NBP-92-88

Blackstone River

"Briefing Paper" and Proceedings from

Narragansett Bay Management Committee 122 pp

Narragansett Bay Estuary Program
BLACKSTONE RIVER
"BRIEFING PAPER"
AND
PROCEEDINGS FROM
NARRAGANSETT BAY PROJECT
MANAGEMENT COMMITTEE

Ms. Katrina V. Kipp,
Mr. Richard R. Zingarelli,
and the staff of the
Narragansett Bay Project

#NBP-92-88

Recommendations included in this briefing paper represent preliminary decisions reached by the Management Committee and are subject to amendment prior to their incorporation into the Comprehensive Conservation and Management Plan (CCMP).

The Narragansett Bay Project is sponsored by the U.S. Environmental Protection Agency and the R.I. Department of Environmental Management.
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FOREWORD

The United States Congress created the National Estuary Program in 1984, citing its concern for the "health and ecological integrity" of the nation's estuaries and estuarine resources. Narragansett Bay was selected for inclusion in the National Estuary Program in 1984, and the Narragansett Bay Project (NBP) was established in 1985. Narragansett Bay was designated an "estuary of national significance" in 1988. Under the joint sponsorship of the U.S. Environmental Protection Agency and the Rhode Island Department of Environmental Management, the NBP's mandate is to direct a program of research and planning focused on managing Narragansett Bay and its resources for future generations.

The NBP will develop a draft Comprehensive Conservation and Management Plan (CCMP) by December, 1991, which will recommend actions to improve and protect the Bay and its natural resources.

The NBP has established the following seven priority issues for Narragansett Bay:
- management of fisheries
- nutrients and potential for eutrophication
- impacts of toxic contaminants
- health and abundance of living resources
- health risk to consumers of contaminated seafood
- land-based impacts on water quality
- recreational uses

The NBP is taking an ecosystem/watershed approach to address these problems and has funded research that will help to improve our understanding of various aspects of these priority problems. The Project is also working to expand and coordinate existing programs among federal, state and local agencies, as well as with academic researchers, in order to apply research findings to the practical needs of managing the Bay and improving the environmental quality of its watershed.

The attached report includes a "briefing paper" prepared for consideration by the Management Committee of the Narragansett Bay Project (Section I) and Management Committee Proceedings (Section II). Section II includes a) minutes of the Management Committee meeting(s) where the issues identified in the "briefing paper" were discussed (Appendix A); b) preliminary recommendations endorsed by the Management Committee (Appendix B); and c) Management Committee attendance (Appendix C). The Narragansett Bay Project will subsequently estimate the cost of each preliminary recommendation made by the Management Committee and identify possible funding sources. This information will enable the Management Committee to develop the draft CCMP including priorities for implementation over a five year planning horizon. Upon completion, the draft CCMP will be available for public review and comment.
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2. Nonpoint source abatement.
3. Water quality classifications.
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SECTION I:

BLACKSTONE RIVER
"BRIEFING PAPER"

Ms. Katrina V. Kipp,
Mr. Richard R. Zingarelli,
and the staff of the
Narragansett Bay Project

"Water? Never touch the stuff... Fish swim in it."

W.C. Fields
SYNOPSIS

The Blackstone River is the second largest tributary river to Narragansett Bay. It arises near Worcester, Massachusetts, and flows through Woonsocket, Rhode Island, entering Narragansett Bay as the Seekonk River near Slater's Mill in Pawtucket. Seventy-one percent of the Blackstone’s drainage basin is in Massachusetts.

The Blackstone River is considered "the birthplace of America's industrial revolution;" by the 1830’s, most of the river was harnessed for hydropower, with one dam for every mile of river. Along with this increase in industrial activity was an increase in pollutant inputs to the river. The industries and towns along the river used it for disposal of industrial wastes and sewage. Despite improvements in regulation and treatment, the Blackstone remains significantly impaired.

Examination of the results of studies funded by the Narragansett Bay Project, as well as surveys conducted by USEPA and Massachusetts and Rhode Island regulatory agencies, led to several conclusions. First, the Blackstone River is a major source of contaminants, including metals, toxic organics, and nutrients, to Narragansett Bay, during both dry and wet weather, and likely contributes to water quality violations observed in the Providence and Seekonk Rivers.

Second, the water quality of the Blackstone River is significantly degraded. For most of its length, the river does not meet water quality standards. Chronic water quality criteria are routinely violated for cadmium, chromium, copper, lead, nickel, and PCBs, and the dissolved oxygen criterion is occasionally violated. Acute criteria are frequently violated for copper, and occasionally for cadmium, chromium, and zinc. Although Rhode Island does not have criteria for fecal coliforms and nutrients for Class C waterbodies, levels in the Blackstone are elevated for these constituents.

Third, the sediments in the Blackstone are severely contaminated with metals, particularly in impoundments behind dams in Massachusetts. Aquatic life are adversely impacted by these contaminated sediments; the sediments may also contribute to poor water quality when resuspended during high flow conditions.

The fourth major conclusion is that fish and wildlife habitats, aquatic organisms, and aesthetic and recreational uses, have been impacted by the water and sediment quality of the Blackstone. In particular, loss of habitat due to changes in land use resulting from population growth, and fluctuations in water flow due to hydropower dams have been identified as major contributing factors. Dams have also eliminated anadromous fisheries on the river, although poor water quality probably contributed to their disappearance, and may impede efforts to reintroduce anadromous species to the Blackstone.

The fifth conclusion is that there are still gaps in our knowledge and understanding of the Blackstone. Lack of a synoptic interstate river survey, and lack of adequate
information on wet weather inputs, nonpoint source locations and inputs, sediment interactions, water withdrawal impacts, and biological responses make it difficult to develop management strategies with great certainty.

Lastly, the cooperation and coordination between Massachusetts and Rhode Island and with other agencies has been inadequate to protect the Blackstone River. Although much effort has been focussed on the Blackstone, most of this has occurred independently of other agencies. A major focus of effort and resources will be needed to achieve the level of cooperation and coordination necessary to effectively solve the problems of the Blackstone River.

Based on the above conclusions, a series of proposed recommendations have been developed to address these problems. Several objectives have been identified to achieve the goal of eliminating the adverse impacts on Narragansett Bay caused by the Blackstone, and to protect and improve the Blackstone River itself. These objectives are as follows:

A: The states of Massachusetts and Rhode Island should improve the water quality of the Blackstone River and its tributaries to meet all water quality standards. This could be achieved through a combination of strategies including increased point source control, nonpoint source abatement, upgrading water quality classifications, and regulation of water withdrawals. Specific strategies would include more stringent discharge permits, reconciliation of water quality classifications between the states, pollution prevention and improved pretreatment, CSO abatement, elimination of illegal discharges, stormwater management, nonpoint source identification and control, improvement in licensing for hydropower facilities, and maintenance of adequate river flow.

B: The states of Massachusetts and Rhode island shall eliminate or remediate the impacts from contaminated sediments in the Blackstone river on biota and water quality. This objective could be reached through sediment remediation demonstration projects, repair of dams, and development of a comprehensive sediment remediation plan for the river.

C: The states of Massachusetts and Rhode Island shall maintain and restore fish and wildlife habitat and aesthetic and recreational uses of the Blackstone River and its watershed. Strategies include improving water quality and maintaining flows, fish passages at dams, critical habitat protection plans, and consistency review.

D: The states of Massachusetts and Rhode Island, USEPA, and other interested organizations shall develop and implement a program to increase understanding of the environmental quality of the Blackstone River. This could be achieved through dry and wet weather synoptic river surveys, water quality modeling, establishment of a Blackstone River library, and a public information program.
E: The states of Massachusetts and Rhode Island, USEPA, and other interested organizations shall develop a collaborative interstate approach to protecting the Blackstone River. Strategies identified include establishment of a Blackstone River Task Force, coordinated reviews, cooperation in field work, support of the Blackstone River Valley National Heritage Corridor, and establishment of a consistency review program.
I. INTRODUCTION

The Blackstone River is a major tributary of Narragansett Bay, contributing the second largest freshwater flow, after the Taunton River. The Blackstone River is located in south central Massachusetts and northern Rhode Island, and enters Narragansett Bay as the Seekonk River near Slater’s Mill Dam in Pawtucket. Studies funded by the Narragansett Bay Project (NBP) have indicated that the Blackstone River is a major source of contaminants to Narragansett Bay. Because of the significant pollutant loadings contributed by the Blackstone River to Narragansett Bay, the Narragansett Bay Project felt that a separate briefing paper focusing on the Blackstone River was warranted. If any progress is to be made toward reducing the impacts to Narragansett Bay from the Blackstone River, then it is important to make specific recommendations aimed at particular problems and sources within the river.

The Project’s interest in the Blackstone River is two-fold. First, the Blackstone River is important as a tributary to Narragansett Bay and, as such, a major source of pollutant loadings to the Bay. Therefore, specific recommendations focus on reducing the impacts to Narragansett Bay originating from the Blackstone River. Second, and just as important, the Blackstone River itself should be protected and improved. The goals and recommendations for the Blackstone contained in this briefing paper reflect this dual approach.

It should also be noted that the proposed recommendations contained in this paper, although extensive, are not totally comprehensive, in the sense that they focus largely on water quality related problems. Although other topics, such as open space preservation and recreation, are important in the overall strategy for protecting the Blackstone, these issues are being addressed in more detail by other groups such as the Blackstone River Valley National Heritage Corridor (BRVNHIC) and are generally recommended only by reference in this briefing paper.
II. BACKGROUND

A. Description and History

The Blackstone River originates in Worcester, Massachusetts (MA), at the confluence of the Middle River and Mill Brook, and flows through south central Massachusetts, entering Rhode Island (RI) near Woonsocket, eventually discharging into the Seekonk River, and from there to Narragansett Bay (Figure 1). The river drains approximately 475 square miles, about one-quarter of the Narragansett Bay watershed (Figure 2). A total of 335 square miles, or 71%, of the Blackstone basin is in Massachusetts, and 140 square miles is in Rhode Island. The river is about 45 miles in length, with 29 miles in Massachusetts and 16 miles in Rhode Island. Major tributaries to the Blackstone include Kettle Brook and the Quinsigamond, Mumford and West rivers, which enter the Blackstone in Massachusetts, and the Mill, Peters and Branch rivers, which enter the Blackstone in Rhode Island. Although the Mill and Peters rivers enter the Blackstone in Rhode Island, the majority of their watersheds is in Massachusetts.

The Blackstone River is perhaps best known as "the birthplace of America's industrial revolution". The first successful water-powered textile mill in the United States was established along the Blackstone River in Pawtucket by Samuel Slater in 1790. This was the first cotton mill in the U.S. to use mechanical spinning machines. Subsequently, numerous mills were built along the entire length of the Blackstone, and by 1800, Pawtucket alone contained 29 cotton mills. Due to its slope of 10 feet/mile (relatively steep for a coastal river), the Blackstone River was particularly attractive to industries because it provided a cheap and efficient source of power. By the 1830's, most of the river was harnessed for hydropower, with one dam for every mile of river.

Accompanying the increased industrial activity along the river was an increase in pollutant discharges. The textile industry predominated along the river, but other industries flourished, including tanneries, metal platers, wire and steel mills, woodworking companies, and textile machinery manufacturers. These industries used the river for hydropower, as well as for disposal of industrial wastes and sewage. They contributed heavy metals from plating, dyes from textile plants, petroleum products from manufacturing, organics and metals from tanneries, solvents and paints from woodworking, and sanitary waste. The legacy of a century and a half of pollution is still present in river sediments and continued industrial inputs. In general, prior to the enactment of the Federal Water Pollution Control Act (Clean Water Act) in 1972, sewage and wastes were inadequately regulated, and as a result, were usually discharged directly into the river in large quantities. However, the Massachusetts Division of Water Pollution Control was established in 1966 and construction of several wastewater treatment facilities occurred in the late 1960's in the Massachusetts portion of the Blackstone. Despite significant, measurable improvements (Hoffman, 1988), most likely due to the closure of many industries and water pollution control measures such as upgrading of treatment
Figure 2

NARRAGANSETT BAY WATERSHED

BLACKSTONE RIVER WATERSHED

TAUNTON RIVER WATERSHED

PAWTUXET RIVER WATERSHED

Over 60% of Narragansett Bay's Watershed is in Massachusetts.
plants and the institution of pretreatment programs, there still remain some serious problems.

B. Description of Problems

The Narragansett Bay Project has funded a number of studies that either focussed on the Blackstone River, or included the Blackstone as a sampling location. Numerous studies have also been conducted by other agencies and organizations. In addition, the NBP funded Dr. Ray Wright of the University of Rhode Island to evaluate available water quality and discharge monitoring data for the Blackstone. This report (Wright et al., 1991) summarizes results and data from a variety of sources, and contains much greater detail regarding water quality issues than this briefing paper; the interested reader is encouraged to refer to it for more information.

1. Impacts on Narragansett Bay

Early on, the Narragansett Bay Project funded several water quality monitoring surveys to identify the water pollution problems in Narragansett Bay and to determine the relative importance of various pollutant sources to the bay. These surveys all included sampling at stations and point sources in the upper Bay. As part of the SINBADD cruises in 1985-86 (Pilson and Hunt, 1989), the SPRAY cruises in 1986-87 (Doering et al., 1989), and the wet weather study in 1988-89 (Wright et al., 1990), major tributaries, including the Blackstone River, were monitored at their mouths for numerous parameters including conventional and toxic pollutants. For the wet weather study, all stations and sources were sampled prior to and during rain events, resulting in data for both dry and wet weather periods.

Based on the above surveys and other data, estimates of the relative importance of the Blackstone River compared to other sources to the upper Narragansett Bay and Providence River were be made by Metcalf and Eddy (1991) for the Narragansett Bay Project. Annual loads were calculated by extrapolating inputs from the sources over a "typical" year. Based on these estimates, the Blackstone River was found to be a major source of many pollutants to Narragansett Bay. Figure 3 shows relative loading estimates from categories of sources; Figure 4 shows the relative loadings from individual rivers.

Based on the SINBADD cruises, Quinn (1989) estimated that the Blackstone was the single largest riverine source of solids and petroleum hydrocarbons (PHCs), and a significant source of polycyclic aromatic hydrocarbons (PAHs) to Narragansett Bay, for the periods sampled during 1985-86. It contributed 57% of the total river input of PHCs, 44% of solids, and 23% of PAHs to the Bay. Latimer (1989) reviewed polychlorinated biphenyl (PCB) data for Narragansett Bay and also concluded that the Blackstone River is the major source of PCBs to the Bay, contributing 50% of the...
Figure 3. Relative loadings estimates to the Providence River/Upper Narragansett Bay from POTWs, CSOs and other sources (e.g., upstream sources, direct runoff, stormwater runoff and atmospheric deposition) based upon data in Table 3, Metcalf & Eddy, Inc. 1991.
Figure 4. Relative loadings estimates for upstream point and non-point and other sources (exclusive of RI POTW s) to rivers based upon data in Table 3, Metcalf & Eddy, Inc. 1991.
annual fluvial load (which was estimated to be 70% of the total load from all sources).

Wright et al. (1991) examined all three surveys (SPRAY, SINBADD, and wet weather study) and ranked their relative importance in terms of loads measured during the dry weather sampling periods (event load rather that annual load). The dry weather ranking of sources to the Providence River derived from the surveys for various parameters (Wright et al., 1991) are shown in Table 1. For most constituents, the Blackstone ranked first or second for dry weather loadings.

The major pollutant sources to the Bay measured during the three rain events evaluated in the wet weather study were ranked by Wright et al. (1990; 1991) in order of importance. The rankings were developed based on loadings for dry weather, wet weather, and on a total event (wet weather event plus pre-event dry weather period) basis, using measured flows and concentrations. It should be noted that these are not annual loads but rather are calculated using the actual loads measured during the survey period. Tables 2, 3, and 4 summarize the relative importance of these sources for a number of pollutants. As can be seen, the Blackstone River ranked first or second in total mass contributed to Narragansett Bay during the three wet weather events surveyed for almost all pollutants.

During dry weather, consistent with findings from the previous surveys, the river ranked first for 4 of 9 and second for 3 constituents. For wet weather events, it ranked first for 10 of 12 constituents and second for the other two, ranging from a high of 84% of the measured loads for PCBs to 28.8% for ammonia. For total event loadings, the Blackstone ranked first for 7 of 14 constituents, ranging from 54.4% of the measured loads for nitrate to 11.9% for ammonia. Based on the total event loading calculations, the Blackstone River was the principal source of solids, cadmium, chromium, copper, lead, nitrate, orthophosphate and PCBs to Narragansett Bay.

2. Water Quality of the Blackstone River

It should be noted that the water quality of the Blackstone River has improved significantly from the days prior to regulatory controls. However, the identification of a statistically significant trend towards improvement in recent years has been difficult due to a lack of adequate data collected over a several year period, data collected at different locations and times under different flow conditions, and continuing changes in dischargers, water withdrawals/diversions and other factors.

a. Water Quality Classification

Waterbodies such as rivers are classified according to the goal uses they should support (e.g., fishable, swimmable). Definitions of water quality classifications vary between states, but generally, Class A is defined as a high quality water that supports
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(1983-86)  
(1988-89)  

NA: no data available; Rankings are the average of results from three studies including SPRAY, SINBADD, and NBP Wet Weather which spanned the years from 1984 to 1989. Details relative to each study are provided in Appendix F Table F.1. Ranking of 1 equals the greatest contribution.

BRSM - Blackstone River at Slater’s Mill
MOSH - Moshassuck River
WOON - Woonasquatucket River
TENM - Ten Mile River
PAWT - Pawtuxet River
EPRO - East Providence WWTF
BVDC - Blackstone Valley District Commission WWTF
NBCS - Narragansett Bay Commission WWTF
CS09 - NBC CSO 9
BVDB - BVDC Bypass (North Diversion Structure)
NBCB - NBC Bypass
### Table 2

Summary of rankings and percent of total dry weather loading for all three storms for suspended solids, trace metals, and nutrients

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**PERCENT OF TOTAL DRY WEATHER LOADING**

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See Table 1 for source descriptions.
Table 3

Summary of rankings and percent of total wet weather loading for all three storms for suspended solids, trace metals, nutrients and organics

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PERCENT OF TOTAL WET WEATHER LOADING

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Values for organics are from the first two storm events only.
* : BVDB flows were not available at the time of this draft report.

See Table 1 for source descriptions.
Table 4

Summary of rankings and percent of total event loading for all three storms for suspended solids, trace metals, nutrients and microbiological indicator organisms

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PERCENT OF TOTAL EVENT LOADING

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all desirable uses, including drinking water supply, Class B designates lower quality that supports all uses except drinking water (Class B in Massachusetts may also be water supply sources), and Class C means no primary contact recreation (e.g., swimming). There are no Class C waterbodies in Massachusetts. A waterbody may not have good enough water quality to support its designated uses and is then considered "non-supporting", indicating a need for improvement.

The water quality classifications of the Blackstone River vary between the two states. In Massachusetts, the classification is the responsibility of the Department of Environmental Protection (MADEP); in Rhode Island the Department of Environmental Management (RIDEM) is the responsible agency. The Massachusetts portion of the river is designated Class B (the segment immediately downstream of Worcester is Class B-CSO); however, 25.1 miles, nearly the entire length in Massachusetts, is considered not supporting the designated uses associated with this classification (e.g., fishable, swimmable) due to coliforms, nutrients, metals and dissolved oxygen (MADEP, 1990). Only 3.7 miles are considered to be supporting uses. Rhode Island has classified its portion of the river as Class C. None of the 16 miles in Rhode Island are considered supporting the uses due to metals; nutrients and coliforms have also been identified as areas of concern (RIDEM, 1990). Appendices 1 and 2 list the water quality classifications and status for the Blackstone River and its tributaries in RI and MA, respectively.

[For further information on water quality standards and classifications, and an explanation of water quality criteria, discharge permits and permit limits, please refer to the NBP "Toxics" briefing paper (Penniman et al., 1991). For the purposes of this paper, reference to criteria means the EPA (or state) freshwater aquatic life criteria.]

b. Toxics and other Pollutants

In 1985, the Narragansett Bay Project funded a study of the Rhode Island portion of the Blackstone River to determine the extent of toxics contamination within the water column, and to model the transport of those toxics throughout the river. RIDEM intended to use the water quality model to perform a toxics waste load allocation for the Rhode Island portion. However, the study found that levels of cadmium, copper, lead, and PCBs were already exceeding RI freshwater aquatic life chronic criteria, where the river entered Rhode Island from Massachusetts, and that inputs from Rhode Island discharges were relatively insignificant compared to loads coming from Massachusetts (Quinn et al., 1988; Wright, 1988). In addition, copper concentrations also exceeded the acute criteria. Based on these findings, Wright (1988) stated that "the water quality of the Blackstone River as it leaves Massachusetts is clearly the controlling factor governing the water quality of the river in Rhode Island."
The NBP funded Wright et al. (1991) to examine available water quality data for the Blackstone; they concluded that accurate estimates of toxics loadings to the river, and water quality within the river were not possible. Both Rhode Island and Massachusetts have conducted water quality surveys; however these surveys have generally been conducted independently at different times, and therefore, at different flow conditions. The lack of coordinated, interstate synoptic data sets, and associated toxic modeling, of the river make it difficult to establish the distinct effect of each individual point source discharger in the two states. This lack of data plus the frequent occurrences of water quality criteria violations dictate the need for interstate synoptic surveys and a wasteload allocation. Because concentrations in Rhode Island are controlled by Massachusetts inputs at the state line, Rhode Island cannot conduct a wasteload allocation for its portion of the Blackstone. Wright et al. (1991) recommends both synoptic surveys and an interstate wasteload allocation.

