0034312 MAJOR/MINOR: Minor

NEW/RENEWAL: New EXPIRATION DATE OF LAST PERMIT: NA

LOCATION AND TYPE OF DISCHARGES: Remediated groundwater discharge to a stormdrain to the Neponset River.

PERMITTED/CURRENT VOLUME OF DISCHARGES: An application was submitted in 1993 but a permit was never issued. The application estimates a discharge volume of 10 gpm. Operating under an emergency exclusion issued in 1991.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: NA/unknown

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: Contaminated groundwater is treated with an activated carbon system.

1994 SITE VISIT: The treatment system is operated by Groundwater Technology (508 769-7602).

SPECIAL ISSUES/RECOMMENDATIONS: Should verify that the discharge is in compliance with the emergency exclusion requirements. Unlikely that a permit is necessary.

WASTEWATER DISCHARGE FACT SHEET 7.13D

NAME AND ADDRESS: Grant Gear
921 Providence Highway, Norwood

NPDES PERMIT #: MA0029262 MAJOR/MINOR: Major

NEW/RENEWAL: Renewal EXPIRATION DATE OF LAST PERMIT: 9/28/95

LOCATION AND TYPE OF DISCHARGES: Storm water discharge to Meadow Brook.

PERMITTED/CURRENT VOLUME OF DISCHARGES: Flow is not limited and the current flow is unknown.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: Limits are included in the permit for oil and grease (15 mg/l max) and TSS (60 mg/l max) and monitoring is required for metals, PCBs, dioxin, trichloroethylene, bromochloromethane, chlorobenzene, and fecal coliform. A best management practices (BMP) plan was required within 90 days of issuance of the last permit.

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: The facility is engaged in the manufacture of gears. There is currently no process wastewater discharge, however, past industrial activities by the previous owner caused accumulation of contaminants in subsoils and groundwater. The drainage system and the brook are also contaminated. The site is a federal superfund site.

1994 SITE VISIT: The company was not very cooperative so a tour of the grounds was taken without a representative of the company. There are numerous groundwater testing wells throughout the property. Meadow Brook flows through the extreme north end of the property. There was no discharge the day of the site visit. There was a detectable sewage smell in the brook. We were referred to Stephan Lemoine of Certified Engineering (617 337-7887) for information on the storm water management plan.

SPECIAL ISSUES/RECOMMENDATIONS: The monitoring data and the BMP plan should be reviewed prior to reissuing this permit.

WASTEWATER DISCHARGE FACT SHEET 7.14D

NAME AND ADDRESS: Plymouth Rubber Company
104 Revere Street, Canton
(617) 828-0220

NPDES PERMIT #: MA0000884 MAJOR/MINOR: Major

NEW/RENEWAL: Renewal EXPIRATION DATE OF LAST PERMIT: 6/30/95

LOCATION AND TYPE OF DISCHARGES: Eight non-contact cooling water (nccw) discharges and storm water to the East Branch of the Neponset River. The nccw discharges go to two outside culverts of the three underground culverts that convey the East Branch under Plymouth Rubber's property.

PERMITTED/CURRENT VOLUME OF DISCHARGES: The permitted nccw flows are 2.6 MGD avg. and 3.6 MGD max. Actual flows range from 2.3 - 2.6 MGD.

RECEIVING STREAM 7Q10: 3.6 cfs

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY:

Temperature = 83° F max.
TSS = 50/100 mg/l avg/max
Copper, lead, and zinc = monitor 2/yr

DMRs
Temperature = 79° F max.
TSS is very low

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: The company formerly produced diversified rubber and plastics products and was the leading world supplier for rubber bands. Currently they produce electrical wrap tape only. Many buildings are now vacant. The cooling water source is the East Branch and no chemical additives are used. There is no treatment of the discharges.

1994 SITE VISIT: There was evidence of the need for storm water management controls throughout the property. The upstream impoundment above the Plymouth Rubber dam had heavy algal growth. For nine months of the year some of the East Branch flow is routed around the facility through a Corps of Engineers flood control channel. For three months of the year all of the flow goes through the three culverts under the Plymouth Rubber property. Monitoring is done at the mouth of the culverts reportedly due to access difficulties for monitoring the outfalls separately. The company was requested to send an update on cooling water discharge locations, volumes, and sampling access points.

SPECIAL ISSUES/RECOMMENDATIONS: The company submitted information on discharge locations and volumes but not on sampling access points. The permit should be reissued with the temperature limit required to be met at the individual discharge points. The TSS limit and the metals monitoring requirements could be eliminated. The permit should include the standard pollution prevention/best management practices language for storm water discharges as well as a TSS monitoring requirement.

WASTEWATER DISCHARGE FACT SHEET 7.15D

NAME AND ADDRESS: Shield Packaging Inc.
21 University Road, Canton
(508) 828-0286

NPDES PERMIT #: MA0035629 MAJOR/MINOR: Minor

NEW/RENEWAL: New EXPIRATION DATE OF LAST PERMIT: NA

LOCATION AND TYPE OF DISCHARGES: Remediated groundwater discharged to a wetland channel leading to the East Branch of the Neponset River.

PERMITTED/CURRENT VOLUME OF DISCHARGES: An application was submitted in 1993 but no permit has ever been issued. The current discharge volume ranges from 18,000 - 30,000 gpd.

RECEIVING STREAM 7Q10: 3.6 cfs

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: The major contaminant is 111 trichloroethane and effluent concentrations are less than 1 mg/l.

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: The company currently produces packaging materials. Groundwater contamination is from past practices at the facility. The treatment system consist of carbon filtration and air stripping. The system has been operating under an emergency exclusion for 24 hrs/day since September 1992 and is expected to operate for another 8 years.

1994 SITE VISIT: The final effluent looked clear. A review of recent monitoring reports indicates greater than 99% removal of contaminants. Storm water flow from the parking lot appears to be well managed through the use of grass swales.

SPECIAL ISSUES/RECOMMENDATIONS: Should monitor to ensure continued compliance with the emergency exclusion requirements. Unlikely that a permit is necessary.

WASTEWATER DISCHARGE FACT SHEET 7.16D

NAME AND ADDRESS: Devaney Oil Company (Formerly Hughes Oil)
111 River Street, Dedham
(617) 323-8383

NPDES PERMIT #: MA0030848 MAJOR/MINOR: Minor

NEW/RENEWAL: New EXPIRATION DATE OF LAST PERMIT: NA

LOCATION AND TYPE OF DISCHARGES: Truck wash water drains off property into River Street storm drain which discharges to Mother Brook.

PERMITTED/CURRENT VOLUME OF DISCHARGES: A 1986 application was submitted but was never finalized and a permit has never been issued.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: NA/unknown

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: Approximately six oil delivery trucks are washed once every week or two using commercial detergents. The washwater flows down the asphalt driveway and into a stormdrain on River Street.

1994 SITE VISIT: Company indicated that they would look into ceasing the washing of trucks on-site and use a commercial wash instead. The company would prefer this over dealing with the state and federal permit process.

SPECIAL ISSUES/RECOMMENDATIONS: Should get a letter from Devaney Oil indicating that they no longer wash trucks on-site and then closeout the file.

WASTEWATER DISCHARGE FACT SHEET 7.17D

NAME AND ADDRESS: L.E. Mason Co. (Formerly Magnesium Casting)
98 Business Street, Hyde Park
(617) 361 -1710

NPDES PERMIT #: MA0003999 MAJOR/MINOR: Minor

NEW/RENEWAL: Renewal EXPIRATION DATE OF LAST PERMIT: 9/28/84

LOCATION AND TYPE OF DISCHARGES: Non-contact cooling water discharge to Mother Brook.

PERMITTED/CURRENT VOLUME OF DISCHARGES: Previous permit was for two outfalls but only one outfall is still used. The permitted volume is 0.11 MGD and the actual volume is unknown.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: The discharge temperature is limited at 70° F. The actual temperature is unknown.

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: Facility produces small plumbing and electrical parts using a variety of die cast molds. All process wastewaters are discharged to MWRA. Non-contact cooling water is used to cool degreaser equipment in the mold heating process.