Although during dry weather, Rhode Island loadings to the Blackstone River (as measured in the Rhode Island portion of the river) are generally insignificant compared to Massachusetts inputs, this situation is somewhat different during wet weather. Other inputs, such as combined sewer overflows (CSOs), runoff, and sediment resuspension, become important factors during wet weather events. Wright et al. (1990) found that Massachusetts continued to be the dominant source of cadmium, chromium, copper and nickel during rain events, but that Rhode Island was relatively more important for solids and lead, constituents often associated with resuspension of river bottom sediments and runoff, and therefore more likely to be locally important. Both states were relatively equal in importance for ammonia, nitrates, and orthophosphate.

Other studies have found water quality criteria to be violated throughout the Blackstone, in both states and during dry and wet weather conditions. An intensive river survey for metals at eight stations on the Rhode Island portion of the river conducted by RIDEM in 1988, found that lead, cadmium and copper violated chronic criteria at every station (RIDEM, 1990). Near the Massachusetts border, and extending some distance downstream, acute criteria for cadmium and copper were exceeded. Levels of metals were generally highest at the station furthest upstream (the RI/MA border) and decreased downstream. A study conducted by the U.S. Environmental Protection Agency (USEPA) in 1980 in Massachusetts found that cadmium, chromium, copper, lead, selenium, and silver concentrations exceeded EPA acute criteria at one or more stations (USEPA, 1983b). Copper concentrations exceeded acute criteria at all six stations, cadmium at five stations, and chromium at four stations (USEPA, 1983b).

Data from 1985-89 collected at the USGS gage at Manville, summarized in the 1990 Rhode Island 305(b) report (RIDEM, 1990), indicate that annual concentrations of nitrate and phosphorus exceeded US Council on Environmental Quality (CEQ) guidelines, suggesting that the river is nutrient enriched. Median total and fecal coliform values were extremely elevated and turbidity, color, sodium and chloride
were also high. The gage data show that criteria for cadmium, copper, lead, mercury, silver and zinc were violated.

Save The Bay (STB) evaluated data collected by MADEP in 1989 during a survey of metals in the Massachusetts portion of the Blackstone (Save The Bay, 1990). This analysis indicated that for cadmium, copper and zinc, acute criteria were violated for portions of the river and that cadmium and copper were above the acute criteria for the entire Massachusetts portion of the river. An important conclusion of the STB report was that the discharge from the Upper Blackstone Water Pollution Abatement District’s (UBWPAD) wastewater treatment facility (WWTF) is the source of major loadings of some metals to the Blackstone, and that the permit should be revised to incorporate stricter limits for these metals.

Quinn et al. (1988) found that the chronic criteria for PCBs, cadmium, copper, and lead were violated from the RI/MA border throughout the entire RI section. Acute criteria were violated through the entire RI section for copper and occasionally for cadmium. Levels of nickel often approached the chronic criterion near the MA border. Violations of the chronic criterion for bis-2-ethylhexylphthalate (BEHP) occurred immediately downstream of Woonsocket (the WWTF is a major source of phthalates to the Blackstone) (Quinn et al., 1988). Fecal coliform measurements reported by Quinn et al. (1988) were meeting the Massachusetts standard for Class B waters of 200 counts/100 ml at the state line, but rose as high as 36,000 counts/100 ml at Woonsocket. They also rose as high as 9300 counts/100 ml in the Pawtucket area, probably due to illegal dry weather discharges from the CSOs in that area (Hoffman, 1988).

Wright et al. (1990) found that during rain events, chronic criteria were violated for cadmium, copper and lead, and the acute criterion was violated for copper.

c. Dissolved Oxygen

Wright et al. (1991) examined existing dissolved oxygen (DO) data for the Blackstone and concluded that there are several problem areas. Sampling conducted by MADEP in 1985 for the Massachusetts portion of the river consisted of a total of 297 DO measurements at 33 stations over a period of three days. Of these, 36 were below the criterion of 5 mg/l, with the lowest measurement of 3.2 mg/l. Although the lowest daily mean, 5.2 mg/l, was above the standard of 5 mg/l, a significant oxygen sag was noted immediately downstream of the UBWPAD discharge. A survey conducted by RIDEM in August of 1987 consisting of a single sample at four locations found the lowest oxygen concentration, 3.4 mg/l, to occur at the Manville Dam below the Woonsocket WWTF. Although these surveys are by no means conclusive, they indicate that the low DO concentrations noted may be point source in origin. Although both states have conducted some oxygen modeling, Wright et al. (1991) feel that neither effort has been adequate; Massachusetts efforts are old and Rhode Island’s calibration and validation were inadequate. The models do, however, predict violations of DO criteria downstream of UBWPAD and Woonsocket during
low flow conditions. Wright et al. (1991) recommend that a synoptic interstate survey be undertaken and that a single model, QUAL2E, be applied to the entire river with the purpose of 1) better understanding the nature of the DO problem in the Blackstone and 2) post-auditing the upgrade of UBWPAD to advanced treatment (AWT).

Ocean State Power (OSP), a cogeneration (not hydro) power plant applicant in Burrillville, has proposed the withdrawal of a maximum amount of four million gallons per day (MGD) of water from the Blackstone River near Woonsocket. Because of the potential water quality impacts downstream of the withdrawal point due to reduced flow, OSP has been required to conduct two DO surveys on the upper Rhode Island portion of the Blackstone as part of its Water Quality Certification, with a third planned for the summer of 1991. All DO measurements have been above the criterion except for two measurements downstream of the Woonsocket WWTF (RIDEM, 1990).

d. Odors

Another water quality problem in the Blackstone River is odors. The aesthetic quality of the water is important considering much of the river is part of a state or local park and recreational uses are a high priority. A distinctive, unpleasant odor is often present throughout the length of the river, and worse in some stretches, particularly at dams, where the water is aerated. Odors, however noticeable they may be, are often difficult in terms of locating sources.

e. Toxicity

State water quality standards specifically forbid the discharge of toxics in amounts or combinations that may cause toxicity to aquatic life. The toxicity test, the primary method for measurement of biological effects, is EPA's approved method of determining the toxicity of a chemical or an effluent using living organisms. The test measures the degree of response of an exposed test organism to a specific chemical or effluent. It is a laboratory procedure where an effluent sample is collected and diluted to predetermined concentrations in a test chamber, and certain species are exposed for set periods of time. The lowest effluent concentration that causes a certain endpoint effect (e.g., mortality, reduced growth rate) is calculated. This concentration is a quantified measure of the concentration that could cause instream impacts if exceeded for a specified period of time. Permit limits for toxicity specify the allowable level of effluent toxicity to a test species.

Toxicity testing of effluents has been conducted as part of the permit requirements for some dischargers; this data is currently being evaluated. USEPA and the states plan on conducting a major toxicity testing program on the Blackstone this summer (1991). Effluents, ambient river water, and sediments will all be tested.
3. Sources of Loadings

The water quality of the Blackstone River continues to be impacted by direct discharges of sewage and industrial wastes (including combined sewer overflows), and probable nonpoint source inputs from urban and agricultural runoff, leaching from landfills, leaking underground tanks, and other current and former industrial sites, and resuspension of contaminated sediments.

a. Point Sources

There are 41 permitted dischargers to the Blackstone River and its tributaries, as listed in Table 5. Twenty-eight of these are industrial and 13 are municipal discharges. The municipal dischargers include 11 WWTFs and 2 others. The Massachusetts portion has 10 major (7 municipal) and 12 minor dischargers, and Rhode Island has 4 major (3 municipal) and 15 minor dischargers. Only two of the 11 WWTFs have pretreatment programs (UBWPAD, Woonsocket); neither have local limits. Three WWTFs (UBWPAD, Hopedale, and Northbridge) currently provide seasonal advanced treatment for biological oxygen demand (BOD) and total suspended solids (TSS) and 3 (UBWPAD, Hopedale, Burrillville) provide seasonal nitrification; Hopedale also has seasonal phosphorus removal. Worcester has one CSO with a treatment facility; Pawtucket and Central Falls have 18 CSOs which are the responsibility of the Blackstone Valley District Commission (BVDC).

The UBWPAD, which serves the Worcester area, is the largest wastewater treatment facility in the Blackstone basin with an average flow (based on 1988-89 Discharge Monitoring Reports (DMRs)) of 37 MGD (design flow is 56 MGD); this accounts for about 72% of the permitted point source flows to the Blackstone. The Woonsocket WWTF is the second largest with a flow of 8.65 MGD (16 MGD design flow), about 17% of the point source flow. These two WWTFs account for 89% of the total point source flow to the Blackstone. Actual point source inputs during the period of 1988-89 were 40.9 MGD (81%) from Massachusetts sources, and 9.68 MGD (19%) from Rhode Island sources. The river low flow condition or 7Q10 (the lowest flow Q condition during 7 days for an average 10 year period), historically used as the low flow condition for dilution and water quality impacts, is about 100 cubic feet per second (cfs) at the Woonsocket gage (Wright et al., 1991). At this low river flow, and average point source flows, contributions from all point sources to the river are estimated to be 78% of the total river flow. At average river flow conditions (860 cfs), the point source inputs account for about 9% of the total river flow.

The pollutant loadings of several constituents from the 17 largest permitted dischargers to the river were calculated and compared using monthly Discharge Monitoring Reports (DMRs) for 1988-89 by Wright et al. (1991) for the Narragansett Bay Project. Because of the differing permitted constituents, and differing discharge limits for the same constituents, it was difficult to make comparisons between facilities. BOD, TSS and fecal coliforms were the only constituents for which a conclusion could be made. Comparison of the actual discharges to the permit limits
Table 5: Permitted Dischargers to Blackstone River Watershed. (M) indicates major discharger.

**MASSACHUSETTS**

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<th>Expiration date</th>
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<td>Wyman Gordon-Worcester</td>
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**Municipals:**

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<td>Upton (M)</td>
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Table 5: (cont.) Permitted Dischargers to Blackstone River Watershed
(M) indicates major discharger

RHODE ISLAND

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<th>Expiration date</th>
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<td>RI0000906</td>
<td>Branch River</td>
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indicates that most facilities performed within their limits during this two year period. UBWPAD contributed about 51% and Woonsocket 37% of the total actual BOD discharge from the 17 facilities. For TSS, UBWPAD was responsible for about 51% and Woonsocket about 37%. Rankings for fecal coliforms show that Woonsocket was significantly more important than UBWPAD.

The loadings from UBWPAD, estimated from discharge monitoring data, account for 79-96% of metals and solids inputs (Hoffman, 1988; Save The Bay, 1990) from Massachusetts point sources. Contributions of cadmium, copper, nickel, and zinc to the Blackstone from the UBWPAD are significant (Wright et al., 1991). The Woonsocket WWTF is the largest contributor of metals to the Blackstone within Rhode Island, but no significant increases in any metal concentrations in the water column at that location could be attributed to it (Wright et al., 1991). Little data from other facilities exists; these numbers are based on available data only.

It should be noted that the Blackstone Valley District Commission (BVDC) has not been included in the above discussions. Although it serves areas within the Blackstone River basin (hence the name), the wastewater treatment facility actually discharges into the Seekonk River. The discharge location is significantly below the mouth of the Blackstone where it enters the Seekonk at Slater's Mill and does not contribute to the water quality of the Blackstone. Water quality impacts associated with the BVDC discharge will be evaluated through its current CSO facilities planning effort, and the importance of BVDC in relation to other Providence River and upper Bay sources will be investigated as part of the Narragansett Bay Project wasteload allocation project for that area.

A study conducted by Metcalf and Eddy (1990) for the NBP estimated the total annual combined sewer overflow discharge from the BVDC CSOs to be on the order of 800 million gallons; however, that study did not attempt to separate the percentage of that flow discharging to the Blackstone River. Although 18 of BVDC's 28 CSOs discharge to the Blackstone, it is likely that less than half of BVDC's total CSO discharge goes to the Blackstone. This is because the single largest (by far) CSO discharge is the approximate 300,000 gallons per day from the North Diversion Structure, discharges to the Seekonk River.

BVDC recently initiated a CSO facilities plan, scheduled for completion (draft report) in May 1992, that is intended to develop recommendations for abatement of the CSOs under BVDC control. A monitoring plan has been developed, as part of this facilities plan, that will provide the data necessary for development of stormwater models that will estimate the discharge, and associated loadings, from individual CSOs. Until the model is developed, it is impossible to accurately estimate volumes and loadings of CSO discharges to the Blackstone in Pawtucket and Central Falls. Surveys taken during wet weather periods (Wright et al., 1990) documented a 100-fold degradation of the water quality in the Rhode Island portion of the Blackstone River, as measured by fecal coliform levels; however, the degradation was not solely due to CSO discharges, but also from point source discharges such as the Woonsocket WWTF.
The Worcester CSO facility has been partially operating (pumping dry weather flows and some storm flows to UBWPAD) since about 1986, and achieved full operation with the issuance of its NPDES permit on December 8, 1990. The facility provides screening and chlorination/detention for flows resulting from rain events up to the 5 year storm severity. The CSO facility has not been evaluated as to its effectiveness; because it was only recently issued a permit, no limits have existed for comparative purposes. However, the permit requires implementation of a monitoring program. There may also be many illegal connections to Mill Brook as it flows underground through Worcester (Save The Bay, 1990).

b. Nonpoint Sources

Nonpoint pollution sources include those that are not associated with a pipe, but rather are diffuse, and as a result, are difficult to quantify. Nonpoint sources to the Blackstone may include agricultural and urban runoff, leachate from landfills, leaking underground storage tanks, and hazardous waste sites, soil erosion and sediment resuspension, atmospheric deposition, and effluent from failed septic systems. Usually, loadings from these sources are exacerbated by wet weather. Nonpoint pollutants include suspended solids, toxic metals and organics, nutrients, and pathogens.

Little data exists for nonpoint sources and associated pollutant loadings to the Blackstone but they are likely a significant input. Population growth has been rapid as the communities surrounding Worcester have evolved into bedroom communities for Boston (Figure 5). Land use has been changing from mostly rural to suburban sprawl. These pressures are likely to continue.

EPA's National Urban Runoff Program (NURP) attempted to quantify pollutant loadings resulting from urban runoff. The Lake Quinsigamond area of Worcester was evaluated as part of the NURP study in 1980. The findings were two-fold; the lake is experiencing eutrophic conditions due to runoff of phosphorus, and bacterial pollution was widespread as a result of sewage contamination of storm drains via routes such as illegal connections and infiltration (USEPA, 1983a).

USEPA regulations for stormwater (listed in 40 CFR 122) issued in 1990 requires cities of over 100,000 people with separate storm sewer systems to apply to USEPA for a National Pollutant Discharge Elimination System (NPDES) stormwater permit. Worcester and Providence will be required to obtain such permits or apply for an exemption if the population serviced by separate, rather than combined, sewers is less than 100,000. Facilities that generate and discharge stormwater associated with industrial activity will also be required to obtain stormwater permits. The NPDES permits for discharges from municipal separate storm sewer systems will include a requirement to prohibit non-stormwater discharges into the storm sewers and controls to reduce the discharge of pollutants to the maximum extent practicable. For Part 1 of the permit application the cities will have to identify all their storm
Figure 5


% Population Change (1980-1986)

- ≤ 0
- > 0 ≤ 5
- > 5

U.S. Census Bureau
drains, characterize the discharge from each drain, and describe the existing management system. In Part 2 of the application, the cities will be required to propose a more complete management plan including 1) control measures to reduce pollutants in runoff from commercial and residential areas; 2) a program to eliminate illicit discharges; 3) a program to control pollutants from facilities including landfills, hazardous waste sites, and industries; and 4) a program to control pollutants in construction site runoff. Dates for submission of permit applications are May 18, 1992 for Part 1 and May 17, 1993 for Part 2.

Industrial sites will also be subject to stormwater permit requirements. Individual industries have until November 18, 1991, to apply and Group Industrial applications are due September 30, 1991, for Part 1 and May 18, 1992, for Part 2. It is likely that there will be several industries within the Blackstone basin that will require stormwater permits.

4. Water Supply/Water Withdrawal

There are numerous dams along the length of the Blackstone. Over the years, many dams have been removed or fallen into disrepair, but several still remain. Hydropower is still a major use of the river, and this activity, along with water withdrawals for other purposes, has resulted in conflicts with maintaining water quality.

Many of the dams are in poor condition and have been breached, exposing contaminated sediments that had settled out in the dam impoundments. The Fisherville Dam is particularly noteworthy; its sluice gate has been welded open since 1986 to prevent undermining of the dam (Save The Bay, 1990). There is a large area behind the dam that is now exposed; this former lake and marsh was considered to be one of the biggest migratory bird refuges in New England before it was drained. The river now cuts across the lake bed, eroding contaminated sediments.

There are currently a total of six Federal Energy Regulatory Commission (FERC) licensed hydropower operations within the Blackstone River watershed, five in Rhode Island and one in Massachusetts (Table 6). These hydropower plants are permitted as "run-of-the-river" operations, meaning that flows are to be generally maintained at the natural rate of river flow. While the turbines are operating, flows pass both through the turbine and over the spillway. When the turbines are shut off, all flow passes over the spillway. When the water elevation drops below the spillway, the turbines should be shut down; however, unless this occurs immediately, there will be a period of no flow over the spillway while the river flow builds up to the spillway crest. This lack of river flow may result in downstream water quality problems and ecosystem stress due to lowered DO and increased chemical concentrations of pollutants, as well as the direct loss of habitat from reductions in the area inundated. Similarly, sudden releases of water through the turbines that are greater that natural flow can cause water quality impacts due to
### Table 6: Permitted FERC Hydropower Facilities on the Blackstone River

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*exemption granted from licensing (mandatory conditions imposed)
resuspension of sediments and associated contaminants. Sudden high flow acts similarly to a rainfall induced flow.

Although all the hydropower facilities on the Blackstone are supposedly run-of-the-river, the conditions of high and low flow described above have been frequently observed on the river. Flows have been observed to vary from 500 to 2300 cfs in less than one hour (RIDEM, 1990). Besides the impacts on water quality, this can be a serious problem during river sampling.

Water withdrawals from the Blackstone are also an issue. Water is diverted from surface and groundwater sources for drinking water supply. For the most part, this water is returned in the form of treated effluent from WWTFs; however, an out-of-basin transfer is possible under the Massachusetts Interbasin Transfer Act if the service area straddles two basins. It should also be noted that since most of Worcester's drinking water comes from outside the basin, there is actually a net transfer into the basin, which ends up as UBWPAD effluent. Another type of withdrawal is the use of water for industrial purposes. For example, as mentioned previously, the OSP plant, when fully operational, could take (and not return, through consumptive cooling uses) approximately 4 MGD from the Blackstone. Both of these types of withdrawal will result in lower flow and may have potential water quality impacts due to lower reaeration and lower dilution, as well as potential impacts on the available physical habitat.

5. Sediments

There are an estimated 2,180,000 cubic yards of contaminated sediments in the Massachusetts portion of the Blackstone River alone (McGinn, 1981). These sediments, especially those trapped behind current or former impoundments, have been identified as a potential major source of pollutants to the Blackstone River. Because many toxics, particularly heavy metals, tend to bind to particles that then settle out of the water column, these toxics accumulate in the sediments. In swiftly flowing sections of the river, the particles tend to remain suspended, but behind impoundments, where the water slows considerably, the particles tend to settle out, and here sediment and associated contaminants accumulate. During periods of heavy rainfall, the flow rate of the river may increase to the point that these sediments are resuspended and carried downstream, therefore contributing to water quality problems (Wright et al., 1991). In addition, a number of dams have been breached and the contaminated sediments are exposed to erosion by the river flow and runoff. To quantify the extent of sediment contamination, two sediment studies of the Blackstone River have been conducted.

In 1981, the Massachusetts Department of Environmental Quality Engineering (DEQE) conducted a major study of sediment metal contamination and toxicity at eight sites along the river (McGinn, 1981). This study concluded that the sediments in the Blackstone River are "grossly polluted with heavy metals" and are the "most severely contaminated sediments in the Commonwealth of Massachusetts". In
addition, the study found that the flora and fauna are being adversely impacted by the contamination. The study also evaluated various abatement strategies and recommended a sediment management plan including dredging and disposal, sediment and bank stabilization, and dam reconstruction, with a total estimated cost (in 1981 dollars) of $35,609,461. No action has been taken on these recommendations to date, although a recent nonpoint source (CWA Section 319) grant from USEPA to Massachusetts is planned for a set of demonstration streambank stabilization projects (see Section C.2.a. below).