1994 SITE VISIT: The current discharge is from a 3/4 inch pipe at the rate of several gpm. No flow measurements are taken. The pH and temperature is measured quarterly by Briggs Lab, Rockland, MA, but it is not clear where the data is submitted. The discharge duration is approximately 16 hrs/day for 5 days/week. The company has submitted a Notice of Intent to EPA for non-contact cooling water general permit coverage. The discharge is expected to be eliminated in the near future and the company will notify EPA when this occurs.

SPECIAL ISSUES/RECOMMENDATIONS: Should continue general permit coverage until discharge is terminated. [Received a call from the company on 3/1/95 indicating the discharge has been eliminated and they will send DEP and EPA a letter.]

WASTEWATER DISCHARGE FACT SHEET 7.18D

NAME AND ADDRESS: James G. Grant Recycling Facility
28 Wolcott Street, Readville

NPDES PERMIT #: None MAJOR/MINOR: NA

NEW/RENEWAL: New EXPIRATION DATE OF LAST PERMIT: NA

LOCATION AND TYPE OF DISCHARGES: Storm water (however, all storm water is contained on-site according to the company).

PERMITTED/CURRENT VOLUME OF DISCHARGES: No permit has ever been issued and current storm water volumes are unknown.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: NA/unknown

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: The facility has a vast collection of salvage materials in various stages of processing covering a 10 acre site. There are no storm water controls.

1994 SITE VISIT: All storm water either soaks into the ground immediately or pools on-site. There were no obvious storm water conduits leading off site. A Boston Water and Sewer Commission (BWSC) storm drain goes under the property, however, according to the company contact there are no storm water connections from the facility. There was a significant flow discharging from the BWSC pipe to the Neponset River even though it had not rained in several days. The discharge was relatively clear. There was a significant amount of trash behind an adjacent apartment building but it was unclear if it was from the recycling facility. The site is fenced and there is approximately a 100 ft. wide buffer strip between the facility and the Neponset River.

SPECIAL ISSUES/RECOMMENDATIONS: This facility should be visited on a rainy day to determine if a storm water permit is necessary. In 1991 the facility submitted a DEIR to MEPA covering plans for an expansion of the facility. The plans included the construction of storm water retention berms with associated outlets. If the expansion is ever implemented a storm water permit will be necessary.

WASTEWATER DISCHARGE FACT SHEET 7.19D

NAME AND ADDRESS: Milton Academy
325 Randolph Avenue, Milton

NPDES PERMIT #: MA0034061 MAJOR/MINOR: Minor

NEW/RENEWAL: New EXPIRATION DATE OF LAST PERMIT: NA

LOCATION AND TYPE OF DISCHARGES: Remediated groundwater discharge to O'Hare Pond.

PERMITTED/CURRENT VOLUME OF DISCHARGES: No permit has ever been issued and the current volume of discharge is unknown.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: NA/unknown

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: Unknown

1994 SITE VISIT: No site visit conducted.

SPECIAL ISSUES/RECOMMENDATIONS: Should verify that the discharge is still active and that it is in compliance with emergency exclusion requirements. It is unlikely that a permit is necessary. If the discharge is not still active then the file should be closed out.

WASTEWATER DISCHARGE FACT SHEET 7.20D

NAME AND ADDRESS: Town of Milton, Engineering Department
Town Office Building
525 Canton Avenue, Milton
(617) 696-5731

NPDES PERMIT #: MA0100536 MAJOR/MINOR: Minor

NEW/RENEWAL: Renewal EXPIRATION DATE OF LAST PERMIT: 8/28/91

LOCATION AND TYPE OF DISCHARGES: Ten bypass points in the separate sanitary sewer system discharge to the Neponset River and various tributaries. An eleventh bypass point was recently discovered by DEP. Four of these bypass points were associated with siphons and have since been sealed off.

PERMITTED/CURRENT VOLUME OF DISCHARGES: Discharge volumes are not limited in the current permit. A recent permit application submitted by Milton indicates that discharge flows range from 0.01 MGD - 0.3 MGD. It should be noted that these figures represent average daily flows but the discharges are actually intermittent and are associated with wet weather and/or high groundwater.

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: The permit prohibits all bypasses, unless they are in accordance with the bypass provisions, and requires that each incident of overflow be reported. Milton has failed to comply with the reporting requirements of the permit.

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: All of the remaining bypass points are associated with pump stations and all, with the possible exception of the one recently discovered, have backup power sources. An MWRA relief sewer that is currently under construction should reduce the occurrences of bypasses but it is unclear to what extent. The town has made little progress in reducing I/I despite a 1986 consent order.

1994 SITE VISIT: There was evidence of past bypasses at each location. The Pleasant Street bypass appears to be subject to blockages and may be more active than others during the year. The Libby Road bypass was recently equipped with a chlorination system. The system is unlikely to be effective in disinfecting bypasses without resulting in a toxic discharge. The town was asked to refrain from adding chlorine to any bypasses.

SPECIAL ISSUES/RECOMMENDATIONS: The town has now submitted an application but it is more than three years late. The town has a long history of non-compliance with state enforcement actions. The bypasses are illegal in that they are discharges from a separate sanitary sewer system as a result of excessive I/I. A schedule for eliminating the bypasses is needed. It is not necessary to reissue the permit.

WASTEWATER DISCHARGE FACT SHEET 7.21D

NAME AND ADDRESS: US Army National Guard Armory
70 Victory Rd., Dorchester
(617) 944 0500

NPDES PERMIT #: MA0030252 MAJOR/MINOR: Minor

NEW/RENEWAL: New EXPIRATION DATE OF LAST PERMIT: NA

LOCATION AND TYPE OF DISCHARGES: Vehicle washwater discharged to below ground catchment which discharges to the Boston Water and Sewer Commission storm sewer and ultimately to Dorchester Bay.

PERMITTED/CURRENT VOLUME OF DISCHARGES: NA/Intermittent

RECEIVING STREAM 7Q10: To be calculated.

SUMMARY OF PERMITTED LIMITS AND CURRENT EFFLUENT QUALITY: Permit applied for in 1986 but a permit was never issued. Current effluent quality is unknown.

BRIEF DESCRIPTION OF FACILITY PROCESS/TREATMENT: Military truck washing operation adjacent to the main vehicle maintenance building which was completed in 1992. The washwater drains to a below ground catchment basin which has an oil/grease separator. The basin drains to the storm sewer via a 6" outlet located near the top and is pumped out annually by a licensed hauler. Only biodegradable/phosphorous free soap is used.

1994 SITE VISIT: The washing stall is intermittently used and was not in use at the time of visit.

SPECIAL ISSUES/RECOMMENDATIONS: An application should be submitted and a permit should be issued that limits solids and oil and grease. This is not a high priority relative to other discharges in the Neponset River Basin.

APPENDIX E
THE NPDES STORM WATER PERMIT PROGRAM

THE NPDES STORM WATER PERMIT PROGRAM

The first phase of the U.S. Environmental Protection Agency's (USEPA) National Pollutant Discharge Elimination System (NPDES) requirements for storm water discharges was implemented in 1992. Phase one of the NPDES Storm Water Permits Program provides a mechanism for establishing appropriate controls for certain categories of storm water discharges associated with industrial activity, including construction sites of five acres or more and discharges from municipal separate storm sewer discharges located in municipalities with a population of 100,000 or more. In Massachusetts, only Boston and Worcester are included in this category.

The Federal Storm Water Permit Program

The USEPA is responsible for issuing NPDES permits in Massachusetts, as Massachusetts has not assumed NPDES program delegation. The NPDES permit program is administered by USEPA Region I, with the Massachusetts Department of Environmental Protection (DEP) certifying permit conditions according to the requirements of Section 401 of the Federal Clean Water Act. In addition, DEP signs each NPDES permit, thus creating separate state and federal permits which provide equal regulatory and enforcement authority for both agencies. The Massachusetts Storm Water Permit Program, and its requirements, is discussed in further detail below.

Table E.1 lists the facilities with storm water discharges associated with industrial activity covered by the NPDES Storm Water Permit Program. All storm water associated with these industrial activities that culminates in a point source which discharges directly to a Water of the United States or to a separate storm water sewer which in turn discharges to a Water of the United States is required to obtain permit coverage.

There are three permit application options for storm water discharges associated with industrial activity. The first option is to file a Notice of Intent (NOI) to be covered under the USEPA general storm water permit. The second was to participate in a group application by facilities that have similar industrial operations, waste streams, or other characteristics. The third option is to file an application for an individual permit.