The Narragansett Bay Project funded Dr. John King of the University of Rhode Island to collect four sediment cores in the Blackstone River as part of a larger study of Narragansett Bay. These cores were collected in 1990 and have recently been analyzed for metals by USEPA. They are also being analyzed for nutrients and organic contaminants, but these results are not yet available. Preliminary findings indicate that the metal concentrations found in the cores are extremely high - among the highest ever observed by Dr. King (J. King, pers. comm.). Figure 6 compares some Blackstone River sediment values to sediment metal concentrations used under certain specific conditions to define "contaminated" sediments, and, in most cases, the Blackstone River levels far exceed those concentrations. Profiles of the concentrations within the cores from surface to background levels (about 1 meter), in most cases, do not show a decrease at the surface. Figure 7 shows two representative profiles from one site on the Blackstone. Although levels deposited were very high in the past, the surface levels do not reflect decreases in current discharges. This indicates that either current discharge levels, and subsequent deposition, continue at a high level, or that sediments upstream are continually resuspending and redepositing.

Toxicity tests using sediments from four locations on the Blackstone were conducted as part of the sediment study conducted by MADEP in 1981 (McGinn, 1981). Sediments from Rice City Pond and Sutton Street (Northbridge) were extremely toxic to daphnids, and sediments from all sites produced identifiable sub-lethal effects in fathead minnows.

6. Habitat/Fisheries/Biota

Prior to the construction of dams on the Blackstone, anadromous fish, salmon and possibly shad, herring, and alewives, migrated up the river to spawn each year. With the passage blocked by dams, these fish disappeared from the Blackstone. The State of Rhode Island, with the assistance of the U.S. Fish and Wildlife Service (USFWS), is in the process of preparing an anadromous fish restoration plan for the lower section of the river that would require the provision of fish passages at several dams (D. Ryan, pers. comm.). Initially, shad and herring will be reintroduced, and if successful, reintroduction of other species such as alewives and salmon will be attempted.
Figure 6. Sediment metal concentrations in the Blackstone River and a tributary (Lackey Pond).

MA Cat III - Dredge material considered "contaminated"; typically not approved for open water disposal
ER-L - NOAA classification; 10th percentile of data that produces adverse biological effects
Figure 7. Profiles of metal concentrations in sediment core from Blackstone River impoundment.
Studies undertaken as part of the 1981 MADEP sediment study found that fisheries in the Blackstone were being adversely affected by the sediments, either directly or through impacts on food organisms or habitat, and that plant life in certain areas had been "seriously impaired" (McGinn, 1981). Finfish were collected from the Riverdale Pond by MADEP annually from 1985 to 1990 and analyzed for metal residues. Levels measured were considered within a normal range and did not warrant a consumption advisory based on fish tissue residues (A. Cooperman, pers. comm.).

As part of a study conducted by USEPA in 1980 to correlate toxics contamination in the Blackstone with UBWPAD and other municipal dischargers in Massachusetts, benthic invertebrates were sampled at six locations near Worcester (USEPA, 1983b). The study found a dramatic shift in macroinvertebrate species composition in the river downstream of the dischargers, from a diverse benthic community typical of good water quality conditions, to one dominated by oligochaete worms, typical of rivers with high nutrient levels. However, oligochaetes are also highly sensitive to metals. Bioassays for toxicity of the water column and sediments were conducted but did not indicate the presence of toxic constituents. The report concluded that despite the high concentrations of metals in the water and sediment, unknown toxicity-reducing chemical interactions may be responsible for the lack of toxic response (USEPA, 1983b).

RIDEM maintains some benthic monitoring stations on the Blackstone River. Some improvement in water quality has occurred, based on a reduction in the percentage of tolerant organisms and an increase in sensitive species present over the last few years (RIDEM, 1990). However, based on the dominance of the chironomid (midge) larvae, RIDEM concluded that the Blackstone River is "one of the most impacted of Rhode Island water sections" (RIDEM, 1990).

7. Land Use/Open Space/Habitat Loss

The Blackstone River basin has been, and continues to be, subjected to increasing population pressure, due to its proximity to Boston, Worcester, and Providence. However, according to the Blackstone River Valley National Historic Corridor (BRVNHCC) Land Use Management Plan, the major problem facing the Blackstone basin is not the amount of growth projected, but rather the decentralized pattern in which it is occurring (BRVNHCC, 1989). This growth has been accompanied by a loss of open space and habitat. A map and table showing land use in the Blackstone basin are contained in Appendix 3.

As a result of this increased growth and development, the associated loss of habitat, and the poor water quality of the Blackstone, concerned citizens interested in protecting the Blackstone formed the Blackstone River Watershed Association in the early 1970's. This group and others lobbied for the creation of parks to protect the river. Massachusetts designated the Blackstone River and Canal Heritage State Park, a linear park along the river extending from the Rhode Island border to
Worcester. Rhode Island created the Blackstone River State Park along a three-mile segment of the Blackstone Canal; this park has been expanded to include 150 acres. In 1986, Congress established the Blackstone River Valley National Heritage Corridor (BRVNH) with the intended purpose of preserving and interpreting the important historic and cultural lands, waterways and structures within the valley. The BRVNH is overseen by the National Park Service (NPS) and is working with Massachusetts and Rhode Island to develop a comprehensive land use management strategy for the basin. In addition to the BRVNH efforts, local communities along the Blackstone are active in developing land use strategies to protect open space and river water quality. In Rhode Island, the Comprehensive Land Use Planning and Regulation Act requires each municipality to prepare a comprehensive plan by December of 1991. Protection of open space and water quality will be addressed by these plans.

A recent issue of concern is the proposed Route 146 interchange on the Massachusetts Turnpike. This interchange will involve a large construction effort directly adjacent to the Blackstone and has the potential for significant detrimental environmental impacts. However, through environmental review processes such as the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA), there is an opportunity to minimize the impacts through measures such as stormwater management techniques, and potentially to derive significant environmental benefits.

C. Regulatory Framework and Recent Planning Activities

Numerous agencies and organizations conduct activities focussed on the Blackstone River. A list of many of these groups compiled by the Blackstone River Coordinator of the Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement (MADFWLE) is contained in Appendix 4. Space does not allow for discussion of all the important groups and activities related to the Blackstone; this section discusses the major ones which focus on water quality issues.

Prompted by the Narragansett Bay Project findings of high levels of toxics and water quality violations where the Blackstone River enters Rhode Island from Massachusetts, the Narragansett Bay Project requested USEPA to take the lead in getting Rhode Island and Massachusetts to address this problem. USEPA convened a meeting of key regulatory agencies that deal with the Blackstone River in March of 1990. At that meeting, the agencies' representatives developed a series of recommendations regarding specific actions that should be taken to protect and improve the Blackstone River. A follow-up meeting was held in July of 1990 to obtain commitments from the agencies to support and implement these recommendations. This meeting was attended by the heads of Rhode Island and Massachusetts environmental agencies and these individuals committed to supporting these activities. Where appropriate, these recommendations have been incorporated into this briefing paper. This series of meetings, to a great extent, has
provided the groundwork for this briefing paper and recommended management strategies.

1. Planning Activities

a. Narragansett Bay Project

As previously discussed, the NBP has conducted various studies of the Blackstone River. As part of the development of this briefing paper, and the associated suggested recommendations, the NBP has held two Blackstone River Round Tables. The purpose of these round tables was to convene a meeting of all interested groups which conduct activities dealing with the Blackstone to discuss issues and obtain input regarding potential recommendations. The minutes of these two round tables are available for review from the NBP Office.

b. River Surveys

Massachusetts and Rhode Island regulatory agencies have independently conducted water quality surveys for several years as part of the basin planning process for the Blackstone River. Basin planning is also conducted for water supply (drinking water) purposes in Massachusetts. The two states have generally acted independently in studying and managing the Blackstone. A major hurdle to a cooperative approach to understanding and managing the Blackstone is the lack of an interstate synoptic river survey.

Pollution abatement controls implemented in Massachusetts have likely resulted in improvements in water quality over the last decade, however, despite these improvements, the water quality of the Blackstone is still degraded. With the documentation of the importance of Massachusetts sources to the water quality of the river, came the realization that regulatory controls imposed by Rhode Island alone are likely to have little effect on improving water quality. This made it apparent that an interstate cooperative approach would be needed to adequately address this problem, and that USEPA should take the lead in getting the two states to work together.

c. EPA’s Blackstone River Initiative

With the realization that solution of the interstate nature of the water quality problems of the Blackstone would require going beyond the traditional regulatory approach, USEPA Region I recently selected the Blackstone River for special attention by establishing the Blackstone River Initiative. Creation of such an initiative meant that a team was formed, consisting of EPA Water Management Division staff who deal with various aspects of the Blackstone. In addition, a Team Leader was appointed to provide leadership to the team. Some USEPA regional resources have been reallocated to support the Initiative's activities. Proposed activities were identified and two year work plan was developed. Some of these
activities are coordination with other agencies, an intensive field survey of the river during 1991, establishment of a Memorandum of Understanding with the BRVNHCC, increased focus of EPA water regulatory programs (e.g., Compliance, Permits) on the Blackstone River, and reissuance of minor permits.

2. Regulatory Activities

a. Nonpoint Source Section 319 Grant

Massachusetts received a nonpoint source (CWA Section 319) grant from USEPA in 1990 for a project on the Blackstone. The purpose of the project is to repair several sites of streambank erosion along the Blackstone using a variety of "bioengineering" systems; these sites will serve as demonstration areas. It will also offer training workshops to agencies, and others, involved in streambank repair work. This project hopes to demonstrate that streambank stabilization using non-construction techniques is feasible and economical. These techniques could then be applied to other exposed, contaminated streambanks of the Blackstone that are currently subject to erosion.

b. Discharge Permits

The Clean Water Act requires the attainment of designated uses of a waterbody through the development of state water quality standards, and their enforcement through discharge permits. These permits may be issued by USEPA through its National Pollutant Discharge Elimination System (NPDES), issued jointly by USEPA and the state, as is the case for Massachusetts, or issued by the state if the permit program is delegated, as with Rhode Island. Because the program has been delegated, Rhode Island issues discharge permits through its Rhode Island Pollutant Discharge Elimination System (RIPDES), subject to approval by USEPA.

State water quality or technology based standards, whichever are more stringent, are the basis for deriving permit limits for pollutants. Permit limits are usually maximum allowable monthly and daily concentrations, based on instream criteria and dilution of the effluent; exceedance of this limit is a permit violation resulting in enforcement action by the state or USEPA. Determination of which constituents are limited is based on a review of existing discharge monitoring data, including priority pollutant scans, and any information on receiving water impacts. All dischargers do not have the same limits (e.g., non-contact cooling water is not generally regulated for nutrients and toxics).

Currently, where appropriate, permits that are being reissued within Region I generally contain both limits for individual toxic pollutants, particularly metals, and specific numeric limits for whole effluent toxicity, as well as quarterly toxicity testing requirements. Initially, Rhode Island focussed on limits based on numeric criteria and Massachusetts on toxicity; now the permits are more consistent and include both approaches to setting limits. Massachusetts permits that have been reissued
during recent years contain specific limits for metals, as well as toxicity limits. These include New England Plating, Guilford Industries and Wyman-Gordon. The permit for UBWPAD, currently in draft form, also will contain limits for metals and toxicity. Rhode Island permits that are reissued also contain limits for metals and toxicity. Wright et al. (1991) examined the permits of 22 (3 draft) dischargers to the Blackstone and found them to be inconsistent in terms of which pollutants are limited, the basis for deriving the limits (i.e., technology based and/or water quality criteria), and monitoring requirements. Wright et al. (1991) argues that identical monitoring requirements for all dischargers would allow evaluation of trends in water quality, determination of nonpoint source inputs, and a better understanding of point source loadings.

Minor permits are generally not reissued by USEPA, but continue in effect after the expiration date, provided the permittee has reapplied in a timely manner. Because they are usually considered insignificant discharges (for example, a large portion of the permits are for non-contact cooling water), reissuance is a low priority when staff resources are limited. Because it is a delegated state, RIDEM is responsible for permit reissuance; although Rhode Island does reissue minor permits, this activity is behind schedule due to limited staff. As part of USEPA's Blackstone Initiative, USEPA is taking a close look at minor permits on the Blackstone in Massachusetts and plans on reissuing all of them. Already, it has been determined that at least five minor permittees in Massachusetts are no longer discharging.

c. Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission (FERC) is the federal agency responsible for regulating the energy generation industry. FERC issues licenses to hydropower facilities on the Blackstone which allow the power plants to divert water from the river through turbines for generation of electricity. Currently, these facilities must also receive a Section 401 water quality certification from the state, thus allowing some control by the state over the plant's design and operation. However, there is a dispute between FERC and USEPA over the degree to which FERC is subject to the Section 401 certification process (USEPA, 1991). The permit is also subject to public review. The USFWS has been active in reviewing FERC licenses with regard to potential fish and wildlife impacts. The USFWS, or the state, may require that fish passage is provided, or on other such conditions.

There are some significant problems with the FERC licensing process. Most importantly, these licenses are usually for a 30 to 50 year period, and once issued, cannot be reexamined unless permit conditions are violated. Older facilities, in operation prior to 1936, are grandfathered from the permit process and, as long as they are owned and operated by the same company, they are never required to have a license. Only one existing hydropower operation (in MA) is known to be operating under this provision. With no requirement for a FERC license, there is no legal mechanism to ensure that such a plant is operated in a manner to avoid water quality impacts, or to stop them if they cause such impacts. Enforcement action can
be taken against licensed plants, but only if adequate documentation of water quality impacts directly attributable to the plant is obtained. Additionally, although projects are licensed as run-of-the-river projects, many of the existing licenses do not contain specific minimum flow release requirements. At present, according to the USFWS, the best mechanism to ensure that water quality impacts from hydropower plants are minimized is through establishing voluntary agreements with the owners (D. Ryan, pers. comm.).

d. Source Reduction Activities

Massachusetts has sponsored a major source reduction project in central Massachusetts for about two years. The Blackstone Project, under the direction of the Massachusetts Office of Technical Assistance Source Reduction Program within the Department of Environmental Management (MADEM), meets with industries in the Worcester area to evaluate their industrial processes and make recommendations relative to reducing the use of water, energy, and raw material, and reducing the production of hazardous pollutants. The Blackstone Project assists participating firms through on-site waste audits, workshops on various issues, and distribution of technical materials. Massachusetts and UBWPAD have entered into an agreement that establishes mutually agreeable procedures regarding referrals, training, reporting and assistance on source reduction in enforcement actions. The Blackstone Project receives referrals from UBWPAD and MADEP for technical assistance, including firms in violation of discharge regulations.

Rhode Island has a similar program, the Hazardous Waste Reduction Project (HWRP), that was established with funding from the NBP. The purpose of the HWRP is the same as the Blackstone Project, with the exception that the HWRP does not work with firms with any violations. The HWRP has conducted its activities statewide rather than emphasizing the Blackstone River or any other area.

The NBP held four Metals Industry Round Tables, similar to the Blackstone River Round Tables discussed earlier. Discussions at these round tables led to the formation of the Rhode Island Pollution Prevention Council (RIPPC). This committee, consisting of industry representatives, regulatory agencies, academics and others, will provide the state of Rhode Island with expertise and guidance on pollution prevention and source reduction activities.

e. MADFWELE Blackstone River Case Study

The Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement Riverways Program (MADFWELE) produced a case study report on the Blackstone River (Cohen, 1990). The report identified the major problems facing the Blackstone and addressed some of the obstacles preventing solving the problems. This is an excellent background document with a good discussion of major issues.
3. Other Organizations and Activities

a. Blackstone River Valley National Heritage Corridor Commission (BRVNHC)

This entity was discussed previously under the land use section. The BRVNHC has been developing a comprehensive land use strategy for the Blackstone Valley including both Massachusetts and Rhode Island.

b. Save The Bay Report on the Blackstone River

Save The Bay (STB), Rhode Island's largest environmental organization, has been actively involved with the Blackstone River, and has been working to establish a Massachusetts branch of STB focussed on the Blackstone. In 1990, STB released a special report, "Bring Back the Blackstone" (Save The Bay, 1990). This report presented data collected by MADEP in 1989 related to the water and sediment quality problems of the Blackstone and presented some recommendations. These recommendations included 1) control of toxic discharges from UBWPAD; 2) control of toxic sediments; 3) improved interstate cooperation; and 4) minimized water withdrawals (Save The Bay, 1990).

D. Conclusions

Based on the available data and previous discussions, a number of conclusions can be drawn about the Blackstone River.

1. The Blackstone River is a major source of contaminants to Narragansett Bay. Results from several surveys, and loadings calculations indicate that the Blackstone is a major source of many pollutants to the Bay during both dry and wet weather, and likely contributes to water quality violations observed in the Providence and Seekonk Rivers and upper Bay. It is a major source of solids, cadmium, chromium, copper, lead, nitrate, orthophosphate, PAHs and PCBs to Narragansett Bay, particularly during wet weather events.

2. The water quality of the Blackstone River is significantly degraded. The Blackstone River for most of its length does not meet water quality standards. Chronic water quality criteria are routinely violated for cadmium, chromium, copper, lead, nickel, and PCBs and levels of other contaminants were frequently elevated. The dissolved oxygen criterion below UBWPAD and Woonsocket was occasionally violated. The water quality problems of the Blackstone are probably due primarily to point sources during dry weather, and point and nonpoint sources, during wet weather. Water withdrawals may also be an important contributor to poor water quality.

3. The sediments in the Blackstone River are severely contaminated with metals. Sediment cores taken from impoundments along the Blackstone River have exhibited extremely high metal levels. Aquatic life shows evidence of being
adversely impacted by these contaminated sediments. In addition, the sediments may be resuspended during high flow conditions, thereby contributing to poor water quality, as well as increasing pollutant loads to Narragansett Bay.

4. Fish and wildlife habitats, and aquatic organisms, as well as aesthetic and recreational uses, have been impacted by the water quality of the Blackstone River. Studies have demonstrated impacts related to both water and sediment quality. Hydropower dams, fluctuations in water flows, and increased population pressures with accompanying land use changes in the Blackstone basin have contributed to the loss of habitat in and along the river. Physical blockage by dams has eliminated anadromous fisheries. Odors and other aesthetic concerns have also limited the ability of state and federal agencies to restore recreational and aesthetic use of the river corridor.

5. There are still major gaps in our knowledge and understanding of the Blackstone. Despite a fair body of information on the Blackstone, there remain some unresolved issues. The lack of a synoptic interstate survey and inconsistent permit monitoring requirements are barriers to understanding the true extent, nature and causes of the water quality and other problems. Lack of adequate information on wet weather inputs, nonpoint source locations and pollutant contributions, sediment interactions, water withdrawal impacts, and biological responses makes it difficult to identify and prioritize management strategies with great certainty. Although substantive controls can be identified and implemented, further study is needed to fully confirm the interpretation of the problems outlined in this paper, to enable managers to develop a more effective and efficient strategy to protect and improve the Blackstone.

6. The cooperation and coordination between Massachusetts and Rhode Island and with other agencies has been inadequate to protect and improve the Blackstone River. Although USEPA, Massachusetts and Rhode Island all consider the Blackstone River a high priority, and have worked independently to address the river's pollution problems, to date insufficient interstate and interagency coordination has taken place. In addition, there are many governmental and non-governmental agencies and organizations with varying goals and authorities that have a role in the management of the Blackstone. A major focus of effort and resources will be needed to achieve the level of cooperation and coordination necessary to effectively solve the problems of the Blackstone River.
III. GOALS, OBJECTIVES, AND STRATEGIES

GOAL: Eliminate the adverse impacts upon the water quality, ecological health, and uses of the Narragansett Bay caused by flows of the Blackstone River, and protect and improve the Blackstone itself. The goal shall be achieved through improving the water quality of the river and its tributaries, eliminating or remediating contaminated sediments in the river, and maintaining and restoring fish and wildlife habitat and aesthetic and recreational uses of the river and its watershed.

OBJECTIVE A: The states of Massachusetts and Rhode Island shall improve the water quality of the Blackstone River and its tributaries to meet all water quality standards.

PROPOSED STRATEGIES:

1. Point source abatement.

   a. The Massachusetts Department of Environmental Protection (MADEP), the Rhode Island Department of Environmental Management (RIDEM), and the U.S. Environmental Protection Agency (USEPA) should, as discharge permits issued to wastewater treatment facilities (WWTFs) in the Blackstone River watershed under the NPDES/RIPDES program are reissued, incorporate water quality based effluent limits for nutrients and toxics, as well as effluent toxicity limits. USEPA should be the lead agency in insuring that these permits contain consistent and enforceable limits and monitoring requirements.

As NPDES/RIPDES permits are reissued to WWTFs, these permits should include effluent limits on nutrients and toxic metals and organics, where appropriate. It should be noted that recent permits issued for the Blackstone, including the recent draft permit of the Upper Blackstone Water Pollution Abatement District (UBWPAD), does include stringent water quality based limits and toxicity limits. This process should continue as other NPDES/RIPDES permits are reissued. For this and all recommendations concerning permit limits, USEPA should also ensure that the permit limits are sufficient to meet water quality standards in both states.
b. MADEP, RIDEM, and USEPA should encourage the development of site-specific criteria for toxics to be used in NPDES/RIPDES permits issued to WWTFs in the Blackstone River watershed.

The national aquatic life criteria established by USEPA and adopted by MA and RI are based on laboratory toxicity tests in which aquatic organisms were exposed to known concentrations of toxicants in laboratory water and, thus, may not adequately represent site water and effluent effects. Aquatic life criteria are established solely for the protection of aquatic life and are independent of the water quality classification or intended uses of a waterbody. The aforementioned effects may include possible antagonistic or synergistic interactions of several chemicals within the effluent or receiving water. Thus, the national aquatic life criteria may be either underprotective or overprotective of aquatic life. Site-specific aquatic life criteria should be established, where feasible, for the Blackstone River, to establish conditions which will not impair the biological integrity of the aquatic community native to the river. Methodology for the development of site-specific criteria for four metals by UBWPAD has been approved by USEPA Region I. The proposed methodology involves comparison of toxicity between site water and laboratory water to adjust the national aquatic life criteria; the resulting site-specific criteria will then be used for setting permit limits for UBWPAD.

c. MADEP, RIDEM, and USEPA should jointly conduct water quality monitoring and modeling for the Blackstone River, and use that modeling as a basis for preparing a waste load allocation of metals and nutrients (including BOD) for point source dischargers to the Blackstone River system.

Because of the limited dilution and multiple sources of loadings in the Blackstone River, the potential exists for overlapping impacts from point sources. In order to establish effluent limitations that will result in the achievement of water quality standards for the Blackstone River system, water quality modeling should be developed for the entire length of the river (whether a new model or the extension of an existing state model), and a waste load allocation conducted for metals and nutrients (including BOD). Development of a waste load allocation, a means of distributing the assimilative capacity of a waterbody between all dischargers to that waterbody, taking into account any overlapping impacts, should provide an equitable distribution for the dischargers in both states that will enable compliance with all designated water quality criteria (whether national or site-specific).

d. All WWTFs in the Blackstone River watershed should evaluate the appropriateness of their disinfection practices, as described in the Toxics briefing paper.

The "Disinfection" section of the Toxics briefing paper (Penniman et al., 1991) outlines the trade-offs between the competing desires for effective
disinfection of effluent discharges from WWTFs, and the elimination of chlorine toxicity impacts in receiving waters. Chlorine toxicity has been identified as a potential problem in the Blackstone River, particularly downstream of the UBWPAD (A. Cooperman, pers. comm.). Similarly, there are many direct uses of the Blackstone River (e.g., canoeing, fishing) that require effective disinfection of WWTF effluents. Therefore, the procedure outlined in the "Disinfection" section of the Toxics briefing paper (Penniman et al., 1991) should apply to all WWTFs in the Blackstone River watershed.

e. USEPA, RIDEM, and MADEP should review pretreatment requirements for WWTFs in the Blackstone River watershed. The agencies should evaluate whether pretreatment programs should be instituted at WWTFs which do not currently have programs, and evaluate the effectiveness (including local limits evaluations) where programs are currently in place.

The importance of pretreatment programs in limiting toxic discharges was documented in the Toxics briefing paper (Penniman et al., 1991). Active pretreatment programs are important in the Blackstone River watershed to reduce loadings of metals and organics to the river. In particular, a local limits evaluation should be conducted for the pretreatment program of the UBWPAD.

f. USEPA and the States of Rhode Island and Massachusetts should emphasize pollution prevention and source reduction as the preferred means of reducing toxics loadings to the Blackstone River.

The Toxics briefing paper (Penniman et al., 1991) outlined a comprehensive strategy to reduce toxics loadings to the Narragansett Bay. Measures utilizing pollution prevention and source reduction were identified as preferable to treatment measures, since treatment measures typically serve simply to shift toxic pollutants to other media (e.g., sludge, air). Although pollution prevention and source reduction alone are typically not sufficient for meeting effluent limits that will be developed using strategies a. through e. above, and treatment measures will likely be needed in some cases as well, pollution prevention and source reduction strategies are preferred to treatment when choices exist. The strategies identified in the Toxics briefing paper (Penniman et al., 1991) are considered quite important to reducing loadings to the Blackstone River. Specific strategies for the Blackstone River include:

• USEPA and the States of Massachusetts and Rhode Island should continue to provide financial support to the RI Hazardous Waste Reduction Project (HWRP) and the Blackstone Project. The two projects should coordinate their activities in the Blackstone River watershed to the maximum extent possible. The HWRP and Blackstone projects provide technical assistance to firms in the area of pollution prevention and source reduction measures. This assistance
enables firms to use more effective processes that reduce their use or discharge of materials. These projects should continue to be supported by their respective states. Since both projects at times provide similar assistance to firms within the watershed, they should attempt to coordinate their activities as much as possible. Joint activities such as workshops held jointly by the two projects for firms in the Blackstone watershed might expand their capacities for providing technical assistance.

- **The States of Massachusetts and Rhode Island should establish procedures for coordinated permitting and inspections across all disposal media for dischargers to the Blackstone River or its tributaries.** Existing permitting and inspection procedures may result in firms attempting to meet confusing or even conflicting regulations relating to different disposal media, i.e., water, air, and land disposal. The states of Massachusetts and Rhode Island should, to the maximum extent possible, attempt to coordinate the development of regulations, issuance of permits, and conduct of inspections for the separate disposal media for the purpose of minimizing conflict and confusion. The long-term goal, as outlined in the Toxics briefing paper (Penniman et al., 1991), should be to test and establish procedures for issuing facility-based permits, i.e., each participating industrial user should receive a single permit covering discharges, releases and off-site waste transfers to all media rather than separate permits for discharges to air, land and water.

g. **UBWPAD, MADEP, and USEPA should consider the applicability of issuing tradeable discharge permits to industrial dischargers to UBWPAD.**

Tradeable (or marketable) discharge permits represent a new approach to regulating dischargers, an approach originally instituted in air emissions permits. Under such a system, dischargers who choose to discharge at a level lower than their designated limit may sell those discharge rights to other firms. The ability to market discharge credits, in theory, allows firms flexibility in the methods used to meet overall (system-wide) discharge limits, and is believed to foster innovative technology in reducing pollutant loads. Larger firms with the financial capability to institute large-scale source reduction or treatment measures can, essentially, "sell shares" in those measures to smaller firms, who might be unable to afford such measures themselves. Although it is unlikely that tradeable discharge permits could be applied in a systemwide basis to a linear discharge system like the Blackstone River, such a system may be applicable to the dischargers to the UBWPAD under its pretreatment program. **UBWPAD, MADEP, and USEPA should evaluate whether such an approach is likely to be feasible for industrial dischargers to UBWPAD.**
h. USEPA, RIDEM, and the Blackstone Valley District Commission (BVDC) should take every step possible to ensure that the facilities planning, design, and construction of CSO abatement measures for the BVDC CSO discharges to the Blackstone River are completed on schedule.

As noted previously, 18 of the CSO discharges under the jurisdiction of the BVDC discharge to the Blackstone River. Surveys taken during wet weather periods (Wright et al., 1990) documented a 100-fold degradation of the water quality in the Blackstone River, as measured by fecal coliform levels. Abatement of these CSO discharges is critical to the water quality of the Blackstone River, Providence River, and, potentially, the Upper Narragansett Bay. USEPA, RIDEM, and BVDC should take every effort to complete the draft facilities plan by May of 1992, as scheduled, and continue with design and construction as rapidly as possible thereafter.

i. USEPA and MADEP should evaluate the effectiveness of the Worcester CSO abatement project by examining the data gathered through the monitoring program conducted by the City of Worcester.

The NPDES permit issued to the City of Worcester in December of 1990 required that the city develop a monitoring program adequate to assess impacts of the CSO treatment facility on water quality and compliance or non-compliance with water quality standards for the receiving waters. USEPA and MADEP should carefully review the data gathered through this monitoring program, to determine if the project is effective in complying with water quality standards.

j. MADEP and the City of Worcester should periodically sample the Mill Brook Conduit to identify and eliminate illegal sanitary or industrial connections to that conduit.

The Mill Brook flows underground through much of Worcester, where it is referred to as the Mill Brook Conduit. It has been speculated that there may be historical connections to the conduit in Worcester that discharge industrial or sanitary waste during dry weather (Save The Bay, 1990). The portion of the conduit south of Salisbury Pond was rebuilt in the 1980's as part of the CSO abatement project (see above), and any illegal discharges in that portion should have been identified and eliminated as part of that reconstruction. Therefore, the portion of the conduit north of Salisbury Pond should be monitored to identify and eliminate illegal discharges in that portion. After elimination of illegal discharges in the northern section of the conduit, the entire length should be monitored to determine if any illegal discharges remain.
k. MADEP and RIDEM should periodically conduct shoreline surveys of the Blackstone River and its tributaries during dry weather periods, to identify and eliminate illegal industrial or sanitary discharges to the river.

The Blackstone River has historically been used as a discharge source for industrial and sanitary wastes for over one hundred years. A program to systematically determine if any unpermitted (and thus illegal) discharges remain, and then to eliminate those discharges, should be conducted by MADEP and RIDEM. The states should take advantage of data gathered by citizens groups such as the River Rescue program or the Blackstone River Watershed Association to help identify problem areas or potential sources that require more detailed data gathering and regulatory action. An additional benefit of shoreline surveys may be the ability to locate and identify the magnitude of nonpoint source inputs to the Blackstone River (see Strategy A.2.a. below).

2. **Nonpoint source abatement.**

a. MADEP, RIDEM, USEPA, and other interested parties should conduct a synoptic wet weather water quality survey for the Blackstone River to identify the location and magnitude of nonpoint source inputs.

A synoptic wet weather water quality survey for the Blackstone River has also been identified as needed to estimate the relative importance of bottom sediment resuspension and runoff under wet weather conditions (Wright et al., 1991). MADEP, RIDEM, and USEPA, as described in Strategy D.2., should cooperate to perform a wet weather synoptic survey for the Blackstone River.

b. USEPA, MADEP, and the City of Worcester should expedite the development of stormwater permits for Worcester, that will produce effective reductions in runoff related loadings to the Blackstone River.

The City of Worcester, located at the headwaters of the Blackstone, is the largest city in the Blackstone River watershed. The National Urban Runoff Program (NURP) study conducted for Lake Quinsigamond in Worcester identified phosphorus loadings to the lake as a major concern. Sewage contamination through improperly functioning septic systems, infiltration of sanitary sewers into storm sewers, and leakage at manholes was also identified as a major problem (USEPA, 1983a). As a result of the findings of the NURP study, the City of Worcester enacted its Wetlands Protection Ordinance, which places stormwater systems jurisdiction under the Conservation Commission. Stormwater permits should be issued that will resolve the identified problems and other possible areas of concern (e.g., toxic metals and organics).
c. MADEP and RIDEM should develop and implement a feasible and comprehensive sediment remediation plan for the entire length of the Blackstone River.

As described in a. above, sediment resuspension may be an important factor in observed water quality, particularly in wet weather conditions. Steps toward sediment control should be undertaken, as described in Objective B below.

d. MADEP and RIDEM should develop and implement a pilot program for identifying and reducing loadings from landfills and other nonpoint sources.

Runoff and leachate from landfills and other sources (e.g., scrap metal yards, agricultural land) potentially represent a major loading source for nutrients, metals, and toxic organics to the Blackstone River. MADEP and RIDEM should establish a pilot program that, as a minimum, captures and samples runoff from one or more suspected sources, to quantify loadings and make recommendations for reducing those loadings. A potential location for the pilot program would be the former City of Worcester landfill, which is located adjacent to the UBWPAD treatment plant. The leachate, which flows into the former UBWPAD discharge channel, is suspected of containing high levels of metals. Sampling of the landfill runoff will help determine the need for reducing nonpoint source loadings to the Blackstone River.

3. Water quality classifications.

a. The State of Rhode Island should upgrade the classification of the Blackstone River and its tributaries which are currently listed as Class C waters, to Class B.

Under 40 CFR 131.10(j), the classification of water bodies as Class C is illegal in the absence of a use attainability analysis that has been approved by USEPA. Class C waters are, by definition, inconsistent with the Clean Water Act goal of "fishable, swimmable." A use attainability analysis is the approved means by which a state can demonstrate that it is impossible for a waterbody to reach "fishable, swimmable." Since use attainability analyses have not been conducted for the Blackstone River or its tributaries in RI which are Class C (see Appendix I), they should be upgraded to Class B, regardless of whether they currently comply with Class C standards. Without the conduct of a use attainability analysis, USEPA should not approve a triennial review of water quality standards that contains Class C river segments.
4. **Regulation of water withdrawals.**

a. The Federal Energy Regulatory Commission (FERC), the U.S. Fish and Wildlife Service (USFWS), RIDEM, and MADEP should ensure that any new permit for the development of a hydroelectric power project on the Blackstone River or its tributaries does not allow any storage or withdrawal of flow from the river. Diversions of flow from the river should be of the minimum length necessary for the generation of power and should not affect any significant physical, cultural, or biological resources in the river.

Water withdrawals, and subsequent releases, for hydropower generation that are beyond the normal flow pattern of a river can create serious water quality impacts in that river. Periods of low flow can be responsible for decreases in dissolved oxygen and the loss of instream fish habitat through the drying up of valuable habitat areas. Similarly, sudden flow releases can cause sediment resuspension, resulting in increased levels of metals, organics, and BOD (Wright et al., 1991). All new hydropower permits issued by FERC should be for "run-of-the-river" projects, with specific minimum flow requirements that are protective of water quality and physical habitat. The states should insure through the water quality certification process that any hydropower project does not adversely affect the river's resources. The installation of flow gages by the permit applicant should also be required as a condition of the state water quality certification for new FERC permits (see b. below).

b. FERC, RIDEM, and MADEP should enforce the requirements contained in current hydropower permits through the following actions:

- RIDEM and MADEP should review the requirements included in FERC permits for facilities in their respective states, and the associated state water quality certifications, to determine the minimum flow and diversion stipulations included.

The flow and diversion stipulations in FERC permits can vary widely depending on when the permit was issued, and the level of controversy the permit generated when applied for. The states should review the permits for dams in their state to determine the stipulations in force at each dam.

- RIDEM and MADEP should continue to periodically assess fluctuations in streamflow at the USGS gage in Woonsocket, to determine when illegal storage or discharge operations may be occurring. RIDEM and MADEP should also evaluate the feasibility of supplementing the USGS gage by supporting additional USGS gages at Northbridge and Millville, and/or by installing low-cost real-time reporting flow gages at several locations along the Blackstone River to provide immediate notice of flow fluctuations.
Streamflow fluctuations have been previously noted that were likely the result of upstream hydropower operations (Wright et al., 1991). Flow records for the Woonsocket gage at one time showed an increase of flow from 500 cfs to 2300 cfs in less than one hour, which was believed likely to be associated with hydropower operation (RIDEM, 1990). Fluctuations such as these must be observed as they happen in order to determine at which facility or facilities the storage or discharge is occurring. The feasibility of providing state support for the currently inactive USGS gages in Northbridge and Millville, and/or utilizing real-time flow gages (the use of which has become popular for automated flood warning systems) to provide immediate notice of possible storage or discharge operations, should be evaluated by RIDEM and MADEP. RIDEM and MADEP should also require the installation of flow gages by the permit applicant, as a condition of the state water quality certification for new FERC permits (see a. above).

• RIDEM and MADEP should report hydropower activities that are contrary to permit stipulations to FERC for appropriate action. If FERC does not take action, RIDEM, MADEP, and USFWS, should consider legal action to require FERC to take disciplinary action.

Illegal hydropower operations should initially be reported to FERC, who should then take appropriate action toward the permittee. (Such action could include notice to cease and desist, fines, and, ultimately, revocation of the FERC permit.) Although the states have expended considerable effort in attempting to document problems through the above actions, FERC has rarely taken enforcement action in the past, largely due to the prior inability to levy fines and related measures. However, they have recently shown more interest in pursuing enforcement actions if detailed evidence of violations is available (D. Ryan, pers. comm.). If FERC fails to take action against a permittee for documented permit violations, the state agencies, in conjunction with the USFWS, may be required to consider legal action against FERC and/or the permittee.

c. The USFWS, RIDEM, and MADEP should negotiate cooperative agreements with current hydropower dam owners having no minimum flow release requirements to ensure adequate minimum flow is maintained at all times.

Some existing FERC hydropower licenses do not contain specific minimum flow releases, or allow diversions from a significant length of the river (e.g., approximately one mile in the case of Tupperware Dam). In those cases, USFWS, RIDEM, and/or MADEP should attempt to negotiate agreements with the dam owners to maintain minimum flow releases.
d. MADEM and RIDEM should carefully evaluate proposals for interbasin water supply withdrawals or consumptive water uses from the Blackstone River watershed, to consider both the water quality and habitat impacts of withdrawals from the Blackstone.

Withdrawals from the Blackstone River for the purpose of water supply or consumptive water uses potentially pose a severe threat to plans for improving the water quality of the river. Since the Blackstone already fails to meet water quality criteria, additional withdrawals from the river could likely serve only to exacerbate current problems. Additionally, withdrawals may have impacts to physical habitats directly from reduced flow quantities in the river. MADEM and RIDEM reviews of water withdrawal proposals should evaluate both water quality and physical habitat effects.

e. Comprehensive plans prepared for the Blackstone River that address the issue of regulation of water withdrawals or the maintenance of instream water quality should be submitted by the sponsoring agency to the Federal Energy Regulatory Commission for recognition.

Under Sections 10(a)(1) and (2) of the Federal Power Act, FERC is required to consider the recommendations of all such comprehensive plans recognized by FERC when evaluating any proposed permit for hydro power. Plans that should be submitted to FERC for recognition include the Cultural Heritage and Land Management Plan for the Blackstone River Valley National Heritage Corridor, the Blackstone Region Water Resources Management Plan of the State of Rhode Island, the Blackstone River Basin Plan developed by MADEM, and (when completed) the Comprehensive Conservation and Management Plan for theNarragansett Bay being prepared by the Narragansett Bay Project, of which the recommendations contained in this briefing paper, when approved by the Management Committee, will be a part.

f. The United States Congress should amend the Federal Power Act to require that all hydropower projects, regardless of when initiated, require FERC licenses. RIDEM and MADEP should also include stipulations in water quality certifications granted for FERC licenses that allow for the reopening of the certification if the hydropower operation is found to be inconsistent with the Clean Water Act.

Although the Federal Power Act and the FERC license process allows for extensive public and agency comment on proposed permits for hydropower projects, several circumstances adversely affect the use of FERC licenses in maintaining water quality. For example, projects that have been in continuous operation since before 1936 do not require a license from FERC (D. Ryan, pers. comm.). Additionally, licenses typically run for periods of 30 to 50 years, and can not be reopened unless the original stipulations of the license
have been violated. Thus, hydropower operations being conducted under perfectly legal conditions (either unlicensed or with a valid license) may have severe impacts on stream water quality. The U.S. Congress should amend the Federal Power Act to require that all hydropower operations, even those in operation prior to 1936, be required to obtain a FERC license. In issuing water quality certifications, MADEP and RIDEM should insert "reopen" clauses similar to those included in NPDES/RIPDES permits, which allow for revision if needed to remain consistent with the Clean Water Act. Although a standard article in FERC licenses allows for consideration of modifications to projects, it is a more involved process than reopening of water quality certifications.

**OBJECTIVE B:** The states of Massachusetts and Rhode Island shall eliminate or remediate the impacts from contaminated sediments in the Blackstone River on biota and water quality.

**PROPOSED STRATEGIES:**

1. MADEP and RIDEM should establish a "demonstration" sediment remediation project along the Blackstone River, to evaluate the feasibility of remediation of highly contaminated sediments.

In 1990, Massachusetts and Rhode Island applied to NOAA for a CZMA Section 309 interstate grant. The original proposal called for work on the Taunton River and Mount Hope Bay, and funds to design and implement a sediment control pilot project for the Blackstone River. Due to funding limitations, the Blackstone portion of the grant request was removed. The states should actively pursue further Section 309 grants or other funding which may be made available (e.g., Coastal America Initiative) to conduct a pilot program. The pilot program should be conducted at a contaminated site which appears to have manageable solution(s) and is unlikely to be recontaminated by sediment resuspension from other sources. Demonstrated success by a pilot project is needed to generate widespread support for a comprehensive sediment control plan for the entire Blackstone River. The Assessment and Remediation of Contaminated Sediments (ARCS) Program established by the Great Lakes National Program Office, an integrated program for the development and testing of assessment and remedial action alternatives for contaminated sediments, may provide an appropriate model for action.

2. MADEP should continue to proceed with the "bioengineering" streambank protection demonstration project planned for the Blackstone River.

A proposal was developed by the Massachusetts Association of Conservation Districts to conduct a demonstration bioengineering streambank protection project at several sites along the Blackstone River. This proposal has been approved for
funding by MADEP through a USEPA Section 319 grant. Although the direct purpose of the project is to provide streambank protection, it is believed that prevention of streambank erosion in certain areas will also serve to limit sediment resuspension. If the demonstration proves successful in limiting sediment resuspension, MADEP should consider expanding the project to additional sites.