It should be noted that the Transportation Act of 1991 provided an exemption from the storm water permit requirements for certain industrial activities owned or operated by municipalities with a population of less than 100,000. Only airports, powerplants, and uncontrolled sanitary landfills owned by these municipalities are required to apply for a storm water permit. The Act also revised the group application deadlines for these facilities; the deadlines for submitting Part 1 and Part 2 of the group application were May 18, 1992 and May 17, 1993, respectively.

Storm Water General Permit

To address the pollutant problem of storm water discharges, and to ease the administrative burden on the USEPA and the permittees, the USEPA has issued General Permit for construction sites of five (5) acres or more, and another for storm water associated with industrial activity. These permits were promulgated by USEPA under the authority of the Clean Water Act and were published in the Federal Register on September 25, 1992 (47 CFR 44412 and 47 CFR 44438). The majority of storm water discharges associated with industrial activity can be covered by USEPA's General Permits. Storm water discharges associated with industrial activities that <u>cannot</u> be authorized by the General Permit include those:

- With an existing effluent guideline for storm water (see Category i in Table E.1);

TABLE 8.1E. 1994 NEPONSET RIVER BASIN SURVEY. Storm Water Discharge Associated With Industrial Activity.

The term "Storm Water Discharge Associated With Industrial Activity" includes the discharge from any conveyance which is used for collecting and conveying storm water and which is directly related to manufacturing, processing or raw materials storage areas at an industrial plant. The term does not include discharges from facilities or activities excluded from the NPDES program under 40 CFR Part 122.

For the following industrial categories (i) through (x), the term includes, but is not limited to, storm water discharges from industrial plant yards; immediate access roads and rail lines used or traveled by carriers of raw materials, manufactured products, waste material, or by-products used or created by the facility; material handling sites; refuse sites; sites used for the application or disposal of process waste waters (as defined at 40 CFR 401); sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas (including tank farms) for raw materials, and intermediate and finished products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to storm water.

For the following industrial category (xi), the term includes only storm water discharges from all the areas (except access roads and rail lines) that are listed in the previous sentence where material handling equipment or activities, raw materials, intermediate products, final products, waste material, by products, or industrial machinery <u>are exposed to storm water</u>.

As used here, material handling activities include the: storage, loading and unloading, transportation, or conveyance of any raw material, intermediate product, finished product, by-product or waste product.

The term "Storm Water Discharge Associated With Industrial Activity" excludes areas located on plant lands separate from the plant's industrial activities, such as office buildings and accompanying parking lots as long as the drainage from the excluded areas is not mixed with storm water drained from the above described areas.

The following categories of facilities are considered to be engaging in "industrial activity":

Category i **Industries for which National Effluent Guidelines have been promulgated for storm water**

GUIDELINES	**FACILITY TYPE**
40 CFR 411	Cement Manufacturing
40 CFR 412	Feedlots
40 CFR 418	Fertilizer Manufacturing
40 CFR 419	Petroleum Refining
40 CFR 422	Phosphate Manufacturing
40 CFR 423	Steam Electric Power Generation
40 CFR 434	Coal Mining
40 CFR 436	Mineral Mining & Processing
40 CFR 440	Ore Mining & Dressing
40 CFR 443	Asphalt

TABLE 8.1E (cont.)

Category ii	Facilities with Standard Industrial Codes (SIC) 24 (except 2434), 26 (except 265 and 267), 28 (except 283), 29, 311, 32 (except 323), 33, 3441, and 373
SIC CODE	**FACILITY TYPE**
24	Lumber & Wood Products (except Furniture)
26	Paper & Allied Products
28	Chemical & Allied Products
29	Petroleum Refining & Related Industries
311	Leather Tanning & Finishing
32	Stone, Clay, Glass, & Concrete Products
33	Primary Metal Industries
3441	Fabricated Structural Metal
373	Ship & Boat Building & Repairing
2434	Wood Kitchen Cabinets
265	Paperboard Containers & Boxes
267	Converted Paper & Paperboard Products (except Containers & Boxes)
283	Drugs
323	Glass Products Made of Purchased Glass
Category iii	**Facilities with Standard Industrial Codes 10-14**
SIC CODE	**FACILITY TYPE**
10	Metal Mining
12	Coal Mining
13	Oil and Gas Extraction
14	Mining and Quarrying of non-metallic minerals (except Fuels)
Category iv	**Hazardous Waste Treatment, Storage, or Disposal Facilities, including those that are operating under interim status or a permit under Subtitle C of RCRA**
Category v	**Landfills, Land Application Sites, and Open Dumps that receive or have received and industrial wastes including those that are subject to regulation under Subtitle D of RCRA**
Category vi	**Facilities Involved in the Recycling of Materials, including Metal Scrap Yards, Battery Reclaimers, Salvage Yards, and Automobile Junkyards, Including but Limited to those classified under Standard Industrial Codes 5015 and 5093**
SIC CODE	**FACILITY TYPE**
5015	Motor Vehicle Parts, Used (Dismantling Motor Vehicles for Scrap)
5093	Scrap and Waste Materials
Category vii	**Steam Electric Power Generating Facilities Including Coal Handling Sites**

TABLE 8.1E (cont.)

Category viii	**Transportation Facilities with Standard Industrial Codes 40, 41, 42 (except 4221-25), 43, 44, 45, and 5171 which have Vehicle Maintenance Shops, Equipment Cleaning Operations, or Airport Deicing Operations, only those operations that are either involved in vehicle maintenance, equipment cleaning operations, airport deicing operations, or which are otherwise identified under paragraphs (i)-(vii) or (ix)-(xi) are associated with industrial activity**
SIC CODE	**FACILITY TYPE**
40	Railroad Transportation
41	Local & Suburban Transit & Interurban Highway Passenger Transit
42	Motor Freight Transportation & Warehousing
43	U.S. Postal Service
44	Water Transportation
45	Transportation by Air
5171	Petroleum Bulk Stations & Terminals
Category ix	**Treatment works treating domestic sewage or any other sewage or wastewater treatment device or system, used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage, including land dedicated to the disposal of sewage sludge that are located within the confines of the facility, with a design flow of 1.0 MGD or more, or required to have an approved pretreatment program under 40 CFR 403**
Category x	**Construction activity (except for disturbances of less than five acres of total land area which are not part of a larger common plan of development or sale)**
Category xi	**Facilities where materials are exposed to storm water with Standard Industrial Codes 20, 21, 22, 23, 2434, 25, 265, 27, 283, 285, 30, 31 (except 311), 323, 34 (except 3441), 35, 36, 37 (except 373), 38, 39, and 4221-25**
SIC CODE	**FACILITY TYPE**
20	Food & Kindred Products
21	Tobacco Products
22	Textile Mill Products
23	Apparel & Other Finished Products Made from Fabrics & Similar Materials
2434	Wood Kitchen Cabinets
25	Furniture & Fixtures
265	Paperboard Containers & Boxes
267	Converted Paper & Paperboard Products (except Containers & Boxes)
27	Printing, Publishing, & Allied Industries
283	Drugs
285	Paints, Varnishes, Lacquers, Enamels, & Allied Products

TABLE 8.1E (cont.)

Category xi	Facilities where materials are exposed to storm water with Standard Industrial Codes 20, 21, 22, 23, 2434, 25, 265, 27, 283, 285, 30, 31 (except 311), 323, 34 (except 3441), 35, 36, 37 (except 373), 38, 39, and 4221-25 (continued)
SIC CODE	**FACILITY TYPE**
30	Rubber & Miscellaneous Plastics Products
31	Leather & Leather Products
323	Glass Products Made of Purchased Glass
34	Fabricated Metal Products (except Machinery & Transportation Equipment)
35	Industrial & Commercial Machinery & Computer Equipment
36	Electronic & Other Electrical Equipment & Components (except Computer Equipment)
37	Transportation Equipment
38	Measuring, Analyzing, & Controlling Instruments; Photographic, Medical, & Optical Goods; Watches & Clocks
39	Miscellaneous Manufacturing Industries
4221	Farm Product Warehousing & Storage
4222	Refrigerated Warehousing & Storage
4223	Household Goods Warehousing & Storage
4225	General Warehousing & Storage

[Adapted from: Do I Need An NPDES Permit For Storm Water (USEPA 1993)]

- That are mixed with non-storm water, unless the non-storm water discharges are in compliance with a different NPDES permit or are authorized by these permits;

- With an existing NPDES individual or General Permit for the storm water discharges;

- That are or may reasonably be expected to be contributing to a violation of a water quality standard;

- That are likely to adversely affect a listed or proposed to be listed endangered or threatened species or its critical habitat;

- From inactive mining, or inactive oil and gas operations or inactive landfills occurring on Federal lands where an operator cannot be identified (industrial permit only).