3. MADEM and RIDEM should actively investigate the ownership of failed or unstable dams along the Blackstone within their respective states, and require repair of those dams by their owners if their repair is believed likely to avert sediment resuspension or other adverse environmental impacts. Many dams along the Blackstone River are in various states of disrepair. Should a dam fail, the sudden flows created by the failure, as well as the exposure of previously undisturbed areas, could cause increased sediment resuspension. MADEM, through its Office of Dam Safety, and RIDEM, through its Freshwater Wetlands Division, Dams Office, should establish a program to: (a) inventory existing dams on the Blackstone River; (b) establish the ownership of all existing dams; (c) examine prior inspection records for or inspect all dams to determine the likelihood of dam failure; and (d) require the owners of unsafe dams to implement repairs, if repair is considered necessary to prevent the resuspension of identified contaminated sediments or other adverse environmental impacts from a dam failure. The installation of fish ladders should be required as part of any repair.

4. An agreement should be negotiated between the owners of Fisherville Dam, the U.S. Army Corps of Engineers (USACOE), and the Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement (MAFWELE), to repair the dam and restore a permanent impoundment and marshes behind the dam.

The sluice gate of the Fisherville Dam was welded open in 1986 to prevent possible undermining of the dam. The former impoundment is now exposed, leaving a shifting river bed which is believed to be eroding contaminated sediments during high river flows. Negotiations have been conducted with the owner of the dam, USACOE, and MAFWELE for its repair and restoration of a permanent impoundment. These negotiations have currently reached an impasse, however. The owner has agreed to deed the dam to MAFWELE, who could then reach an agreement with USACOE to repair the dam. However, due to its state of disrepair, the dam is listed as "high hazard," and MAFWELE will not accept the deed as long as the dam is listed as such. The USACOE, meanwhile, can only become involved in repairing the dam if it is in public ownership, not as long as it is held by its current (private) owner. Some agreement should be reached by all parties involved that will result in this important dam and impoundment being restored. As part of the restoration plan, all alternative sediment remediation measures should be evaluated, and an analysis conducted to identify the potential for bioaccumulation of toxic materials if the dam were to be restored. The installation of fish ladders should also be required as part of any repair.
5. MADEP and RIDEM should evaluate all available data, to develop and implement a feasible and comprehensive sediment remediation plan for the entire length of the Blackstone River.

In developing a comprehensive sediment control plan for the Blackstone River, the recommendations in the McGinn report (1981) should provide a starting point. Specific recommendations should be reconsidered based on new sediment contamination data currently being analyzed by Dr. John King and the results of demonstration projects (Strategies B.1. and B.2.). The control plan should identify preferred solutions and potential funding sources for carrying out the proposed remediation.

OBJECTIVE C: The states of Massachusetts and Rhode Island shall maintain and restore fish and wildlife habitat and aesthetic and recreational uses of the Blackstone River and its watershed.

PROPOSED STRATEGIES:

1. A comprehensive program to improve the water quality of the Blackstone River, in order to provide for the maintenance and restoration of habitat, should be implemented.

A program to improve the water quality of the Blackstone River will be critical to efforts to maintain and restore fish and wildlife habitat in the river. The strategies of Objective A will provide improvements in habitat throughout the river.

2. A program to maintain flows in the Blackstone River needed for the maintenance and restoration of habitat, should be implemented.

A program to maintain adequate flow volumes and patterns in the Blackstone River and its tributaries that will sustain fish and wildlife habitat should be established and implemented, as outlined in Strategy A.4. (a. through f.) above.

3. The USFWS, MADEP, and RIDEM should require that all new FERC permits for hydropower operations in the Blackstone River watershed require stipulations for the provision of fish passage at the permit location.

Although the Blackstone River does not currently support anadromous fish, the states of Massachusetts and Rhode Island have a long-term goal of restoring anadromous fisheries to the Blackstone. Since hydropower permits issued by FERC can be for thirty years or longer, and are difficult to reopen once issued, stipulations for the provision of fish passage at Blackstone River dams must be required as permits are issued, so as not to preclude future achievement of this goal. USFWS
and RIDEM have been requiring fish passage in new FERC licenses on the Blackstone River, and should continue to do so.

4. The USFWS, MADFWELE, and RIDEM should negotiate for the provision of fish passage at hydropower operations in the Blackstone River watershed which have existing FERC permits, as those river segments approach the capability of supporting anadromous fisheries.

As stated above, FERC permits for hydropower operations can last thirty years or longer. Permitees whose permits do not specifically state the requirement to provide fish passages can not be mandated to do so, but may be willing to allow their construction, particularly if funding for construction can be identified. In order to leave sufficient time to negotiate agreements and identify funding, USFWS, MADFWELE, and RIDEM should begin to negotiate agreements prior to individual stream segments actually achieving the needed water quality.

5. Communities in the Blackstone River watershed should establish programs for the protection of valuable resource areas.

Communities in the Blackstone River watershed, with the notable exception of Worcester and Central Falls, have faced a significant amount of development in recent years. Development pressures in the area are expected to continue to increase, particularly with the planned Route 146/Massachusetts Turnpike interchange. It is important that communities now establish the growth management framework by which they will manage development pressures which could adversely impact valuable resources (e.g., wetlands, open space, habitats), as well as directly affecting the water quality of the Blackstone River. An integrated program of land use planning, such as the land use strategy of the BRVNHC, including a comprehensive program of acquisition and conservation restriction of land to be preserved as open space, is vital to the protection of key resources. Community programs, including Local Comprehensive Plans developed by communities under the Rhode Island Comprehensive Planning and Land Use Regulation Act, should contain elements on open space and natural resources. The communities should utilize, participate in, and build upon the planned acquisition of land for the establishment of a Blackstone River Greenway by the Blackstone River Valley National Heritage Corridor and the states of Massachusetts and Rhode Island.

6. The Blackstone River and Canal Commission (BRCC) should continue its cooperative approach toward ensuring that development projects are consistent with the goals for the Blackstone River and Canal.

The BRCC, through the Chapter 155 of the Acts of 1988 (Massachusetts), is notified of all proposed projects that might impact upon the Blackstone River and Canal. Although they can not require modifications to any proposal, the Commission has
had success in negotiating modifications to proposals before they are finalized. This cooperative approach should be continued.

**OBJECTIVE D:** The states of Massachusetts and Rhode Island, USEPA, and other interested organizations shall develop and implement a program to increase understanding of the environmental quality of the Blackstone River.

**PROPOSED STRATEGIES:**

1. **MADEP, RIDEM, USEPA, and other interested parties should conduct a synoptic dry weather water quality survey for the Blackstone River.**

The need to conduct a synoptic water quality survey for the Blackstone River has been identified in the *Blackstone River 1990* report (Wright et al., 1991). MADEP, RIDEM, and USEPA have initiated efforts geared toward conducting a dry weather survey for three periods in the summer of 1991, with the ultimate goal of utilizing the data gathered in developing a dry weather wasteload allocation for the Blackstone River. To the extent possible, the agencies should take advantage of the sampling capabilities of the River Rescue Program or other citizens monitoring groups to maximize the potential data coverage of the survey. The following activities are planned to (and should) be conducted:

- Effluent sampling for WWTFs
- Instream water quality sampling
- Flow monitoring and time of travel analysis
- Effluent toxicity testing
- Instream toxicity testing
- Sediment toxicity testing
- Sediment chemistry
- Biological community analysis (fish and macroinvertebrate)

2. **MADEP, RIDEM, USEPA, and other interested parties should conduct a synoptic wet weather water quality survey for the Blackstone River.**

A synoptic wet weather water quality survey for the Blackstone River has also been identified as needed to estimate the relative importance of bottom sediment resuspension and runoff under wet weather conditions (Wright et al., 1991). MADEP, RIDEM, and USEPA, after successful completion of the dry weather survey, should cooperate to perform a wet weather synoptic survey for the Blackstone River. The proposal submitted by RIDEM under the 104(b)(3) program would fund sufficient data gathering for use in a wet weather wasteload allocation. To the extent possible, the agencies should take advantage of the sampling capabilities of the River Rescue Program or other citizens monitoring groups to maximize the potential data coverage of the survey. The following activities are recommended:
• Effluent sampling for WWTFs and CSOs
• Instream water quality sampling
• Flow monitoring
• Effluent toxicity testing
• Instream toxicity testing
• Sediment trap placement (transport analysis)

3. MADEP, RIDEM, and USEPA should conduct water quality modeling for the Blackstone River, to identify the relative importance of toxics and nutrient loadings from point source discharges, runoff, and sediment resuspension.

A major unanswered question in addressing the water quality problems of the Blackstone River is the relative importance of toxics and nutrient loadings from various sources, during both dry and wet weather conditions. While violations of water quality criteria have been documented in both dry and wet weather conditions, it is difficult to determine which sources create the greatest impact. An appropriate water quality model (e.g., QUAL2E), whether a new model or extension of an existing state model, would allow for a stronger effort in those areas expected to achieve the greatest return, e.g., the development of dry weather wasteload allocations for the Blackstone River, with subsequent wet weather analyses, if necessary. Water quality modeling will also allow for a post-audit of the decision to implement advanced treatment at the UBWPAD (Wright et al., 1991).

4. The Massachusetts Turnpike Authority (MTA) and MA Department of Public Works (MADPW) should prepare an Environmental Impact Statement (EIS) that evaluates all potential environmental impacts from the proposed Massachusetts Turnpike interchange with Routes 20 and 146. The EIS should be conducted through the National Environmental Policy Act (NEPA) and Massachusetts Environmental Policy Act (MEPA) processes.

A proposal is currently being developed for a new interchange on the Massachusetts Turnpike with Routes 20 and 146 in Millbury. This proposal has the potential for financial and environmental impacts throughout the Blackstone River Valley that would extend well beyond the immediate construction impacts from the project. An EIS should be developed by MTA and MADPW that will evaluate the long-term impacts of the proposed project on water quality, land use, and sediment stability in the Blackstone River watershed. Preparation of an EIS that fully documents the effects likely to occur will provide the opportunity for public comment on and mitigation of adverse impacts from a project of great importance to the Blackstone River Valley. Since the project is likely to have a significant environmental impact, and is funded through both federal and state sources, it should be reviewed through both the NEPA and MEPA processes.
5. The USEPA, in conjunction with the Narragansett Bay Project, should develop a comprehensive library, bibliography, and database of studies and reports describing the Blackstone River.

Extensive research has been conducted over the years studying the Blackstone River area. As part of its Blackstone River Initiative, and following up on the initial efforts conducted by the NBP’s Blackstone River Round Tables, the USEPA should collect as many of these materials as possible to a single location. A bibliography should also be published by USEPA, listing all available documents and their location, if not kept at a single repository (many reports may be out of print). These documents should be indexed in the Narragansett Bay Data System as the documents are acquired and catalogued by USEPA, and important data should be incorporated into the database.

6. The USEPA, in conjunction with the states of Massachusetts and Rhode Island and other interested parties, should establish a public information program geared toward outlining the need for cooperation in cleaning up the Blackstone River.

The process of improving the water quality of the Blackstone River will require participation from many levels—Federal and state agencies, local communities, business and industry, and private individuals. A public information program, established as part of the Blackstone River Initiative being conducted by USEPA, could be an important step in achieving the needed participation. Together with both states and groups such as the Blackstone River Watershed Association and Save the Bay, public awareness of the need to clean up the Blackstone could be greatly improved. The use of facilities developed as part of the Blackstone River Valley National Heritage Corridor, the Blackstone River Heritage State Park in MA, and the Blackstone River State Park in RI should be strongly considered for portions of this program.

OBJECTIVE E: The states of Massachusetts and Rhode Island, USEPA, and other interested organizations shall develop a collaborative interstate approach to protecting the Blackstone River.

PROPOSED STRATEGIES:

1. The New England Interstate Water Pollution Control Commission (NEIWPCC), in conjunction with the USEPA and the states of Massachusetts and Rhode Island, should establish a permanent Blackstone River Task Force to address interstate pollution problems in the basin.

An interstate Blackstone River Task Force is essential to proper coordination on the issues that impact the Blackstone River in both Massachusetts and Rhode Island. NEIWPCC, an interstate commission experienced in establishing similar task forces
(e.g., a prior interstate task force for the French and Quinebaug Rivers), is the most appropriate organization to establish the task force. Membership, at a minimum, should include USEPA Region I (through its Blackstone River Initiative), NBP, RIDEM, MADEP, MADEM, BRVNHCC, and other interested parties identified through the Blackstone River Round Tables or through other means. The Task Force should be focussed on identifying and carrying out solutions to manageable interstate issues affecting the Blackstone River. Potential topics to be addressed by the Task Force include:

- Permit issues—criteria, pretreatment programs, consistency between states, etc.
- Water withdrawals and water management.
- Sediment remediation.
- Habitat protection and restoration.
- Data and technology transfer (prior studies).
- Funding sources (Federal, regional, state, local, or private).

2. The states of Rhode Island and Massachusetts should include the other state on the automatic review list for all permit reviews or other major actions within the Blackstone River watershed. The USEPA should include both states on all such review lists for permits under its jurisdiction.

Due to the true interstate nature of problems on the Blackstone River, each state should automatically coordinate all proposals and reviews for programs potentially affecting both states. Such programs include NPDES/RIPDES discharge permits (including development of site-specific criteria), water withdrawal permits, major habitat or wildlife restoration efforts, and sediment remediation plans. USEPA should also ensure that any permit limits for any discharger likely to impact interstate waters are appropriate to meet water quality standards in both states.

3. MADEP, RIDEM, USEPA, and other interested parties should continue to cooperate in conducting synoptic water quality surveys and other field and modeling efforts for the Blackstone River.

As mentioned previously, a joint effort has been established to conduct a synoptic dry weather water quality survey for the Blackstone River from Worcester to Pawtucket. Further data gathering and modeling needs, as outlined in Objective D, should continue to be conducted in a comprehensive, river-long basis.

4. The states of Rhode Island and Massachusetts, as well as communities within the corridor, should support the goals and objectives of the Cultural Heritage and Land Management Plan for the Blackstone River Valley National Heritage Corridor.

The BRVNHCC Cultural Heritage and Land Management Plan outlines goals that require the cooperation of state and local entities within the corridor for them to be achieved. The establishment and use by the public of the Blackstone River Valley
National Heritage Corridor will, by increasing awareness of the Blackstone River, provide public and political interest in continuing to clean up the Blackstone.

5. The Blackstone River Valley National Heritage Corridor Commission (BRVNHCC), in conjunction with the National Park Service, USEPA, and other federal agencies, should establish a consistency review program to ensure that federal activities are consistent with the goals and objectives of the Cultural Heritage and Land Management Plan for the Blackstone River Valley National Heritage Corridor.

Public Law 99-647, which established the Blackstone River Valley National Heritage Corridor, requires under Section 9 that federal agencies coordinate their activities which may directly affect the Corridor with the BRVNHCC. The BRVNHCC should establish a consistency program to ensure that all activities are consistent with the goals and objectives of the Cultural Heritage and Land Management Plan for the Corridor.
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Appendix 1

Blackstone River Basin - Rhode Island

<table>
<thead>
<tr>
<th>Trib/Stream/Pond</th>
<th>Classification</th>
<th>Designated Use Criteria Met?</th>
<th>Particular Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackstone River</td>
<td>C (but not in compliance)</td>
<td>Does not support designated use.</td>
<td>Exceeds cadmium, copper, lead, mercury, silver, zinc levels; elevated coliform levels; nitrate and phosphorus exceed USCEQ guidelines; high turbidity, color, sodium, chloride; threatened by erosion, urban runoff, leachate from landfills.</td>
</tr>
<tr>
<td>Peters River</td>
<td>B (but not in compliance)</td>
<td>Does not support designated use.</td>
<td>Chronic water quality problems; accumulated sediments enriched with organic materials; elevated coliform levels.</td>
</tr>
<tr>
<td>Mill River</td>
<td>B (but not in compliance)</td>
<td>Partially supports designated use (not fishable/swimmable).</td>
<td>Chronic water quality problems; accumulated sediments enriched with organic sediments; elevated coliform levels; high copper levels.</td>
</tr>
<tr>
<td>Cherry Brook</td>
<td>C</td>
<td>Fully supports designated use.</td>
<td></td>
</tr>
<tr>
<td>West Sneece Brook</td>
<td>B</td>
<td>Fully supports designated use.</td>
<td></td>
</tr>
<tr>
<td>Scott Brook</td>
<td>B</td>
<td>Fully supports designated use.</td>
<td></td>
</tr>
<tr>
<td>Valley Falls Pond</td>
<td>C</td>
<td>Fully supports designated use.</td>
<td></td>
</tr>
<tr>
<td>Laporte Pond</td>
<td>B</td>
<td>Fully supports designated use.</td>
<td></td>
</tr>
<tr>
<td>Scott Pond</td>
<td>B (but not in compliance)</td>
<td>Does not support designated use.</td>
<td>Elevated coliform levels associated with nonpoint sources of pollution.</td>
</tr>
</tbody>
</table>

58
<table>
<thead>
<tr>
<th>Location</th>
<th>Compliance</th>
<th>Condition Description</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wallum Lake</td>
<td>A (but not in compliance)</td>
<td>Does not support designated use (Exceeds criteria for drinking water; although fishable/swimmable)</td>
<td>Total coliform level elevated; bacterial contamination sources include ISDSs along shoreline, runoff from developed areas, and recreational activities.</td>
</tr>
<tr>
<td>Branch River @ Slattersville</td>
<td>C</td>
<td>Fully supports designated use.</td>
<td>High nitrate level exceeds USCEQ criteria. Elevated total/fecal coliform levels.</td>
</tr>
<tr>
<td>Forestdale</td>
<td>B (but not in compliance)</td>
<td>Does not support designated use.</td>
<td>Elevated total/fecal coliform levels; exceedance of copper, lead, mercury, silver levels.</td>
</tr>
<tr>
<td>Branch River @ Chepachet River</td>
<td>B</td>
<td>Does not support designated use according to regulations; but considered in support by &quot;best professional judgment&quot;.</td>
<td>Threatened by proximity of underground storage tanks and CERCLIS site.</td>
</tr>
<tr>
<td>Clear River (Wallum Lake to</td>
<td>A (but not in compliance)</td>
<td>Does not support designated use (Exceeds criteria for drinking water; although fishable/swimmable)</td>
<td>Proximity of WWTF</td>
</tr>
<tr>
<td>3/4 mile downstream)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear River (3/4 mile point to 1/2 mile upstream from Wilson Reservoir)</td>
<td>C</td>
<td>Fully supports designated use.</td>
<td></td>
</tr>
<tr>
<td>Clear River (1/2 mile point to 1 mile upstream of Chepachet River)</td>
<td>B</td>
<td>Does not support designated use according to regulations; but considered in support by &quot;best professional judgment&quot;.</td>
<td>Somewhat elevated lead level.</td>
</tr>
<tr>
<td>Pascoag River</td>
<td>B</td>
<td>Fully supports designated use.</td>
<td>Threatened by proximity of underground storage tanks.</td>
</tr>
<tr>
<td>Tarkiln Brook / Tarkiln Pond</td>
<td>B</td>
<td>Fully supports designated use.</td>
<td>Threatened by proximity of CERCLIS site; elevated color, lead, total phosphorus levels; exceeds USEPA guideline for eutrophication.</td>
</tr>
<tr>
<td>Location</td>
<td>Impact</td>
<td>Status</td>
<td>Issues</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------</td>
<td>---------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Trout Brook</td>
<td>B</td>
<td>Fully supports designated use.</td>
<td>Threatened by proximity of CERCLIS site.</td>
</tr>
<tr>
<td>Nipmuc River</td>
<td></td>
<td>Fully supports designated use.</td>
<td></td>
</tr>
<tr>
<td>Slatersville Reservoir</td>
<td>B (but not in compliance)</td>
<td>Does not support designated use.</td>
<td>Exceeds USEPA eutrophication standard. Elevated total/fecal coliform levels; exceedance of heavy metal criteria.</td>
</tr>
<tr>
<td>Wilson Reservoir/ Spring Lake</td>
<td>B</td>
<td>Fully supports designated use.</td>
<td>Threatened by inputs from ISDS, erosion and sedimentation, and runoff from developed areas.</td>
</tr>
<tr>
<td>Pascoag Reservoir</td>
<td>B</td>
<td>Fully support designated use.</td>
<td>Threatened by nonpoint source inputs from ISDS, fertilizer, runoff and stormwater discharge from Route 44.</td>
</tr>
<tr>
<td>Smith Reservoir/ Sayles Reservoir/ Keech Pond</td>
<td>B</td>
<td>Fully supports designated use.</td>
<td></td>
</tr>
<tr>
<td>Burlingame Reservoir</td>
<td>B</td>
<td>Fully supports designated use.</td>
<td></td>
</tr>
<tr>
<td>Spring Grove/ Sucker Ponds</td>
<td></td>
<td>Fully supports designated use.</td>
<td>Threatened by increasing urbanization in the watershed.</td>
</tr>
<tr>
<td>Woonsocket Reservoir # 3/ Crookfall Brook/ Spring Brook (aka Mill Brook)/ Woonsocket Reservoir # 1</td>
<td>A</td>
<td>Fully supports designated use.</td>
<td>Threatened by highway runoff (road salt), automobile junkyards, highway construction activities.</td>
</tr>
<tr>
<td>Sneech Pond</td>
<td>A</td>
<td>Fully supports designated use.</td>
<td></td>
</tr>
<tr>
<td>Abbott Run Brook</td>
<td>A</td>
<td>Fully supports designated use.</td>
<td>Threatened by nutrient, heavy metal, organic, solids, and bacteriological contamination contamination from septic systems, stormwater runoff, fertilization, erosion, and sedimentation.</td>
</tr>
<tr>
<td>Happy Hollow Reservoir</td>
<td>A</td>
<td>Does not support designated use.</td>
<td>Exceeds RIDEM standards for total coliforms; urban runoff is the probable source.</td>
</tr>
<tr>
<td>Reservoir</td>
<td>Status</td>
<td>Full Support</td>
<td>Additional Information</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------</td>
<td>--------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Diamond Hill Reservoir</td>
<td>A</td>
<td>Fully supports designated use.</td>
<td>DO profiles show summer stratification; total and fecal coliform levels may be a concern.</td>
</tr>
<tr>
<td>Pawtucket Reservoir</td>
<td>A</td>
<td>Fully supports designated use.</td>
<td>Threatened by nutrient, heavy metal, organic, solids, and bacteriological contamination from septic systems, stormwater runoff, fertilization, erosion, and sedimentation.</td>
</tr>
<tr>
<td>Robin Hollow Reservoir</td>
<td>A</td>
<td>Fully supports designated use.</td>
<td>Threatened by nutrient, heavy metal, organic, solids, and bacteriological contamination from septic systems, stormwater runoff, fertilization, erosion, and sedimentation.</td>
</tr>
</tbody>
</table>
APPENDIX 2

MASSACHUSETTS

BASIN/SEGMENT INFORMATION

Appendix I contains 32 detailed drainage basin summaries. Each synopsis contains a basin map and a classification table of water quality segments. These summaries appear in alphabetical order with the basin order shown in Figure 2. Each classification table has seven elements that are defined below.

1. Segment Description: A description of the river segment or harbor.

2. River Miles: Inclusive mile points of the segment, where 0.0 is the mouth of the river, or the area of a harbor in square miles.

3. Water Use Classification: Freshwater rivers are classified A, B, and C; coastal or marine waters are classified SA, SB, SC. Waters are further divided into cold water fishery (CWF), seasonal cold water fishery (SCWF), warm water fishery (WWF) and aquatic life (AL). Some waters are antidegradation (AD). See the Massachusetts Surface Water Quality Standards (314 CMR 4.00) for the further criteria and definitions.

4. Support Status: An indication of the segments support (S), partial support (PS), non-support (NS), or unknown (U) water classification.

5. Causes: Those parameters which cause a segment not to meet its designated classification, use or natural conditions.

6. Source(s): Wastewater discharges or anthropogenic inputs which cause noncompliance.

NOTE: The Cape Cod and Islands Coastal Drainage Areas were not assessed for the 1990 report. However, a map and assessment from the 1988 report are included for the sake of completeness. This represents the most recent information available.
<table>
<thead>
<tr>
<th>SEGMENT</th>
<th>RIVER MILES</th>
<th>CLASS</th>
<th>STATUS</th>
<th>CAUSES</th>
<th>SOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kettle Brook</strong></td>
<td>8.0</td>
<td>B/WWF</td>
<td>NS</td>
<td>Coliform Bacteria, Nutrients, Unknown Toxicity</td>
<td>Leaking Septic Systems, Worcester Spinning &amp; Finishing</td>
</tr>
<tr>
<td>From Waite Pond, Leicester to Curtis Pond, Worcester</td>
<td>2.5</td>
<td>B/WWF</td>
<td>NS</td>
<td>Coliform Bacteria, Nutrients, Sulfation, Dissolved Oxygen</td>
<td>Urban Runoff, Storm Sewers</td>
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<tr>
<td><strong>Middle River</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>From Curtis Pond to American Steel Dam, Worcester</td>
<td>9.0</td>
<td>B/WWF</td>
<td>NS</td>
<td>Metals, Chlorine, Nutrients, Dissolved Oxygen, Coliform Bacteria</td>
<td>In-Place Sediments, Mill Brook CSOs, Uxbridge WWTP, Urban Runoff, Storm Sewers, New England Plating Co.</td>
</tr>
<tr>
<td>From Fisherville Dam to Rice City Pond, Uxbridge</td>
<td>8.7</td>
<td>B/WWF</td>
<td>NS</td>
<td>Metals, Coliform Bacteria</td>
<td>In-Place Sediments, Urban Runoff, Storm Sewers, Grafton WWTP</td>
</tr>
<tr>
<td>From Rice City of the Water Quality Monitor, Hillville</td>
<td>7.4</td>
<td>B/WWF</td>
<td>NS</td>
<td>Metals, Coliform Bacteria, Dissolved Oxygen</td>
<td>In-Place Sediments, Uxbridge WWTP, Urban Runoff, Storm Sewers</td>
</tr>
<tr>
<td>SEGMENT</td>
<td>RIVER</td>
<td>MILES</td>
<td>CLASS</td>
<td>STATUS</td>
<td>CAUSES</td>
</tr>
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<tr>
<td>Blackstone River (Continued)</td>
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<tr>
<td>From the Water Quality Monitor</td>
<td></td>
<td>3.7</td>
<td>B/WWF</td>
<td>S</td>
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<tr>
<td>to the Rhode Island Border</td>
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<tr>
<td>Beaver Brook</td>
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<tr>
<td>Entire length</td>
<td></td>
<td>3.0</td>
<td>B/WWF</td>
<td>NS</td>
<td>Dissolved Oxygen,</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>Coliform Bacteria,</td>
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<td>Suspended Solids,</td>
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<td>Nutrients</td>
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<tr>
<td>Mill Brook</td>
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</tr>
<tr>
<td>Entire length</td>
<td></td>
<td>3.0</td>
<td>B/AL</td>
<td>S (1.5)</td>
<td></td>
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<td></td>
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<td>NS (1.5)</td>
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<td></td>
<td></td>
<td>Dissolved Oxygen</td>
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<td>Quinsigamond River</td>
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<tr>
<td>Entire length</td>
<td></td>
<td>5.3</td>
<td>B/WWF</td>
<td>S</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Mill River</td>
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</tr>
<tr>
<td>Entire length</td>
<td></td>
<td>11.0</td>
<td>B/SCWF</td>
<td>S (0.8)</td>
<td></td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>PS (9.2)</td>
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<td>Priority Organics,</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Metals, Chlorine,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Unknown Toxicity</td>
</tr>
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</tr>
<tr>
<td>SEGMENT</td>
<td>RIVER MILES</td>
<td>CLASS</td>
<td>STATUS</td>
<td>CAUSES</td>
<td>SOURCES</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>West River</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entire length</td>
<td>9.7</td>
<td>B/SCWF</td>
<td>S (2.3)</td>
<td>Dissolved Oxygen, Organic Enrichment</td>
<td>Source Unknown</td>
</tr>
<tr>
<td><strong>Humford River</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headwaters to the Douglas WWTP</td>
<td>8.7</td>
<td>B/SCWF</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From Douglas WWTP to confluence</td>
<td>5.8</td>
<td>B/SCWF</td>
<td>NS</td>
<td>Metals</td>
<td>In-Place Sediments</td>
</tr>
</tbody>
</table>
APPENDIX 3 - FIGURE 1

Blackstone River Watershed Landuse

SCALE 1:273,000

LEGEND

- Urban and Residential
- Forest and Open Space
- Open Water and Wetlands

Rhode Island data from 1988 RIGIS landuse.
Massachusetts data from 1985 MASS GIS landuse.
APPENDIX 3 - TABLE 1

LAND USE IN THE BLACKSTONE RIVER WATERSHED

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>17,100</td>
<td>19 %</td>
<td>38,000</td>
<td>18 %</td>
<td>55,100</td>
<td>18 %</td>
<td>12 %</td>
</tr>
<tr>
<td>Urban</td>
<td>6,700</td>
<td>7 %</td>
<td>21,400</td>
<td>10 %</td>
<td>28,100</td>
<td>9 %</td>
<td>10 %</td>
</tr>
<tr>
<td>Agriculture</td>
<td>4,200</td>
<td>5 %</td>
<td>17,700</td>
<td>8 %</td>
<td>21,900</td>
<td>7 %</td>
<td>5 %</td>
</tr>
<tr>
<td>Forest</td>
<td>46,200</td>
<td>52 %</td>
<td>124,300</td>
<td>56 %</td>
<td>170,500</td>
<td>56 %</td>
<td>68 %</td>
</tr>
<tr>
<td>Brushland</td>
<td>900</td>
<td>1 %</td>
<td>N/A</td>
<td>N/A</td>
<td>900</td>
<td>0 %</td>
<td>0 %</td>
</tr>
<tr>
<td>Open Space</td>
<td>1,600</td>
<td>2 %</td>
<td>1,700</td>
<td>1 %</td>
<td>3,300</td>
<td>1 %</td>
<td>1 %</td>
</tr>
<tr>
<td>Open Water/Wetland</td>
<td>12,700</td>
<td>14 %</td>
<td>10,500</td>
<td>5 %</td>
<td>23,200</td>
<td>8 %</td>
<td>4 %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>89,400</strong></td>
<td><strong>100 %</strong></td>
<td><strong>213,600</strong></td>
<td><strong>100 %</strong></td>
<td><strong>303,000</strong></td>
<td><strong>100 %</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>

NOTE: Small differences (<5%) between land use surveys may be due to differences in land use category definition or initial map scale used.

Sources:  
1988 - Rhode Island information from RIGIS landuse coverage  
1985 - Massachusetts information from MASS_GIS landuse coverage  
1974 - RI and MA information from USGS GIRAS database
AGENCIES, ORGANIZATIONS AND OTHERS THAT ARE CURRENTLY AND/OR POTENTIALLY INVOLVED IN PROMOTING ENVIRONMENTAL QUALITY WITHIN THE BLACKSTONE WATERSHED.

Prepared by: Russell A. Cohen, Blackstone River Coordinator, Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement, 100 Cambridge Street, Room 1901, Boston, MA 02202 (617) 727-1614 ext. 358.

Date: October 31, 1990

[Note: The following document was prepared to encourage cooperation among the various entities presently or potentially engaged in environmental protection activities within the Blackstone watershed (i.e., the area of land drained by the Blackstone River). A map of the Blackstone watershed follows the text at the end of this document. The groups and programs briefly described here are listed in no particular order. Please feel free to contact the author with any additions, corrections or questions.]

(1) Blackstone River Valley National Heritage Corridor Commission (BRVNHC)
    [James Pepper, Executive Director (508) 278-9400]

    The BRVNHC was established by the U.S. Congress in 1986. It is an affiliated area of the National Park System. The boundaries of the Corridor include a portion of Worcester and most communities to the south that lie within the Blackstone watershed in Massachusetts and Rhode Island. The purpose of the BRVNHC is to recognize the national significance of the Blackstone Valley as the birthplace of the American Industrial Revolution and to promote tourism and economic development that are compatible with the protection of the Corridor's historic and natural integrity. The Blackstone River is a primary focus of the Corridor, and the Corridor's success largely depends on a further improvement of the Blackstone's water quality and the preservation of natural areas along the river. The BRVNHC has an annual budget of $350,000 (which must be matched 1:1 with local contributions), some of which is being allocated for cooperative agreements pursuant to the BRVNHC's objectives (see below). The BRVNHC has also retained consultant Jane Weidman to do preliminary work on the Massachusetts portion of the Blackstone Bikeway.

(2) US Environmental Protection Agency, Region I
    [Ron Manfredonia & Katrina Kipp (617) 565-3531, Beverly Baker (617) 565-3475, Jerry Potamas (617) 565-4876]

    The EPA took a greater interest in the Blackstone about a year ago, when it received a request from the RI DEM Director Bob Bendick for assistance in improving bi-state cooperation for Blackstone River cleanup. The EPA convened several meetings of agencies involved in pollution control in both states and then issued a list of recommendations for further action. Among these recommendations are the establishment of a permanent Blackstone River Taskforce to address interstate pollution problems and develop and help implement solutions, continued support under § 319 of bioengineering and other projects to identify and reduce nonpoint source pollution inputs to the Blackstone, and establishment of metals limits in the NPDES permit renewal for the Upper Blackstone treatment plant. The EPA also helps the Blackstone indirectly through its support (through the Estuary Program) of the Narragansett Bay Project (see below) and may be able to help in the future through the Near Coastal Waters Initiative or the proposed Watershed Initiative.

(3) U.S. Army Corps of Engineers (COE)
    [Bob Hanacek, Thames office (508) 987-0108]

    The Corps has done a number of projects within the watershed, including the Millbury diversion (a tunnel under Pakachoag Hill to handle flood waters from Kettle Brook) and a bank stabilization/channelization project along the Blackstone in the communities of Blackstone, Woonsocket and North Smithfield. The COE operates one facility within the Blackstone watershed, that being the West Hill flood control dam on the West River in Upton. The Corps controls an area covered by a flowage easement which extends upstream from the dam several miles up the West and its tributaries. The West River is a high quality stream and is popular for swimming and fishing. Nevertheless, proposals for water withdrawal and development upstream from the dam threaten the natural integrity of the area. The Corps has the potential for being a powerful ally for resource-based protection initiatives throughout the Blackstone and elsewhere.
Environmental Protection activities within the Blackstone watershed, continued

(4) USDA Soil Conservation Service, Worcester County (SCS)

The SCS is proposing to do a study of floodplain land use along the Mumford River, one of the Blackstone's larger tributaries. The SCS is also currently considering a proposal to study urban runoff pollution problems and solutions within the city of Worcester.

(5) Blackstone River and Canal Heritage State Park (BR&CHSP), MA Department of Environmental Management
[Tom Dyer, DEM Planning (617) 727-3160; John Pelczarski (508) 278-6486, or contact the Blackstone Nat'l Heritage Corridor]

This Heritage State Park was established by the Mass. Department of Environmental Management (MADEM) in 1981. As originally envisioned, the park was to include the entire river and canal corridor from Worcester to the Rhode Island line. Most work to date has been concentrated on the Rice City Pond area at the Northbridge/Uxbridge town line, where about 1000 acres were purchased and some trail and boat launching facilities were established. A visitors center and one mile canal barge ride are being planned just south of this point at the Voss Farm site. Funding constraints have forced DEM to lay off all but a subsistence staff, however, and to suspend most work to expand the Park beyond its current location. Once again, restoration and protection of the natural integrity of the Blackstone River and Canal and adjacent lands is critical to the success of this park.

(6) Blackstone River and Canal Commission (BRCC)
[Rep. Richard T. Moore, Chairman (617) 722-2692]

The BRCC was established by act of the Massachusetts legislature in 1981. Members of the commission and its advisory committee include elected officials, representatives of community organizations and private citizens from the eight communities through which the Blackstone flows in Massachusetts. The BRCC's purpose is to promote the restoration and protection of the historic, aesthetic, ecological and recreational values of the Blackstone River and Canal for public use. The BRCC's major role is to assist in the establishment and development of the Blackstone River and Canal Heritage State Park. In addition, the BRCC has jurisdiction to receive prior notice of and to review some proposed developments along the Blackstone River and Canal. A brochure describing the BRCC is available from Rep. Moore's office.

(7) Riverways Program, Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement (DFWELE)
[Russell Cohen, Blackstone River Coordinator (617) 727-1614 ext. 358]

The purpose of the Riverways Program is to protect, restore and enhance the natural integrity of the Commonwealth's rivers, streams and adjacent lands. The program works closely with local watershed associations and other citizen groups on such issues as water quality improvement and fish and wildlife habitat protection. The Riverways Program also initiates policies and legislation to protect rivers statewide. The role of the Blackstone River Coordinator has been to protect the natural integrity of the Blackstone River, its tributaries and adjacent lands through providing assistance to the Blackstone River Watershed Association and supporting and coordinating other complementary efforts.

(8) Blackstone Valley Heritage Homecoming (BVHH)
[Dorothy Heatherington (508) 278-2300]

Heritage Homecoming was established several years ago as a mechanism to promote local enthusiasm for the Blackstone River and Canal Heritage State Park and the historic and cultural heritage of the communities within the Blackstone Valley. The organization sponsors an annual Heritage Homecoming festival each fall. It is also coordinating the fundraising drive to rebuild a replica of the Lady Carrington barge, which was the first craft to travel the Blackstone Canal in 1828.
Environmental Protection activities within the Blackstone watershed, continued

(9) Blackstone River Watershed Association
[Ben Phelps, President (508) 883-3725]

The BRWA is a nonprofit citizens organization formed about twenty years ago to promote the restoration of the environmental quality of the Blackstone River, its tributaries and adjacent lands. The BRWA seeks to improve awareness of the Blackstone's ecological, historic, aesthetic and recreational value through its sponsorship of annual canoe races, summer beautification projects and educational materials. The BRWA also seeks to protect natural areas along the river and has done parcel research and landowner contact to solicit gifts of land and conservation restrictions. The BRWA recently entered into a cooperative agreement with the National Park Service, the Blackstone National Heritage Corridor Commission and the Rhode Island Parks Association to promote the establishment of a Greenway and Canoe Trail along the Blackstone's entire length. Other, smaller associations exist for portions of the Blackstone watershed including Coes Pond, Lake Quinsigamond, Manchaug Pond, Whittins Pond, and Leesville Pond.

(10) Worcester Area Chamber of Commerce (WACC)
[Bill Short, President (508) 753-2924]

The WACC is currently cooperating with EOA's Office of Technical Assistance (see below) in jointly sponsoring a series of workshops on reducing the use/production/disposal of toxic substances by Worcester-area businesses, especially plating companies.

(11) Blackstone Valley Chamber of Commerce (BVCC)
[Dr. Steven Rice, President (508) 865-2802]

The BVCC (a subsidiary of the Worcester Area Chamber), in addition to working to enhance the general climate for business within the Blackstone Valley, is also interested in protecting the Valley's distinctive character. To that end, it has established a transportation committee to examine land use issues of regional impact as well as sponsoring several seminars focusing on growth management strategies. The BVCC is a good potential source of support for environmental and other programs which protect and enhance the region's quality of life.

(12) Massachusetts Department of Environmental Protection (DEP)

The DEP currently has several programs that focus on specific issues within the Blackstone watershed.

(a) Division of Water Pollution Control, Technical Services Branch (DWPC-TSB)
[Paul Hogan and Leslie O'Shea (508) 366-9181]

This office is responsible for monitoring the water quality of Massachusetts' rivers. The Blackstone watershed was sampled during the summer of 1988. Further samples of heavy metals were collected last year at Save the Bay's suggestion. Sediment samples were collected at four impoundments last fall in a cooperative venture with Dr. John King, the University of Rhode Island and the Narragansett Bay Project. Both sets of data will be presented in a report which was expected to be published earlier this year but is still forthcoming. In effect, DWPC-TSB has been working on a "Blackstone River Initiative Project" for the last two to three years.

(b) DEP Central Regional Office - Worcester
[Lee Dillard, Blackstone Project Coordinator (508) 792-7692]

This office undertook its Blackstone Project earlier this year which was a pilot project to evaluate: alternative cross-media (air, water, hazardous waste and right-to-know) inspection models; alternative source-reduction biased models; regulatory and technical assistance coordination; and the pilot project approach itself. The pilot project was deemed a success, and cross-media inspections are expected to continue in the Central Region and elsewhere.
Environmental Protection activities within the Blackstone watershed, continued

(c) Division of Water Pollution Control - Nonpoint Source Program
[EBen Cheseborough, Coordinator (508) 366-9181]

The U.S. Environmental Protection Agency (EPA), as part of its responsibilities under the reauthorized Clean Water Act, is encouraging the states to initiate various programs designed to reduce nonpoint source pollution. DEP submitted a Nonpoint Source Management Plan which was recently approved by the EPA, making Massachusetts eligible for federal matching grant money on nonpoint source pollution projects. The DEP/DWPC is providing funding to the Worcester County Conservation District to hire a consultant for a demonstration project that will utilize bioengineering techniques to reduce the erosion of contaminated sediments at several sites along the Blackstone.

(d) Division of Water Supply, Water Management Program (WMP)
[Andrew Gottlieb, Director (617) 292-5653]

This office’s primary responsibility is carrying out the provisions of the Water Management Act. The Act requires all water withdrawers of 100,000 gallons or more per day to register (for preexisting withdrawals) or obtain a permit (for new withdrawals). Applications for new permits within the Blackstone watershed are being reviewed by the DEP at this very moment. The Water Management Act mandates that environmental impacts be considered in the permit review process, but it is uncertain at present whether the WMP with its immense workload can give adequate attention to environmental factors.