To apply for coverage under the USEPA General Permit, a facility must submit a Notice of Intent (NOI) to receive authorization for the discharge. The NOI is a one page form that requires the following information:

- Street address or latitude/longitude;

- SIC Code or identification of industrial activity;

- Operator's name, address, telephone number, and status as Federal, State, private, public, or other entity;

- Permit number(s) of any existing NPDES permit(s);

- Name of receiving water(s);

- Indication of whether the owner or operator has existing monitoring data quantifying pollutant concentrations for the storm water discharges;

- A certification that a storm water pollution plan has been prepared for the facility (for industrial activities that begin after October 1, 1992).

In addition this information, NOIs for construction sites of five (5) acres or more require:

- An estimate of the project start date and completion dates and estimates of the number of disturbed acres.

Applicants are not required to collect discharge monitoring data in order to submit a NOI. Facilities which discharge to a large or medium municipal separate storm sewer system must also submit signed copies of the NOI to the operator of the municipal system. Operators of construction activities must also submit signed copies of the NOI to local agencies approving sediment and erosion control or storm water management plans under which the construction activity is operating.

For facilities or construction activities which started after October 1, 1992, an NOI is to be submitted at least two days prior to the Commencement of the industrial activity. Existing facilities and construction activities which started before October 1, 1992 were required to submit an NOI by October 1, 1992. To be covered under the USEPA General Permit NOIs must be submitted to the following address:

Storm Water Notice of Intent
P.O. Box 1215
Newington, VA 22122

Copies of the NOI form and the General Permit are found in the September 25, 1992 Federal Register (57 FR 44412 and 57 FR 44438). Copies can also be obtained by calling the USEPA Office of Water Resources Center at (202) 260-7786.

The Pollution Prevention Plan (PPP) is considered to be the most important requirement of the General Permit. Each industrial facility covered by the General Permit must develop a plan, tailored to the site specific conditions and designed with the goal of controlling the amount of pollutants in storm water discharges from the site. Each facility will select a pollution prevention team that will be responsible for developing and implementing a PPP.

The Federal Register notices of the permits detail the components of the PPPs, and outline special PPP requirements for EPCRA (Emergency Planning and Community Right-to-know Act) Section 313 sites and construction sites. PPPs can incorporate other plans, such as Spill Prevention Control and Countermeasure (SPCC) plans, or Best Management Practices (BMP) programs. Copies of **Storm Water Management for Industrial Activities: Developing Pollution Prevention Plan and Best Management Practices** (USEPA-832-R-92-006) or **Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices** (USEPA-832-R-92-005) are available through Office of Water Resources Center at (202) 260-7786, NTIS at (703) 487-4650, and the Education Resource Information Center/Clearinghouse at (614) 292-6717.

The pollution prevention team must ensure that the plant equipment and industrial areas are inspected on a regular basis. At least once a year a comprehensive site compliance evaluation must be conducted. This evaluation includes looking for evidence that pollutants have or could be entering the drainage system, evaluating pollution prevention measures, identifying areas of the plan that can be improved, and reporting on the inspections and the actions taken.

Under the General Permit certain facilities are required to conduct semi-annual monitoring and report the results to USEPA each year; others are required to sample each year and keep the results on file. Specific monitoring requirements and testing parameters for facilities are listed in the General Permit. If a facility can certify that there is no exposure of industrial areas or activities to storm water, they are not required to sample the discharge.

DEP has certified the USEPA General Permit with special conditions; these conditions are discussed below in the Massachusetts Storm Water Permit Program section.

Storm Water Multi-Sector Permit

Under the group application process, similar industrial facilities were allowed to group together and submit a single application for the development of a storm water discharge permit. Group applications included descriptions of industrial activities, material stored outside, best management practices, and storm water sampling data. Representative facilities submitted monitoring data, thus distributing the effort and cost of the application and compliance among the group. The deadlines for submitting Part 1 and Part 2 of the group application were September 30, 1991 and October 1, 1992, respectively, for all industrial activities except those owned or operated by a municipality with a population of less than 250,000. For industrial activities owned or operated by a municipality with a population of less than 250,000 the deadlines were May 18, 1992 and May 17, 1993. Nationwide, approximately 700 groups covering 44,000 industrial facilities are in the group application process.

Using the group application information, USEPA drafted a storm water General Permit covering 29 industrial sectors based on similar industrial activity. These 29 sectors are listed in Table E.2. This draft storm water multi-sector group permit was published in the Federal Register on November 19, 1993 (59 FR 61146).

Once the final multi-sector is issued by USEPA, a NOI must be submitted to gain coverage under the multi-sector permit. Any industrial discharger described by one of the 29 sectors meeting the eligibility provisions of the permit can apply. Excluded from coverage under the multi-sector permit are:

- Unpermitted process wastewater;
- Combined storm water and unpermitted process wastewater;
- Discharges not in compliance with:
    1. Endangered Species Act
    2. National Historic Preservation Act
    3. National Environmental Policy Act.

As with the General Storm Water Permit described above, the pollution prevention plan is the basic storm water control mechanism in the multi-sector permit. All facilities applying for coverage under the multi-sector permit must prepare and implement storm water pollution prevention plans using industry-specific BMPs aimed at controlling known sources of contamination, such as de-icing compounds at airports. EPCRA Section 313 sites have special PPP requirements under the multi-sector permit.

Discharge monitoring is required for 17 high priority industrial sectors, including USEPA Sector #s 1, 3, 5, 6, 7, 11, 12, 13, 14, 15, 18, 19, 20, 22, 23, 28, and 29 (see Table 8.B). Monitoring for these industrial sectors is required because the group application data indicated at least three pollutants above benchmark levels. Quarterly storm water grab samples are required for the 17 sectors in the second and forth year of the permit. The chemical monitoring provisions of the multi-sector permit have been designed to give feedback on the effectiveness of the PPP and to provide an incentive to implement the most effective BMPs. If the 2nd year monitoring data shows that BMPs have reduced

TABLE 8.2E. 1994 Neponset River Basin Survey. Industries Covered by USEPA'S Storm Water Multi-Sector Permit

USEPA SECTOR #	FACILITY TYPE
1	Timber Products
2	Paper & Allied Products
3	Chemical & Allied Products
4	Asphalt Paving & Roofing Materials & Lubricant Manufacturers
5	Glass, Clay, Cement, Concrete, & Gypsum Products
6	Primary Metals
7	Metal Mining (Ore Mining & Dressing)
8	Coal Mines & Coal Mining-Related Facilities
9	Oil & Gas Extraction
10	Mineral Mining & Processing
11	Hazardous Waste Treatment, Storage, or Disposal
12	Landfills & Land Application Sites
13	Automobile Salvage Yards
14	Scrap & Waste Material Processing & Recycling
15	Steam Electric Power Generating, Including Coal Handling Areas
16 & 17	Motor Freight Transportation, Passenger Transportation, Rail Transportation, & U.S. Postal Service Transportation
18	Water Transportation Facilities that have Vehicle Maintenance Shops &/or Equipment Cleaning Operations
19	Ship & Boat Building or Repair Yards
20	Vehicle Maintenance Areas, Equipment Cleaning Areas, or Deicing Areas Located at Air Transportation Facilities
22	Treatment Works
23	Food & Kindred Products
24	Textile Mills, Apparel, & Other Fabric Products
25	Wood & Metal Furniture & Fixture Manufacturing
26	Printing & Publishing
27	Rubber, Miscellaneous Plastic Products, & Miscellaneous Manufacturing
28	Leather Tanning & Finishing
29	Fabricated Metal Products
30	Facilities That Manufacture Transportation Equipment, Industrial, or Commercial Machinery
31	Facilities That Manufacture Electronic & Electrical Equipment & Components, Photographic & Optical Goods

[Adapted from: Storm Water Multi-Sector General Permit - Press Package (USEPA 1993)] pollutant levels to below the benchmarks, further sampling is not required.