(13) EOEAs Office of Technical Assistance Source Reduction Program (SRP) (formerly the MA DEM Office of Safe Waste Management - Source Reduction Program)
[Tim Greiner, Blackstone Project (617) 727-3180]

The Source Reduction Program meets with industries to review their industrial processes and makes recommendations that will enable the industries to reduce the quantity of pollutants released into the environment. The industries are also frequently able to significantly reduce the amounts of water and energy they use. SRP staff are in the second year of their Blackstone Project, which uses workshops, consultative visits and other means to reduce the use/production/discharge of toxic substances by Worcester industries (especially plating companies).

(14) Massachusetts Audubon Society, Worcester Office (MAS)
[Deborah Cary, Director (508) 755-8899]

MAS’s Worcester regional office is one of the chief advocates for environmental quality within the upper portion of the Blackstone watershed. Audubon is active in a variety of issues, most notably open space protection and water conservation. MAS/Worcester recently sponsored a water conservation conference and is helping to coordinate the efforts of several organizations to reduce residential and industrial water consumption. MAS/Worcester could also help to coordinate water quality improvement efforts within Worcester and environs. MAS/Worcester has listed the Blackstone River as one of its chief priorities over the coming year.

(15) MA Department of Public Works (DPW)
[Susan Quateman, Director, Open Space Program (617) 973-7323]

The DPW has been involved for some time in planning an upgrade of Route 146 in Worcester and a new interchange with the Mass. Turnpike, both of which are in close proximity to the Blackstone River. This project presents an excellent opportunity for a complete redevelopment of this segment of the Blackstone corridor and the inclusion of bike paths, canoe access points, protection of a Blackstone Canal remnant and other amenities. Continued progress on this project has been slowed due to the presence of hazardous waste at many places along the proposed alignment, however.
Environmental Protection activities within the Blackstone watershed, continued

(16) MA DEM Office of Water Resources (DWR)
[Mike Gildea, Chief Planner (617) 727-7267]

This office is charged with the responsibility of preparing comprehensive river basin plans for each of Massachusetts' 28 major watersheds. These plans are then used by DEP's Division of Water Supply in the review of permit applications for water withdrawals under the Water Management Act. DWR is currently in the process of preparing its final river basin plan for the Blackstone. It contains water management recommendations for most of the communities within the Blackstone watershed. Because of the low availability of water in the basin (due to the lack of stratified drift deposits), the necessity to maximize flow to dilute pollutants (from urban runoff, treated effluent and contaminated sediments) and the necessity for good quantity and quality of water (for the success of the state and federal parks focused on the Blackstone River), it is important that water withdrawals from the Blackstone Basin be minimized. DWR's draft Blackstone river basin plan did not contain such a basin-wide recommendation, however.

(17) Worcester Regional Environmental Council (REC)
[Ted Conna, President (508) 754-3374]

The REC is a nonprofit environmental group which serves as a forum for its organizational and individual members from throughout the Worcester region to work on environmental issues from local to global. The REC has been active in a number of areas, including recycling, air quality, water conservation and zoning reform. Although the REC has not tended to focus much attention on the Blackstone Valley, its work to improve the environmental quality of Worcester and surrounding communities clearly benefits the Blackstone and all communities downstream.

(18) Upper Blackstone Water Pollution Abatement District (UBWPAD)
[Arthur Levesque, Chief Engineer (508) 755-1286]

The Upper Blackstone wastewater treatment plant serves the communities of Worcester, Auburn and a portion of Rutland. In addition, a number of public and private wastewater concerns have agreements to have septicage and other wastewater treated at the plant. All effluent from the plant is discharged into a concrete channel which flows into the Blackstone about 1/8 of a mile further downstream. The UBWPAD is a secondary treatment plant, with some limited tertiary treatment (nitrification) during the summer months. It also has a pretreatment program with various Worcester businesses that are tied into the system. Although it uses modern equipment and is well-maintained, the UBWPAD operation is still a major source of pollution into the Blackstone River. Full participation by the UBWPAD in a concerted comprehensive pollution reduction effort would result in a significant improvement in the Blackstone's water quality. UBWPAD's NPDES permit is currently up for review, which provides a good opportunity to encourage the District to pursue river cleanup more aggressively.

(19) Center For Rural Massachusetts (CRM)
[Randall Arendt (413) 545-0153 or 1830]

The Center for Rural Massachusetts was established several years ago at the University of Massachusetts/Amherst to promote the preservation of the distinctive character of Massachusetts' rural landscape. CRM has already been active on several different projects within the Blackstone watershed. It undertook a survey of Valley residents on attitudes regarding their communities' future. It also assisted the Blackstone National Heritage Corridor in the preparation of its Cultural Heritage and Land Management Plan. CRM staff have reviewed specific development proposals and have made presentations in several Valley communities on how to use growth-shaping mechanisms to protect rural character. CRM could play a valuable role in further efforts to protect the distinctive character of rural portions of the Blackstone watershed.
Environmental Protection activities within the Blackstone watershed, continued

(20) Fair Share Development Corporation (FSDL)
[Laura McNaughton, Conservation Specialist (508) 797-5725]

FSDC is a nonprofit neighborhood development corporation interested in promoting solutions to environmental problems in the city of Worcester. It provides technical assistance to help businesses and residents reduce energy and water consumption. This effort is being coordinated with Mass. Audubon/Worcester and the Water Resources Division of the Worcester Department of Public Works.

(21) Central Massachusetts Regional Planning Commission (CMRPC)
[William Scanlan (508) 756-7717]

The CMRPC is a quasi-governmental entity which undertakes various planning projects on behalf of its member communities. Each town within the Blackstone watershed is entitled to 24 hours worth of CMRPC staff time on one or more projects of the community's choosing. The CMRPC prepared a land use and economic analysis for the Blackstone River and Canal Heritage State Park several years ago. This report pointed out, among other things, how Valley communities could amend their zoning and other bylaws to make them more consistent with the goals and objectives of the Heritage Park. These recommendations have unfortunately not been implemented for the most part. The CMRPC is a good source of planning expertise that should be tapped for further work to protect the Blackstone watershed's environmental quality.

(22) Local Planners in Massachusetts portion of Blackstone watershed

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<th>Grafton</th>
<th>Peter Lowitt</th>
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<tr>
<td>Millbury</td>
<td>David Hulseberg</td>
<td>(508) 865-4754</td>
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<tr>
<td>Auburn</td>
<td>Stephen Costello</td>
<td>(508) 832-7704</td>
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<tr>
<td>Worcester</td>
<td>David Dunham</td>
<td>(508) 799-1400</td>
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<tr>
<td>Sutton</td>
<td>Gary Reshke</td>
<td>(508) 865-4213</td>
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(23) Town Boards

Many boards and committees in communities within the Blackstone watershed have worked to promote environmental protection within their areas of responsibility and influence. These bodies include conservation commissions, boards of health, planning boards, zoning boards of appeal and boards of selectmen as well as many ad hoc committees established to focus on specific environmental issues. Town boards are in a powerful position to influence the location, design, construction and maintenance of developments within their communities. A proactive stance to promote environmental protection on the part of these boards and committees could result in substantial improvements to the natural integrity of the Blackstone River, its tributaries and adjacent lands.

(24) Worcester Water Department
[Kathleen Klein, Water Resource Coordinator (508) 799-1484]

Kathy's responsibilities include monitoring the condition of the city's water supply and discharges into surface water. The city is presently evaluating the suitability for Lake Quinsigamond to serve as a backup water supply. As Worcester water use has or will soon be placing a strain on its supplies, however, and as very little additional water is available to the city from within or outside of the basin, Worcester needs to adopt stronger policies and programs for water conservation. Kathy has already begun this effort, in conjunction with Mass. Audubon/Worcester and the Fair Share Development Corporation.
Environmental Protection activities within the Blackstone watershed, continued

(25) MA EOEa Geographic Information System (MASS GIS)
[Steve Johnson (617) 727-9800 ext. 235]

GIS is a computerized geographical data base. A file for the Blackstone watershed is currently being prepared in conjunction with RI's GIS program (coordinated by Stephen Hale of the Narragansett Bay Project - 401-792-6617). The first map generated from this file will be oriented toward river protection. Future data layers could include the location of hazardous waste sites, NPDES dischargers, land enrolled in Chapter 61 programs, etc.

(26) Bay State/Ocean State Initiative
[Joseph Brady (401) 277-3472 or Lisa Kaminski (617) 722-1114]

This initiative was recently launched by Senators Thomas Norton of Mass. and David Carlin of Rhode Island. Its purpose is to promote a coordinated bi-state effort to clean up Narragansett and Mount Hope Bay. Several public hearings have been held to enlist public support for the initiative. Although the impact of the Blackstone River on the environmental quality of Narragansett Bay is substantial, this initiative has not as yet made a significant attempt to coordinate its efforts with Blackstone-focused programs.

(27) Local land conservation trusts.

There are a number of private, nonprofit land conservation organizations active within the Blackstone watershed. Most of these groups were formed to acquire open space within specific communities. None appear to have a particular focus on protecting riparian lands (except the Blackstone River Watershed Association, which is described elsewhere), but they could be encouraged to place more emphasis on protecting river and stream corridors.

(a) Grafton Forest and Land Conservation Trust
[Dexter Pond (508) 832-5394]

(b) Mendon Land Trust
[Chris Noonan (508) 478-0911]

(c) Greater Worcester Land Trust (Worcester and surrounding communities)
[Allan Fletcher (508) 835-6160]

(d) Metacomet Land Trust (Franklin, Bellingham and Blackstone)
[Tom Bik (508) 883-4631]

(e) White Oak Land Conservation Society (Holden and surrounding communities)
[Phil Truesdell (508) 835-3607]

(f) Cumberland Land Trust
[Chuck Horbert (401) 277-6820]

(g) Lincoln Land Trust
[Ruth Tetreault (401) 723-8062]

(h) Gloucester Land Trust
[Robert Huckins (401) __-____]
Environmental Protection activities within the Blackstone watershed, continued

(28) Statewide, regional and national land conservation organizations.

Although these groups presently hold little or no land within the Blackstone watershed, they have the capacity to provide significant assistance in the protection of areas of significant resource value in the region.

(a) The Nature Conservancy, Massachusetts Field Office
[Elizabeth Bell (617) 542-1908]

(b) The Nature Conservancy, Rhode Island Field Office
[Keith Lang (401) 331-7110]

In Rhode Island, the Nature Conservancy owns and maintains the 50-acre Limerock Preserve (located just outside of the Blackstone watershed but still considered part of the Blackstone Valley) in Lincoln, which contains many unusual plants which flourish in the calcium-rich soil. TNC has assisted RI Department of Environmental Management with acquisition projects of properties along the Blackstone in Lincoln and Cumberland.

(c) The Trustees of Reservations
[Wesley Ward (617) 921-1944]

(d) Trust For Public Land, New England Field Office
[Peter Forbes (617) 451-7208]

(e) Massachusetts Audubon Society
[Tim Storrow, Land Protection Officer (617) 259-9500]

(f) American Farmland Trust, New England Field Office
[Robert Wagner (413) ___-____]

(g) Audubon Society of Rhode Island
[Al Hawkes, Executive Director (401) 231-6444]

ASRI is a leader in the efforts to develop a wise water use policy for the state.

(b) Sierra Club - Rhode Island Group
[P.O. Box 2464, Providence, RI 02906]

The Sierra Club's motto, "To preserve, protect and enjoy", has been exemplified by activities of the Rhode Island Group. Members have assisted RIDEM in developing a trail system in the Blackstone River State Park, and will continue to help blaze and maintain trails in newly-acquired property along the River.

(i) Society for the Preservation of New England Antiquities (SPNEA)
[Pat Weslowski (617) 891-1985]

In addition to assisting the National Heritage Corridor describe and document historic buildings and landscapes within the Blackstone Valley, SPNEA recently acquired the historic Free Grace Marble Farm in Sutton.

(29) Worcester County Conservation District
[Peggy Juritsma (508) 885-2595]

Peggy is helping to coordinate the bioengineering project on the Blackstone referred to earlier. Peggy's predecessor, Shirley Mikelk, helped organize the "ZAP IV" cleanup of the Blackstone River held on Earth Day's twentieth anniversary.
Environmental Protection activities within the Blackstone watershed, continued

(30) Save The Bay (STB)
[Noelle Lewis, Massachusetts Program, or Kevin Brubaker, Water Quality Specialist (401) 272-3540]

Save The Bay is a Rhode Island-based environmental organization whose primary objective is to protect the environmental quality of Narragansett Bay. The group is currently seeking to promote joint efforts among Rhode Island and Massachusetts agencies and organizations to reduce the level of pollutants entering the Bay from Massachusetts. STB recently recognized that the Blackstone River is one of the chief sources of metals into Narragansett Bay, and issued a Special Report on the Blackstone River in early 1990 that identified major sources of metals pollution in Massachusetts and made recommendations for action. STB is currently seeking to solicit citizen support for its efforts to clean up the Blackstone under the label "Save the Blackstone".

(31) Narragansett Bay Project (NBP)
[Caroline Karp (401) 277-3165]

This program is jointly funded by RIDEM and the EPA National Estuarine Program. It is charged with preparing a management plan for the entire Narragansett Bay watershed. The Blackstone River is a major contributor of fresh water and pollutants into the Bay. NBP conducted the first major water quality survey of the RI portion of the Blackstone in 1985. It has also developed a toxic transport model. NBP has recently retained a consultant (Planners' Collaborative) to assist in promoting public awareness of pollution problems in the Blackstone River and support for remedial action.

(32) Lt. Governor Begin's Task Force on Rivers
[Cheryl LeClair, Policy Analyst, (401) 277-2371]

Since its formation in January, 1989, the Task Force has investigated two issues: how the state can assist cities and towns to meet clean water requirements after the withdrawal of direct federal aid for wastewater treatment facilities, and how to improve planning for the state's river systems. The Task Force issued a report in January, 1990, with recommendations on funding sources for wastewater treatment and on the formation of a Statewide Rivers Council within the Department of Administration, Division of Planning. The Rivers Council will (1) establish a statewide rivers' policy, (2) resolve disputes among state agencies on river issues, (3) adopt a classification plan for the state's rivers, (4) recognize and provide grants to local watershed councils, and (5) encourage public involvement in river planning.

(33) Blackstone River State Park
[Judy Benedict or Ginny Leslie, RIDEM Planning & Development (401) 277-2776]

In 1983, the State of Rhode Island received a unique donation of land and water: a three-mile segment of the Blackstone Canal and towpath. The donation included the only remaining intact section of the original Blackstone Canal in the state, plus land alongside it and a connecting piece of a never-completed railroad that provides access to the canal and towpath from Front Street in Lincoln. Since receiving that donation, RIDEM has acquired several other parcels of land along the Blackstone River in Lincoln and Cumberland that will be incorporated into the 150-acre Blackstone River State Park. DEM's acquisition efforts have been concentrated in developing a greenway between the village of Albion and Berkeley. The properties acquired to date include the 20-acre Ashton Meadows, land in Lincoln near the Ashton Viaduct that features a network of hiking trails, and almost a mile and a half of riverfront land in Cumberland on which the Blackstone Bikeway will be located. The Wilbur Kelly House, built in Old Ashton around 1815 as the home of an early mill owner, will be restored and will serve as an interpretive center for the state park.

(34) Rhode Island Natural Heritage Program
[Rick Enser or Joanne Michaud (401) 277-2776]

The Rhode Island Natural Heritage Program is a statewide, comprehensive inventory of the state's biological features. An agency of the RI Department of Environmental Management, the Program provides the only central repository of data for the state's rarest and most vulnerable plants, animals, and ecologically significant natural communities. Ongoing field efforts provide data on the distribution, abundance, and threats to the native biota. Information is incorporated into a
Environmental Protection activities within the Blackstone watershed, continued

complex system of map, computer, and manual files for analysis and dissemination to further our understanding and protection of the state's most valuable natural areas. The Heritage Program has identified 60 current occurrences of rare, threatened and endangered species in the Rhode Island communities in the Blackstone watershed.

(35) RIDEM Division of Fish and Wildlife
[John Stolgitis (401) 277-3075]

This division acquires, develops and maintains land and water areas for wildlife preservation and public recreation, and conducts wildlife and marine life research, fish and wildlife management, hunter education, fish restoration and aquatic education programs.

(36) RIDEM Division of Forest Environment
[Thomas Dupree (401) 647-3367]

The Division of Forest Environment manages the state's forests as a harvestable resource while maintaining their environmental quality to conserve, air, land, water, wildlife and recreational amenities. The Division promotes forest management on private land and public understanding of environmental conservation, and manages nearly 40,000 acres of state-owned forest land.

(37) RIDEM Division of Groundwater and Freshwater Wetlands
[Steve Morin (401) 277-3162]

This Division protects groundwater, responds to oil spills and monitors underground storage tanks to prevent or halt leakage of contaminants. The Division also regulates development in or near freshwater wetlands to minimize flooding, protect groundwater supplies, preserve wildlife habitats, and provide recreational opportunities. It regulates the installation and maintenance of individual sewage disposal systems and assures that dams and dikes are planned and maintained to protect life and property.

(38) RIDEM Division of Water Resources
[Ed Szymanski (401) 277-3961]

This DEM Division works to control and abate pollution of Rhode Island's surface waters. The Division administers grants under the Clean Water Act for the construction of sewage facilities and grants to help municipalities extend public sewage services. The Division inspects and monitors treatment plants, sets pollution limits, and monitors water quality in swimming and shellfishing areas to protect the public health.

(39) OSCAR Program, RIDEM Office of Environmental Coordination
[Michele Metolla or Linda Hutnak (401) 277-3434]

The multi-faceted Ocean State Clean-up and Recycling (OSCAR) program includes the very successful youth litter corps program. Grants are awarded to cities and towns to hire high school students for summer clean-ups. Funding for the program is generated by a tax on cases of beverages, and on litter-generating businesses such as fast-food outlets. Towns along the Blackstone have often sent their OSCAR teams to municipally and state-owned sites along the River.

(40) Land Management Project
[Jennie Meyers or Jed Merrow (401) 277-2776]

The Land Management Project helps towns protect water quality by helping them regulate non-point sources of pollution (e.g., septic systems, road runoff, road salt). Project staff members write interpretive documents on sources of pollution, write guides to aid in site plan review, collect model ordinances, sponsor workshops, and provide general technical assistance. The program is jointly funded by EPA and RIDEM.
Environmental Protection activities within the Blackstone watershed, continued

(41) RI DEM Nonpoint Source Management Program
[Elizabeth Scott (401) 277-3434]

This program, under DEM's Office of Environmental Coordination, produced a comprehensive Nonpoint Source Management Plan in April, 1989, which provided a framework for nonpoint source pollution management efforts to be undertaken by state and local agencies. The program's goals include strengthening existing regulatory programs, establishing regulations for nonpoint pollution sources not presently regulated, encouraging municipalities to establish local initiatives, and strengthening public education efforts to increase awareness of the surface and ground water quality concerns associated with various land use activities.

(42) Pawtucket Water Supply Board
[David Golebiewski (401) 725-9492]

The Pawtucket Water Supply Board services residents and businesses in Pawtucket, Central Falls and elsewhere with water from a series of reservoirs in eastern Cumberland. The Board owns approximately____ acres of land surrounding the reservoirs and along connecting waterways; its treatment facility is in Valley Falls.

(43) Woonsocket Wastewater Treatment Facility
[Adel Banoub (401) 762-6406]

The Woonsocket WWTF provides secondary treatment for approximately 8 to 10 million gallons of residential and commercial wastewater per day, discharging into the Blackstone River in Woonsocket.

(44) Blackstone Valley District Commission (BVDC)
[Ray Joubert (401) 434-6350]

The BVDC provides advanced primary treatment for 20-25 million gallons of wastewater per day; construction is now underway to upgrade the plant to provide secondary treatment. The Commission provides service to all or parts of Smithfield, Lincoln, Cumberland, Central Falls, Pawtucket, and East Providence, and discharges into the Seekonk River at Bucklin Point in East Providence (the Blackstone River is renamed the Seekonk below the Main Street dam in Pawtucket). In July, 1989, a state law transferred responsibility for 35 combined sewer overflows (CSO's) in Pawtucket and Central Falls from the cities to the BVDC. The facilities managed by the BVDC currently are a major source of pollution into Narragansett Bay.

(45) Rhode Island Parks Association
[Patricia Beausoleil, Executive Director, (401) 438-1365]

The Rhode Island Parks Association is a nonprofit organization which supports and promotes educational, cultural and recreational use of the state parks. Currently, the group has an agreement with RIDEM for RIPA to hire and oversee contractors and provide volunteer labor for the restoration and renovation of the Wilbur Kelly House in the Blackstone River State Park. RIPA is also assisting the Blackstone River Watershed Association in its Greenway and Canoe Trail and Tours work.