Storm Water Individual Permit

Operators of facilities with storm water discharges associated with industrial activity who did not participate in a group application and who are not included for coverage under the General Permit must submit an individual storm water permit application. The individual permit application process is considerably more lengthy than the General Permit NOI. The **Guidance Manual For The Preparation of NPDES Permit Applications for Storm Water Discharges Associated with Industrial Activity** (Order #PB92199058), available from NTIS, (703) 487-4650, is recommended as a good reference for operators who are preparing individual storm water permit applications. To complete the monitoring data required by the application, **NPDES Storm Water Sampling Guidance Document**, available from the USEPA Office of Water Resources Center at (202) 260-7786, is recommended. As with the General Permit, the deadline for an individual permit application for existing facilities was October 1, 1992. For new industrial discharges the application deadline is 180 days prior to the commencement of the new discharge. For construction activities the application deadline is 90 days prior to the date construction begins. An individual storm water permit for a facility will be developed based on the information received in the application from that facility.

The Massachusetts Storm Water Permit Program

The Massachusetts Department of Environmental Protection's (DEP) Surface Water Discharge Permit Program regulations (314 CMR 3.00) address storm water contamination and require discharge permits to control the amount of pollutants discharged from storm water systems. Section 3.04(2)(a)(1) defines storm water discharges as "...a conveyance or system of conveyances primarily used for collecting and conveying storm water runoff... and which discharges storm water contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, or oil and grease...(or) located in an industrial plant or in plant associated areas...". Such storm water discharges must have a current, valid permit to discharge into waters of the Commonwealth. The Director of the Office of Watershed Management (OWM) may designate other discharges as "storm water discharges" on a case-by-case basis if it is determined that the discharge is or may be a significant contributor of pollution..." This regulatory authority allows DEP to require storm water permits where appropriate.

As stated above, the NPDES permit program in Massachusetts is administered by USEPA Region I, with DEP certifying permit conditions according to the requirements of Section 401 of the Federal Clean Water Act. DEP reviews the conditions of each NPDES permit and certifies the permit unconditionally or with special conditions, if appropriate. In addition, DEP signs each NPDES permit, thus creating separate state and federal permits which provide equal regulatory and enforcement authority for both agencies.

In order to facilitate the administration of the Storm Water Permit Program in Massachusetts, DEP's certification of the USEPA General Permit was published in the Federal Register on September 25, 1992. Under DEP's certification of the USEPA General Permit, storm water outfalls will be designed to eliminate direct discharge and minimize the contamination. New discharge outfall pipes shall be designed to be set back from the receiving water. Existing discharge outfall pipes shall be set back from the receiving water when the system is modified. A receiving swale, infiltration trench or basin, filter media dikes or other BMPs should be used to minimize erosion, maximize infiltration, and otherwise improve water quality prior to discharge. In addition, the conditions of DEP's certification contain provisions to ensure the protection of water segments designated as Outstanding Resource Waters (ORW), including coastal water segments designated as Areas of Critical Environmental Concern (ACEC).

Public water supplies, tributaries to public water supplies, and certain other waters with outstanding socio-economic, recreational, ecological and/or aesthetic values are designated as ORWs in the Massachusetts Surface Water Quality Standards (WQS) (314 CMR 4.00). The provisions of 314 CMR 4.00 are specifically designed to protect and provide safeguards and regulatory control for ORWs. These regulations prohibit discharges which are likely to cause degradation due to runoff and other pollutant inputs. Section 4.04(3) of the WQS contains the antidegradation provisions which prohibit the discharge of new or increased discharge to an ORW, unless the discharge is determined by the Director "...to be for the express purpose and intent of maintaining or enhancing the resource water for its intended use...". The antidegradation provisions also require that existing discharges to ORW's shall cease and be diverted to a POTW (publicly owned treatment works). If the connection to a POTW is not reasonably available or feasible, then the existing discharge must be provided with the highest and best practical method of treatment determined by DEP as necessary to protect and maintain the ORW.

New or increased storm water discharges to ORWs are not allowed under the Storm Water Permit Program in Massachusetts unless they have met the provisions of 314 CMR 4.04(3). If a facility has met these provisions, then the facility may apply for coverage under USEPA's General Permit (or an individual or multi-sector permit). According to DEP's certification of the General Permit, eligible new or increased discharge must be set back from the receiving water, and BMPs must be utilized to protect and maintain the ORW. It should be noted that new or increased discharges to <u>coastal</u> ACECs are <u>not</u> allowed under the Department's certification of the General Permit.

Existing discharges to ORWs must also meet the setback provisions and utilize BMPs to protect the receiving water. DEP's certification of USEPA's General Permit emphasizes the requirements of 314 CMR 4.04 by requiring that:

> "All discharges to Outstanding Resource Waters authorized under this permit must be provided the best practical method of treatment to protect and maintain the designated use of the outstanding resource."

Discharges to ORWs applying for coverage under the General Permit must submit a copy of the NOI, a fee transmittal form, and $50.00 fee to DEP, P.O. Box 4062, Boston, MA, 02108, in addition to submitting the NOI to USEPA. NOI's submitted to DEP will be reviewed to ensure that the discharge is in compliance with the certification provision.

DEP is developing a program to review the storm water systems and ensure that the permit conditions are achieved. This program would include reviewing of storm water management plans to determine if additional control measures are needed.

Compliance and Enforcement

DEP has the ability to take enforcement action against dischargers who are in violation of the storm water regulations or who circumvent the regulations. Enforcement is initiated by DEP regional offices and often involves the State Attorney General's Office.

DEP will take a proactive approach to storm water control, that is to inform all parties of the permit requirements and to institute a program to review the compliance with storm water permit requirements and the implementation of BMPs as required. Storm water pollution preventions plans are required to be developed by the permit, and will be reviewed as part of the OWM watershed approach to permitting.

DEP will utilize the USEPA General Permit for storm water control and to require individual NPDES storm water permits when conditions are such that the General Permit will not sufficiently control the impact of storm water. The storm water NPDES permits do not directly address DEP wetland regulations; however, those regulations, when properly applied, contribute to the overall control of water quality and resource protection. DEP views the wetland regulations as complementary to the storm water permit program.

APPENDIX F

TABLE #	CONTENTS
1.1F	Canton River Watershed Watchdogs Action Planning Matrix
1.2F	Canton River Watersed Watchdogs Segment Summaries
1.3F	Draft: Action Planning Matrix; Neponset Estuary
1.4F	Neponset Estuary Priority Chart
1.5F	Mother Brook Coalition Action Planning Matrix
1.6F	Mother Brook Coalition Segment Summaries

TABLE 1.1F. 1994 NEPONSET RIVER BASIN SURVEY. Canton River Watershed Watchdogs Action Planning Matrix.

ACTION PLANNING MATRIX
IMMEDIATE ACTION: Reporting Problems to Officials *From their priority findings, groups create a list of problems that must be reported. Because these problems directly threaten the stream, reporting to appropriate local or state agencies is usually a first step. Reporting can be accomplished by a letter, by a visit or by having officials attend a meeting of the group.* <u>Report to DEP or local boards</u> 1)running pipe across from Aquaduct • contains a stream • student found high coliform counts below it • DEP coliform counts below area 2) mystery pipe in Forge Pond 3)blue toilet paper in segment 4 4)mill tail race: slow water and hookup from condo. (CC has acted on this.) 5)asphalt swales from parking lots <u>Work with DPW</u> 1)to learn about BMPs on their land <u>Reassess and report if necessary</u> 1)erosion
IMMEDIATE ACTION: Short Term Projects *From their priority findings, groups plan some short term projects that can be accomplished in the next few months. For some groups, these projects can be the first step of their long term action. These projects involve people immediately in stream protection.* 1) Status of East River Report • Summary • Introduction • Section reports 2)Town wide clean up 3)Increase membership from East Branch and tributaries 4)Evaluate & support Ground water protection warrant article if protects river 5. Follow East-West Road proposal and look at environmental effects on Beaver Meadow Brook and East Branch (Canton River) 6)Learn more about oil spill clean up and effect on habitat 7)Participate in Canton Rotary River Festival May 21. 8)Storm drain painting stencils to decrease illegal dumping (Scout project?)

TABLE 1.1F (cont.)

LONG RANGE PLANNING AND ACTION:
These activities can be the glue that holds a group together. They are the major issues on which a group chooses to focus.
A. Join Adopt-A-Stream Program

B. Protect and restore water quality
1)work with schools, Riverways, NRCS to create a water quality monitoring program to establish where and if problems exist in mainstem and tributaries

2)action to remedy problems found

C. Promote Public Awareness of River

1)educate landowners and residents about stewardship

2)consider storm drain stenciling project

3)clean ups

4)support town board proposals for river improvement

5)river festivals etc.

D. Promote recreational access

E. Advocacy

1)support efforts of Town officials to enhance and protect the river

2)provide information and report problems to help protect river

3)recommend actions to protect the river

TABLE 1.2F. 1994 NEPONSET RIVER BASIN SURVEY.Canton River Watershed Watchdogs Segment Summaries.

Problems found by segment	Assets found by segment	Priorities
Segment 1: 1) eutrophication: brown scum probably from algae 2)trash & debris 3)silt 4)mystery pipe 5)DPW topsoil pile and truck washing 6)paved swale from parking lot behind shops	1)habitat 2)beautiful areas 3)undeveloped large piece in middle (who owns ?) 4)people enjoy area behind shops for fishing and picnicing	1)DPW: sand pile, mystery pipe, truck washing 2)Clean up
Segment 2: 1)trash & debris 2)asphalt from parking lot 3)storm drains (signage be helpful)	1)water clean: sandy bottom 2)oil spill	1)trash cleanup 2)
Segment 3: 1)poor stewardship on private property: leaves pushed into river 2)oil spill from high school still leaving traces in river	1)water clear with sandy bottom 2)good bass fishing behind impoundments 3)Plymouth Rubber & neighbors pick up litter 4)habitat: Canada Geese, Mallards, muskrat, raccoons, bass, pickerel,snapping turtles 5)good stewardship along river	1)stewardship--public education 2)status of oil spill: find out
Segment 4: 1)trash & debris near MWRA pipes and blue toilet paper at high water mark 2)no flow in mill tail race--only flow is from Emerson & Cummings (and from condo) 3)leaking pipe near Rivers Edge condo 4)bank erosion: steep banks 5)trash & debris including RR ties 6)young anglers have seen no fish since oil spill	1)sewered: this is why coliform counts are low 2)MWRA site, erosion mitigation seems to work 3)floor of stream is rock: water clear 4)habitat: frogs, turtle nests, deer tracks	1) blue toilet paper? 2) mill tail race (**ConCom has acted on this)** 3) leaking pipe across from viaduct 4) lack of fish? 5) trash
Segment 5: 1)oil sheen 2)site of old tannery: may have some old pollution 3)orange spot in water	1)beautiful section 2)pools up to 5 feet deep 3)good habitat 4)site of Warner Trail 5)cultural and archeological area	1)help with Warner Trail 2)look to see if problems from Rte. 95; check orange mass

TABLE 1.3F. 1994 NEPONSET RIVER BASIN SURVEY. DRAFT: Action Planning Matrix; Neponset Estuary.

ACTION PLANNING MATRIX: Neponset Estuary

IMMEDIATE ACTION: Reporting Problems to Officials
From their priority findings, groups create a list of problems that must be reported. Because these problems directly threaten the stream, reporting to appropriate local or state agencies is usually a first step. Reporting can be accomplished by a letter, by a visit or by having officials attend a meeting of the group.

Report to Local Boards:
Milton Conservation Commission:
(1) Hood Plant: Downspouts go immediately into river. People are concerned that roofing runoff (rubber, etc) are harmful.
2) Runoff from Adams Street in Milton
3) Erosion at storm drain in Section 2D near NVYC. Will also report to DEP.
4) Dumping by contractors and others. There is a telephone near the locked gate near the expressway. People come in to use the phone and leave debris. The group suggested that to discourage future dumping, that a light be established and left on all night. Perhaps signage with fees attached. The group encourages continued enforcement by discovering names of perpetrators and requiring removal of debris and fines.
5) **Boston Conservation Commission or Kathy Douglas Stone:** Oil at old flounder fleet near E. MBTA Bridge.
6) **Executive Secretary in Milton: Success** Open manhole covers at 2 Granite Place. Reported to Executive Secretary and immediately problem was solved.

Report to Massachusetts Highway Department:
1) Runoff from Adams Street
2) Reconstruction from Bridge Street
3) Open Manhole covers in Dave and Tom's section

DEP
1) Pipe at Humbolt
2) Erosion near storm drain near NVYC.
3) Oil at old Flounder Fleet near the E. MBTA Bridge

MAPC: Martin Pillsbury
1) Runoff from Adams Street

Boston Water and Sewer:
1) Oil spill at old flounder fleet near E. MBTA Bridge. Joan reported that Paul Demmit wanted to know about any leaking pipes under Boston Water purview immediately so that they could get them fixed. Someone asked about running pipe at UMA which is outside of estuary

TABLE 1.3F. (cont.)

IMMEDIATE ACTION: Short Term Projects
From their priority findings, groups plan some short term projects that can be accomplished in the next few months. For some groups, these projects can be the first step of their long term action. These projects involve people immediately in stream protection.

1) Request that the ACEC management plan include phragmites management. Either request this or do some preliminary research to determine. Contacts could also be made to the Wetland Restoration and Banking Program (Christie Foote-Smith at EOEA).

2) Contact the Milton Conservation Commission and the Milton Land Trust to see if they would begin negotiations with owners of the Forbes Property to see if Conservation Restrictions on these properties would be beneficial to the owners.

3) Look into possibilities of creating the Granite Wharf Trail. The first step would be to see if the Massachusetts Highway Department would be willing to move the fence back closer to the highway or create a cow fence or some way to make it manageable.

4) Clean ups:

a) Tidal trash: these clean ups must occur before May first so that they do not interfere with breeding season.
b) 2 Granite Avenue site and Parkers: runoff from Granite Ave.
c) Point Norfolk Clean up. People were concerned about the barges which could be cut up and removed and the old fishing boat near Jordon Marsh. Could the National Guard help with the project?
d) MDC reservation has oil drums: removal of these is also heavy work: could National Guard help?
Invite groups such as the "100 leadership" students to come and work on cleanup.

5) Participate in Community Events such as Milton Pride Day. (This year on May 20). There could be a booth alerting people to the river, its needs and values and to future events on the river.

6) Complete Shoreline Survey and create a Shoreline Survey Report to contain

a) an executive summary
b) paragraphs describing the segments written by surveyors
c) photographs, maps, graphics
d) appendix: Natural History

Copies of the plan could be given to town boards in the 3 towns, to DEP, NepRWA, MDC, Riverways, and DEM would like to include the report in an appendix of the ACEC Management Plan.

7) Look into protection of wetlands: Work with the Wetlands Restoration and Banking Program (Christie Foote-Smith) to restore marshes. People wanted to see if there was Army Corps money to remove the dredging spoils placed there by the COE at the last dredging. Work with the Wetlands Restoration and Banking Program, make inquiries about sources of money.

8) Learn more about water quality. Get the MWRA testing results or invite them to come and speak.

LONG RANGE PLANNING AND ACTION:

These activities can be the glue that holds a group together. They are the major issues on which a group chooses to focus.

I. Create a coalition for the Estuary: Create a coalition or an umbrella group of civic associations, non-profits, businesses, individuals. The Coalition/group would be a way for different towns, interests and groups to share problems and create solutions, discuss issues and resolve differences which would benefit the Neponset Estuary. By working with existing groups on projects, the group/coalition would look at the effect of the project on the estuary.

II. Public Involvement and Education

A. *Community Involvement*:

Work to bring together businesses, landowners, civic organizations, town and city officials in learning about and protecting the estuary. Projects could include:

1. Public access, greenway viewsheds and recreation

- work with municipal officials, BNAF, MDC, landowners, civic organizations and interested individuals to provide appropriate access to the river and to protect visual points
- work with other organizations (including MDC, BNAF, and ACEC) on Greenway issues
- promote opportunities for recreation that are compatible with the estuarine resources (such as a boat house for canoes, shells, small sailboats)

2. Clean ups

- participate, co-sponsor and publicize clean up events
- coordinate planning so that all cleanups are not on one day

B. *Education*

1. *Community education*: Cooperating with NepRWA, BNAF, MDC, ACEC, MA Bays, municipalities, & groups, promote education about the estuary

a. through brochures, public events (River Festival, Milton Civic Day, cleanups, forums) and signage

- raise public awareness about the estuary and ways to protect its
    - ecological health
    - salt marshes
    - flora and fauna
- provide signage
    - for water taxis
    - to show high water mark (restore old sign)
    - to discourage littering
    - to encourage leashing of dogs on the marsh
    - at bridges to raise awareness

2. *Youth education*

- promote advocacy and learning by creating long term relationships with schools and youth groups

III. Protection of Natural Resources

A. *Water quality*

- review existing water quality monitoring results from agencies such as MWRA, MDC and DEP

B *Wildlife habitat*

- identify and protect important habitat areas

C *Fisheries*

- promote protection of habitat (including adequate water flow and spawning areas)
- support appropriate testing at new sites including biological sampling of fish

D. *Salt Marsh*

- support long range planning for and protection of the marsh
    - identify and protect areas of critical habitat, and provide access only in other appropriate areas
- protect indigenous species and reduce phragmites invasion
- restore and protect tidal flow

E.*Land adjacent to the estuary*

- encourage protection of land for habitat, viewsheds, ecological health, or access
- support appropriate use of adjacent lands to enhance the estuary
- remove billboards (from Granite Avenue) to enhance aesthetics

TABLE 1.4F. 1994 NEPONSET RIVER BASIN SURVEY. Estuary Priority Chart

Problems Found	Assets Found	Priorities
Segment 1: Lower Mills Dam to Milton YC Parking lot. **Surveyors:**Ellen Anderson and Vernon Woodworth 1)many pipes: not sure what they drained. (One had been hooked up to a house now demolished) (photos of all sections) 2)Oil was seen at the Hood Plant. 3)Trash	1) good diversity of marine life & shorebirds. Increased numbers of shore birds and sea weed in recent years. Lots of cormorants 2) chubs, eels, shrimp and sea worms, herring, porgies, smelt, shrimp and sea worms. More barnacles seen on boats than previously. 2) 10 years ago this section full of paper pulp and when bottom disturbed, huge gas bubbles came up. Both Humbolts and Milton used to throw snow in river; neither does so now. 3) life is coming back to Neponset. 4)Muddy red water comes from Mother Brook in the spring which colors the water; in the summer when less comes, they see clear green water from the sea: At their moorings, they can see 2.5 feet down--could not see this far 2 years ago.	1)Ask Milton DPW to look into pipes. Look also into pipes and downspouts from rubber roof at Hood Plant. 2)Number each pipe on a map. (This group purchased copies of the assessors maps and it is easy to locate findings). 3) Question: is there a fish ladder behind Hendries?
Section 2A: Hutchinson Field to Gulliver Creek. Surveyors: 1) There are septic system problems in this area which are placed in glacial till. The town of Milton has found 3-5 failing systems: two have been corrected.	1) This is a beautiful area. Fish, birds, turtles. A beech grove on the Forbes estate and a fragile marsh are particularly notable.	1. Effort made to work with landowners to get Conservation Restrictions. Group may want to contact the Milton Land Trust and Conservation Commission. 2. Town will continue to work on septic systems. **(Town has appropriated money for engineering study of area.)**
Section 2B: Gulliver Creek. Surveyors: Marty Curtis & Gerde 1)brook is piped under road. Evidence of sand from street work last winter. 2)in flat section, in addition to grass and cattails, there was loosestrife and tall, pervasive fragmites. 3)people push leaves and grass clippings to banks.	1)at the beginning of the Gulliver's Creek, the brook was shaded with clear waters. The creek here is small with a 50 foot wooded buffer. Minnow sized fish were here and were not downstream. Vegetation in stream looked similar to water cress (but wasn't). Steep -sided banks. 2)in flatter sections, stream was muddier. Habitat seen: raccoon tracks, holes in bank for muskrats. Some grass and cattails.	1)Check pipes at beginning of brook. 2)Check Unquity Brook to see if high readings of bacteria found by DEP can be explained. Tom Palmer said that he would survey Unquity Brook.
Section 2C: Puddingstone Outcrop across from YC northeast to Granite Avenue and to mouth of Gulliver Creek. Surveyors: Ron and Steve Donovan 1)Sewer connected with a cement culvert which overflowed last year--MWRA fixed pipe. 2)piles of debris noted at MWRA yards and at Slager Autobody which were within 10 feet of river. These may contain hazardous materials.	1)MDC marsh, an important resource and provides good habitat, is in this section. Red-backed voles, muskrats, harbor seals, periwinkles seen. Shorebirds: Black ducks, mallards, Canda Geese, Red and Common Mergansers, 10 Great Blue Herons, Double Cormorants, a permanent pair of kingfishers & transient ospreys.	1)The most important thing here is to improve water quality and to protect the marsh. 2)Work to improve practices at Slager Autobody and MBTA yards.

TABLE 1.4F. (cont.)

Section 2D. Granite Ave to Gulliver Creek Milton. Surveyors: Dave Queeley & Tom Palmer 1)fill for highway ramps have changed the ecology because the embankment prevents tidal action. Phragmites have been filling in for last 35 years: today 60-70% of the vegetation is fragmites; the rest is spartina. 20 years ago, kids skated in ponds now filled with fragmites. 2)large pipe drains the road into the spartina: people reported that at big storm tides, the manhole covers are blown off. 3)Pipe #3 had a great deal of sand below it. (This pipe is where Route 93 is the highest). 4)the state DPW sand pile is covered by a tarp. Is this a problem? 5)fence for Rte. 93 prevents access: if fence removed or moved back toward highway, people could enjoy great views of the marsh all the way to Milton Hill. 6)no clams or oysters seen: when last dredging done, lots of oyster shells.	1)potential for trail, access and vistas if highway fence moved back.	1)Look into potential of a great trail from the boat club to the wharf. Impediments include fragmites and chain link fence. Can something be done? Could fence be moved closer to highway? Anything about dense forest of fragmites. 2. Pipe # 3: which has brought excessive sand into the river corridor
Section 3: Granite Ave and Expressway. Surveyors: Bob Boushell & Vic Campbell 1)'Two Granite Place' in bankruptcy court and there are contaminated soils in place. 2) Industrial uses on Dorchester side could harm the river. These uses include junk yard and a construction company. These have been in operation for a long time and there could be problem. No pipes identified.	1) salt marsh on Milton side: spartina grass	Two Granite Place: **Clean up on June 9, 1995 addressed many of the issues**
4A: *Surveyors: Tom Palmer and Martha Curtis* volunteered to do this section in June		
4B: Surveyors: Tom Palmer and Martha Curtis volunteered to do this section in June		

TABLE 1.4F. (cont.)

4C: BNAF: to be reported		
5A: Quincy Side: Surveyor: Ed Grogan volunteered to do this section with his class in June.		
5B: Quincy Side: Surveyor: Ed Grogan volunteered to do this section with his class in June.		
5 C:**Section 5 C: Condominiums to Bridge and Tenean Beach (one side only).** Surveyors: Emy Thomas & Albert 1) Trash: styrofoam, rusty fences, rusty pipes, abandoned barges and pilings. 2) Last summer where they had planted eel grass in front of condo, silt fence falling into ground. 3)MDC has purchased Sterns Lumber Yard and is planning to remove the old pilings. A full barrel of something should be reported to MDC. 4)CSO at Port Norfolk YC and Venezias and one at Black's Creek/Tenean Creek which drains the ball park. 5)oil seen in slime in old flounder fleet area. 6)In one area (near RR bridge and MDC headquarters?) there is a "No Smoking" sign. Does this indicate that there is storage of dangerous materials?	1)habitat/species seen: great blue herons, buffleheads, egrets, and last summer, a pair of swans.	1)Clean up trash and remove barges. This is hard physical work which would need MDC involvement. 2) Recheck the oil slick.
Section 5 D: Commercial Point to Tenean Beach: Surveyor: Dave Queeley will do this additional segment in June		

TABLE 1.5F. 1994 NEPONSET RIVER BASIN SURVEY. Mother Brook Coalition Planning Action Matrix.

ACTION PLANNING MATRIX:

IMMEDIATE ACTION: Reporting Problems to Officials
From its priority findings, the Mother Brook Coalition members created a list of problems that must be reported.
Report:

To DEP and Conservation Commission
1) corrugated pipe from a private house (segment 1)

2) PVC pipe on Washington Street Bridge (segment 2)

3) pipe which sticks up in brook (segment 2)

4) pipes from AliMed

5) pipes from Commonwealth Gas (right side of Condon Park) and possible sewage

6) outflow pipe: running over car parts

7) open runoff channel from Maaco Car to brook (note: this was reported to Strike Force and no problems were found)

8) L.E. Mason pipes (note: this problem has been resolved)

9) Major concern about inlet near Condon Park
  a) sewage

  b) rotten egg smell

  c) very poor water quality

To Board of Selectmen and Conservation Commission

1) transfer station debris in brook (note: forwarded to boards, still requires monitoring)

2) fill and trash on bank of Cemetery (note: forwarded to boards, still requires monitoring)

Report to DEM Office of Dam Safety DEM) and MDC:

1) structural problems (apparent leaks) may cause major accident. (note: MBC reported to MDC who said that leaky area is an intentional part of the dam's design.)

TABLE 1.5F. (cont.)

IMMEDIATE ACTION: Short Term Projects

1) Work on a trail/greenways section as first pilot. Suggestions:
   - create a graded Trail from Bussey Street to Mother Brook Condominiums in Dedham to include a foot bridge and two picnic areas (see Appendix)
   - create access from Cemetery
   - create an education area behind Avery School: trail from playground to brook cleared by Middle School and High School students

2) Sponsor clean ups on Mother Brook to raise awareness about brook & remove trash. Consider National Guard for refrigerators & heavy items. Mother Brook Coalition will join forces with the Dedham Civic Pride Committee for a fall clean up. Hyde Brook members will clean a stretch in Hyde Park on the same day.

3) Look at erosion and see if BMPs could be installed. (CC, NRCS, others.)

4) Create a Report from Shoreline Survey & present to town Boards, civic groups, NepRWA, state and federal agencies. Presentations have been made to Dedham Conservation Commission and Parks and Recreation.

5) Sponsor an event or events which would bring Hyde Park and Dedham awareness of Mother Brook.
   - sponsor canoe race, walking/running event along river, clean up,
   - have educational booths at the Conlon Park Event
   - sponsor elementary poster contest
   - set up riparian landowners watchdog group

6) Learn more about Floodgate and flow issues relating to Charles River and Mother Brook.
(Kate Bowditch, CRWA and Nick Winter, MDC made a presentation at an early meeting)

7) Find out from DEP where there are discharge permits on Mother Brook

LONG RANGE PLANNING AND ACTION:

These activities can be the glue that holds a group together. They are the major issues on which a group chooses to focus.

A. Create long term stewardship group

B. Create Greenway, with access and trails. Do section by section. This was felt to be the most important single thing. Work would lead to
   - greenway, a valuable resource protected.
   - consciousness raising which would lead to protection for Mother Brook: habitat, water quality, etc.
   - Town involvement: selectmen, conservation commission, residents, citizen groups, students, scouts, etc.
   - Funding & grants

C. Continue water quality monitoring and reporting. Include Hyde Park High School classes and adults. Add organics if possible.

D. Raise public awareness of the brook, stewardship through public education, clean ups, poster contests.. Organize riparian landowners watchdog group.

E. Expand membership in Hyde Park and Dedham. Involve whole watershed.

F. Combine Historical Commissions in Hyde Park and Dedham and write history of Mother Brook.

G. Conduct inventory of wildlife and habitat in order to provide more protection.

H. Encourage wildlife by protecting, restoring and creating habitat

TABLE 1.6F. 1994 NEPONSET RIVER BASIN SURVEY. Mother Brook Coalition Segment Summaries.

Problems found by segment	**Assets** found by segment	**Priorities**
Segment 1: Sluiceway MDC: Route 1-Washington Street 1) trash: but not as much as expected 2)large pigeon population under bridge if water high, 6" droppings in river 3) strange orange colored area 4)transfer station a problem: trucks level bank by pushing it into river 5) private sump pump 6)2 bridges totally channelized 7)little public access: steep banks & chain link fence		1)fill from the transfer station
Segment 2A: Dedham Mall to Maverick Street 1)pipes from Washington St. Bridge - one looked like an added pipe 2)2 pipes from backyards on Curb Street 3)Trash: shopping carts (8 at Washington St. Bridge) 4) stewardship: clear cutting, lawn debris into brook 5)no public access 6)lawns including debris and trash on MDC 50 foot easement		1)lawn debris and trash: public education and work with MDC
Segment 2B: Cemetery 1)no trees on this side and erosion, dirt over fence on the bank 2)cemetery fill from grave sites was pushed directly on to unstable bank slope. Is fill on MDC land? 2) trash: old refrigerators, tires	1)possible access from cemetery side	1)trash and fill on banks. Work with DPW & MDC
Segment 3A: Maverick Street to Mill Lane 1)dead vegetation, stagnant smell, pipes from 16 roof drains at Allied Med 2)camping site	1)access good through fence at elementary school. School owns land which could become nature trail and education area	1)pipes from Allied Med 2)??school site: work to become education area & trail??
Segment 3B: Bussey Street to Mill Lane 1)Trash on both sides of brook 2)logs, road construction sites,55 gallon drums, old steel desk 3)brownish-gooey material 4)Condon Park: fill and trash (concrete blocks, old bikes, pipes, old motor parts, etc.) 5) inlet near Con Gas which gives off a rotten egg smell. inlet particularly degraded. petroleum products and runoff from dumpster containing hot water heaters may come from Con gas. There may be indications of sewage. 6)After inlet, duck feeding area	1)residential side of river cleaner 2)duck feeding area is attractive	1)culvert and inlet at Gas Co. 2)trickle of sewage coming out of a 2" pipe just before the bridge

TABLE 1.6F. (cont.)

Segment 4A: Mill Pond to Mother's Brook Condominium 1) erosion from overflow pipe & outwash gully 2)informal "beer drinking" area with trash 3)lack of vegetation has promoted erosion 4)milfoil 5)dam shows structural flaws which should be repaired since Mother Brook condos downstream 6)area showing severe erosion and shoreline creep which has been blacktopped to edge and broken blacktop falling into brook 7)trash 8)pet bathroom area at condos	1)informal trail area 2)Dedham-owned land which could have picnic tables and become a good recreational area: (full of trash now looks like a dump)	1)clean up trail system (70% has informal trails) 2)trash clean up 3)BMPs to correct erosion and fix spillway 4)fix spillway before major accident
Segment 4B: Mother Brook Condominium to Hyde Park 1)at DPW site: refrigerators, tires and car parts 2) pipes on bank 3)car businesses & moving company area: car parts, rotting old stored trucks 4)constantly flowing pipe; water flows over car parts: oily sheen noticed 5)dumping & evidence of backhoe work 6)18" pipe had trickle of water including white milky substance (paint or sandblasting residue?) 7) sluice with stagnant water	1)wetlands and a grassy meadow at housing project 2)potential for terrific public access 3)marsh has great potential	1)address the 24" pipe 2)clean up litter and trash 3)find out from DEP which businesses have NPDES permits
Segment 5A: Hyde Park-Milton Line at Solaris Road to Bridge at Neponset Valley Parkway 1)water is stagnant 2)Hyde Park Cemetery, which sits high above the brook, is open to traffic and trash: refrigerators and old trucks	1)marsh land 2)lots of ducks and egrets 3)people catch carp and catfish--cemetery provides good access for fishing	1)pipes from cemetery and fertilizers 2)?trash?
Segment 5B: Bridge at Neponset Valley Parkway to Reservation Road 1)debris	1)island with good habitat for ducks, geese and muskrats 2)good access for fishing	1)trash
Segment 5C: Reservation Road to Dana Avenue Bridge 1)trash: shopping carts behind Star Market, old building debris, pipes 2)small pipe comes out of Red Dot which has a steady flow 3)impassible by boat because of debris		1)running pipe from Red Dot 2)trash