(46) C.A.N.A.L. (Committee for the Advancement of Natural Areas in Lincoln)
[Ruth Tetreault (401) 723-8062]

This private, non-profit group was organized in 1965 to oversee green areas in the town of Lincoln, with special emphasis on the Blackstone River and Canal. This was one of the first groups to determine the sources of pollution in the river and the canal and to work for improvements in water quality. C.A.N.A.L. has sponsored many volunteer clean-ups along the river. This group is somewhat inactive at this time, however.
Environmental Protection activities within the Blackstone watershed, continued

(47) Local planners in Rhode Island portion of Blackstone watershed

All the communities along the Blackstone in Rhode Island have plans underway for parks and/or open space areas along the River. Staff people in the cities and towns are:

- Central Falls: Bill Semers (401) 728-3270
- Cumberland: Robert Cox (401) 728-2400
- Lincoln: Sally Zelonis (401) 333-1100
- North Smithfield: Deborah Perry (401) 767-2202
- Pawtucket: Roger Giraud (401) 724-5200
- Woonsocket: Nancy Brittain* (401) 762-6400

* Recently accepted Community Planner position at BRVNHIC

(48) National Park Service (NPS)
[Linda Neal, Project Manager (617) 223-5136]

The NPS helped to establish the Blackstone National Heritage Corridor (see description above) and continues to play an important supporting role to Corridor planning and implementation. The NPS receives an annual appropriation (no local match required) specifically earmarked for work on the Blackstone. Some of this money may be available for cooperative agreements to further Corridor objectives such as developing hiking and canoe trail brochures, natural resource inventories, etc.

[Once again, please inform the author of any additions, corrections or questions.]
SECTION II:

PROCEEDINGS FROM NARRAGANSETT BAY PROJECT MANAGEMENT COMMITTEE

SEPTEMBER 11, 1991
APPENDIX A:

MANAGEMENT COMMITTEE
MEETING MINUTES

SEPTEMBER 11, 1991

Prior to the NBP Management Committee's discussion of the Blackstone River Briefing Paper, the Committee received a copy of the Briefing Paper and a checklist for their comments, in order to solicit review. A response to these comments was then prepared by NBP staff. Recommendations receiving no opposition or for which reviewers requested only minor changes in wording were generally approved by the Committee without further discussion at the meeting. As a result, the Committee was then able to focus primarily on the recommendations which had elicited comments requesting substantive changes.
I. Review and Discussion of Briefing Paper Recommendations - Blackstone River
Briefing Paper

Goal Statement, Page 2

Mr. Malcolm Grant (Chair) asked if anyone had any objections to the revisions made by NBP staff.

(No objections)

Objective A, Page 3

Mr. Richard Zingarelli (NBP) said that everyone should have a copy of "Addendum to the 'Revisions and Response To Comments' Proposed Wording Changes." He said the addendum included changes to Objective A, Recommendation A.1.g., and Recommendation A.3.a. which were designed to address the comments and concerns of RIDEM.

Mr. Kevin Brubaker (Save The Bay) asked why neither of the papers included DEM's comments. He said that he approved of the wording changes in the original document, but was not as satisfied with the changes in the addendum.

Mr. Zingarelli said that the first document responded to the comments of the US Army Corps of Engineers. Subsequent to that, DEM thought the new wording referring to Class B water quality standards would be confusing. He said DEM's comments related to Recommendation A.3.a. He said that DEM thought Class B standards for fishable and swimmable waters could not be met directly in the vicinity of treatment plant outfalls, and that upgrading river standards to Class B in these locations would not be appropriate without some type of subdivision. He said DEM proposed that a Class B-Sub CSO category be developed for areas directly in the vicinity of treatment plants and CSO outfalls to make it clear that those waters are not fishable and swimmable.

Dr. Jan Prager (EPA-ERLN) said that EPA criteria already included regulations and laws for mixing zones, and that reclassifying things would be inconsistent with what other agencies are trying to do.

Dr. Chris Deacutis (RIDE&M) said that DEM is following what other states, such as Massachusetts, have done in areas where there are CSOs. He said that in these areas,
standards are exceeded under certain conditions, such as a hurricane. He said that legally if these areas are categorized as Class B, anytime there is a hurricane or an uncontrollable discharge that violates Class B standards, it would be subject to litigation. Creating a B-Sub CSO category for these areas, acknowledges that there are certain situations which might violate the normal Class B criteria.

Ms. Katrina Kipp (EPA-Region I) said that under the EPA's regional and national policy, this type of designation is allowed. She said the EPA is encouraging development of this B-Sub CSO category, rather than keeping these areas designated as Class C.

Dr. Deacutis said that the category would be more stringent than Class C.

Mr. Brubaker said that he is uncomfortable with the recommendation because Rhode Island has not yet defined the B-Sub CSO category, so he is not sure to what he is agreeing.

Dr. Deacutis agreed that DEM and the EPA have not yet determined how the category will be defined, but said he is opposed to the original wording of the recommendation because it would prohibit them from developing this subcategory.

Ms. Kipp said she is not sure if the water quality people will accept the B-Sub CSO category, because in the past, the EPA has used "mixing zones" as areas where water quality criteria can be exceeded by point source discharges. She suggested that the recommendation use the Class B category, with the understanding that Class B can have subcategories where necessary.

Ms. Karp suggested rewording the recommendation to read "to meet Class B standards, which may include a Class B-Sub CSO category upon approval by the EPA."

Ms. Noelle Lewis (Save The Bay) asked how Massachusetts regulates areas around CSOs.

Ms. Kipp said that certain areas around CSOs are defined to permit four violations per year. She said this is limited to CSOs and does not include treatment plant outfalls.

Mr. Brubaker said he wants to ensure that the wording does not allow authorities to disregard standards in the area around treatment outfalls.

Mr. Greene added that subcategories could be changed and upgraded as technology evolves to improve discharges.

Mr. Grant asked if the new wording was acceptable.

Mr. Zingarelli stressed that the recommendation will not eliminate any incentive to clean up the CSOs, but recognizes that there will still be certain storms during which the design storage will be exceeded. The subcategory for CSOs allows for different standards during those periods.
(Agreement was reached on new language)

**Objective B, page 3**

Mr. Grant said the staff does not feel that this objective warrants further discussion. He asked if the Committee agreed.

(Agreement)

**Objectives C, D, and E, page 3**

Mr. Grant said the staff received no negative comments or opposition to these objectives.

(Agreement)

**Strategies / Recommendations, Part I**

Mr. Grant said that Part I, pages 5-16, includes recommendations which the staff thinks do not require additional Committee discussion. He asked if the Committee agreed. He added that no representatives from Massachusetts commented on the briefing paper and no one was present to comment at this meeting. He said that following the meeting, some attempt should be made to elicit more involvement from Massachusetts Committee members.

Ms. Virginia Lee (Coastal Resources Center) said she thought Recommendation B.3 warranted further comment. She said that the overall objective for the Blackstone River should be to have a free flowing river. She said a policy of repairing all the existing dams does not make sense to her, when, she added, in her opinion they should be dismantled.

Mr. Zingarelli said the paper is only recommending repair of dams if the repair is considered necessary to avert sediment resuspension or other environmental problems.

Ms. Lee said that even if dismantling the dams resulted in sediment resuspension, it would be of more benefit to the river.

Mr. Zingarelli said that he would agree, if there were feasible means for doing sediment remediation. However, in some cases the best approach is to restore the dams. He added that other strategies in the paper recommend that all dams be "run of the river," with no flow withdrawals or flow diversions. He said that this recommendation calls for permanent impoundment of the sediments.

Ms. Lee said it would be better policy to remove the sediments, rather than impound them.
Ms. Lewis said that in some cases resuspension of sediments would be far worse for the river than correcting the dams.

Ms. Lee said that the sediments will eventually be resuspended. She said the Project should develop a sediment remediation effort, rather than maintain an unsatisfactory pollution situation.

Ms. Karp said that a study released in 1981 investigating sediment remediation plans for the Blackstone River and NBP research conducted since 1981 both found these sediments to be highly contaminated. NBP researchers also found that the river is beginning to erode a path through some of these contaminated beds, moving the contaminated loads downstream. The Blackstone River's contribution to the total toxic loads in Narragansett Bay is significant for almost every organic of concern, many of which are elements which are particle associated. She said that the most contaminated sediments are found behind these old dams. She said that the thinking of the NBP staff and of the 1981 report was that it may be worthwhile to impound these sediments, since the cost of removal and incineration is almost unthinkable.

Ms. Lewis said that the areas of contamination are very large, in the vicinity of 2 million cubic yards.

Ms. Karp added that one Massachusetts representative who commented during the Blackstone roundtable meeting was strongly in favor of repairing one of these contaminated beds to recreate wetlands which are now being damaged by the way the river is running. NBP staff has raised concerns about creating a wetland over areas which are known to be contaminated, but the Massachusetts Division of Fisheries and Wildlife is interested in remediating this area. She said that this is one of the areas where repair of a dam should be considered.

Ms. Lewis said that repairing the dams will result in capped, cleaner sediments.

Ms. Lee said that she understood that the sediment problem is a legacy from previous inputs, but that sediments are eventually going to be eroded. She said she does not agree with a policy to stabilize the problem so that someone else has to deal with it. She said the NBP should deal with the problem and remove the sediments.

Mr. Brubaker suggested that the sediments need to be contained now and treated later, that it is a short-term vs. long-term issue. He suggested rewording the recommendation to state that in the short term, dams should be repaired and protected, and that in the long term, sediments should be treated and removed.

Mr. Zingarelli said that Section B5 recommends developing a comprehensive sediment remediation plan for the entire length of the Blackstone. He said it recognizes that in some locations sediments should be removed, but in other cases in-place remediation is more appropriate. He said in some cases removal simply is not feasible. A comprehensive plan needs to be developed which looks at all alternatives.
Ms. Lee said that if a comprehensive plan needs to be developed, dams should not be restored before that plan is completed.

Mr. Zingarelli said that the areas included in this recommendation have been determined to pose an immediate threat of sediment resuspension which will cause severe environmental impacts. He said that until this plan can be developed, the dams should be repaired as a short term measure to prevent resuspension.

Mr. Brubaker asked if insertion of the words "as a short term solution" would satisfy Ms. Lee's concerns.

Mr. Greene agreed with this wording and recommended that it also require that whatever is done be consistent with the remediation plan.

Ms. Lee said that there should also be language in the recommendation requiring establishment of fish ladders and minimal flow agreements.

Mr. Greene said that these issues are addressed in other recommendations.

Ms. Lee said that she was also concerned that Recommendation C.4 on page 13 only dealt with fish passage at hydropower operations and not at dams.

Mr. Greene said that if a dam is not being operated it will not create the flow variations that cause problems. He said flow problems are only caused by hydropower operations.

Ms. Lewis agreed but said that during periods of low flow, even non-hydropower dams can cut off fish access if they don't have fish ladders.

Mr. Greene said that fish ladders are required as part of any repair.

Ms. Lewis said that this should be referenced in this recommendation.

Ms. Lee again recommended that sediments should be removed, not impounded. She said that any impoundment slows the flow of the river, which does not serve the goal of restoring habitats and achieving fishable and swimmable waters. She said impoundments will especially cause problems in dry weather. She also added that on page 12, she does not understand why Recommendation B5 is different from Recommendation B1.

Mr. Zingarelli said that the two recommendations are specifically linked in the original briefing paper.

Ms. Karp asked to clarify Committee decisions on Recommendation B3. She said that language will be added to distinguish between short-term and long-term solutions, and that the recommendation will be cross referenced to require fish ladders.
Ms. Lee said she was satisfied with those revisions, but said she had an additional question on pages 14-15. She said Recommendations D3, E3, and A1 seemed to be all the same.

Mr. Greene said that there is some repetition in the recommendations, but each addresses a different objective.

Ms. Karp said that after all recommendations are approved by the Committee they are reviewed by the Division of Planning to eliminate redundancy.

Ms. Lee asked where the library recommended in D.5 would be located.

Ms. Kipp said that a location for the library has not been determined, but that EPA would take the lead in developing it. She said it would probably be located in Region I or in the EPA's Lexington lab.

Mr. Zingarelli also recommended that as much data as possible be incorporated in the NBP data system.

Ms. Karp said that NBP is negotiating to establish a centralized natural resources database at University of Rhode Island linked with the Rhode Island Geographic Information System.

Ms. Lee said that if the library is going to be used, it should be closer to Rhode Island than Boston.

Mr. Zingarelli said that a main function for EPA will be to produce a bibliography stating where all reports are located, rather than just maintaining a library of all reports.

Ms. Lee also commented on Recommendation E.5. She said that she disagreed with the NBP staff response that the goals and objectives of the BRVNHCC Cultural Heritage and Land Management Plan are too lengthy to include in the briefing paper. She said a synopsis or summary of the plan should be included.

Ms. Lewis said the BRVNHCC Plan is also part of the State Guide Plan.

Ms. Morrison said there is a State Guide Plan summary which includes the elements of the BRVNHCC Plan.

Dr. Deacutis said it is important to ensure that there are no conflicts between the Cultural Heritage and Land Management Plan and the State Guide Plan.

Mr. Brubaker asked what would happen if a NBP recommendation contradicts something in the State Guide Plan.

Ms. Morrison said she tries to identify any potential conflicts before they are approved.
Ms. Karp said that there is also a consistency review which will try to clarify any inconsistencies.

Mr. Grant asked if any modifications should be made in response to Ms. Lee's comments.

Ms. Karp said that the Cultural Heritage and Land Management Plan should be referenced but not included in the briefing paper.

Mr. Zingarelli said he has read through the plan and thinks that it is not organized in a way which can be easily summarized. He said he thinks it is important to support its Environmental Conservation section, without getting into all the details of its actions.

Ms. Lee said she does not think NBP can ask the States of Rhode Island and Massachusetts to support the actions of the Cultural Heritage and Land Management Plan without enumerating what those actions are.

Ms. Karp said that each element of the CCMP is going to include a brief background section, followed by the recommendations. She said the "Background" section could include an explanation of which goals the NBP is recommending support for, but not the "Recommendation" section.

Mr. Grant suggested that this section refer to the broad goals and objectives of the BRVNHCC Plan, but that it should not get into the specifics.

Mr. Zingarelli reiterated that the plan is not organized in a way which can be easily summarized, but that he would make an attempt at it. He suggested limiting the recommendation for support to the Environmental Conservation section. He said that it would be easier to summarize.

(Agreement)

Mr. Grant asked if there were additional comments on anything from Part I of the document.

(No additional comments)

PART II

Recommendation A.1.b

Mr. Brubaker said that Save the Bay acknowledges that the development of site-specific criteria is allowed under the Clean Water Act but rigorously opposes that its development be "encouraged." He said that Save the Bay objects to the wording of the recommendation.

Ms. Karp said that the site-specific criteria issue has already been agreed to by the Committee when it reviewed the toxics paper. She said she will make sure that the
wording of the recommendation in this paper is consistent with the language that has already been agreed approved.

Dr. Prager asked Mr. Brubaker if he had reviewed the guidelines for the development of site-specific criteria. He said the guidelines are often more restrictive than the national criteria.

Mr. Brubaker said that it is not an issue of whether or not site-specific criteria should be allowed. He said that his objection is that with limited resources, state dollars should be spent on enforcement rather than on developing new criteria.

Ms. Lewis added that the EPA has already spent federal dollars developing criteria, and that the state should not be spending more public funds "redeveloping" criteria.

Mr. Mariscal (Narragansett Bay Commission) asked if the development of site-specific criteria could result in both more stringent criteria as well as less stringent criteria.

Mr. Brubaker said that it could theoretically, but that an applicant would not pursue an application if it was going to result in more stringent criteria.

Ms. Lee asked why this recommendation is included if it is already allowed for under the Clean Water Act.

Mr. Zingarelli said that the recommendation, combined with other recommendations, are intended to develop a series of steps for how permits and point source abatement should be handled. He said that it is important to include it if the CCMP is to be a comprehensive plan.

Ms. Karp reiterated that the Committee has already approved conditions on how the State should develop site-specific criteria, and that this recommendation should be consistent with the toxics paper recommendation. She said the only conflict is that this recommendation uses the word "encourage." She suggested deleting the word.

Mr. Grant said that the language will be made consistent.

Recommendation A.1.g.

Mr. Zingarelli said that the addendum responds to DEM comments, but there are still outstanding comments which need to be discussed.

Mr. Brubaker said that the rewritten recommendation seemed to sidestep the debate on whether or not tradable discharge permits are a good idea.

Mr. Zingarelli said the recommendation now states that tradable discharge permits may have some merit and should be examined in regards to whether they might be applicable to the dischargers of the Upper Blackstone Treatment Plant. He said it also sets guidelines for how a program should be established.
Mr. Brubaker said that it is hard to react strongly one way or the other to the recommendation.

Mr. Mariscal said that he is curious as to why there is no response listed from the EPA, the MADEP, or the Upper Blackstone Water Pollution Abatement District. He said he personally thinks tradable permits are a terrible idea, but he wonders what these three agencies think.

Ms. Kipp said the EPA does not strongly support the idea but is willing to try it out as a pilot program in the Upper Blackstone area.

Dr. Prager said he is strongly opposed to tradable permits. He said this policy would spread the dirt around, rather than cleaning anything up.

Ms. Lewis said she does not think the Upper Blackstone region should be used for a pilot project.

Ms. Karp explained her reasoning behind the recommendation. As an example, she said that if regulators determine that they want no more than 10 pounds of copper emitted into the environment, and they are currently getting 100 pounds, the tendency is to regulate every entity that produces copper across the board. She said that with tradable discharge permits, you look at the entity that is best able to get rid of copper. If there is a large discharger that can remove copper, it is a more cost effective way to reach the 10 pound limit than regulating everyone across the board. Under the tradable discharge system, the state sets the cap, but the regulated community is allowed to determine the best way to meet those reductions. This is independent of the source reduction recommendations which are already imbedded into the entire plan.

Ms. Karp also said the Blackstone River was chosen because the industrial community is very poorly regulated. She said the Massachusetts portion of the Blackstone River is ripe for this. There are new permits going into effect at the treatment facilities, the treatment authority does not believe it can meet its limits, and industry is concerned about meeting its limits. She said the area could provide a very confined test case.

Dr. Deacutis said that the reasoning makes sense, but that limits are set on concentrations rather than loadings. He said that if concentrations can become a sellable commodity, industries will not allow discharges to be lowered, because they can sell the excess.

Ms. Karp said that while DEM may not be setting targets based on mass, some of the treatment authorities may be setting targets on mass rather than concentration.

Dr. Deacutis said that the argument still holds that their tons are worth money.

Mr. Mariscal said that he is concerned about enforcement. He said that whenever an enforcement action is undertaken, industries will try to make tradeoffs and any enforcement will be thrown out.
Ms. Lewis said that the Narragansett Bay Commission is one of the more organized and efficient treatment authorities. She said that if NBC had concerns about enforcement, it would not be wise to try out the program on one of the least efficient treatment plants in the upper Blackstone area.

Mr. Grant said he did not hear much support for the recommendation and asked if it should be deleted.

Several Committee members moved to delete the recommendation.

Ms. Karp said she had no objections to deleting the recommendation.

(Recommendation A.1.g. deleted)

Recommendation A.3.a, page 18

Mr. Zingarelli said that the wording of this recommendation needs to be revised to include the language from Objective A to which the Committee previously agreed.

(Agreement)

Recommendation A.4.a, Page 19

Mr. Brubaker said that he was uncomfortable with the recommendation because it puts the burden of proof on advocates and regulators, rather than on the person proposing to withdraw or store water.

Mr. Zingarelli said that in response to the Army Corps of Engineers’ comments, the NBP staff thinks that water should not be withdrawn or stored for any reason, not only if it will “adversely affect water quality.”

Ms. Lee said that the last sentence of the recommendation on diversion should include the phrase "should not adversely affect any physical, cultural or biological resource of the river."

Dr. Prager suggested using the phrase "should not harm."

Ms. Lee approved of that wording.

Mr. Brubaker asked why withdrawal and storage is prohibited, yet diversion is at times allowed. He suggested also prohibiting diversion.

Mr. Zingarelli said hydropower process requires that water be diverted through turbines, then returned to the river. He said the process requires some diversion, but the recommendation attempts to keep the diversions to a minimum length.

(Agreement)
Recommendation A.4.d., page 20

Mr. Brubaker said that Save the Bay is arguing for a moratorium, rather than "careful evaluation." He said that the Blackstone River can not afford any further withdrawals and that every remaining drop of water needs to be protected.

Ms. Lee agreed, adding that she did not understand the argument against a moratorium.

Mr. Zingarelli said that the original draft of the paper received very strong comments from MA DEM stating that there are some minor withdrawals for consumptive uses which are very important and should be allowed.

Ms. Kipp said that there are some small communities which require withdrawals for drinking water purposes. She said MA DEM also argued that it is not within its legal authority to impose a moratorium on withdrawals.

Mr. Brubaker recommended that MA DEM get that power from the state legislature.

Ms. Lee said that her understanding was that with drinking water withdrawals and consumptive uses, the water is returned to the river.

Ms. Kipp said that consumptive uses include uses which do not return water, such as the use of power plants. She also said that many of the communities have septic systems, which do not return water to the river.

Mr. Zingarelli said that many communities in the area straddle more than one watershed. He said that some of these communities receive drinking water from the Blackstone watershed, but use treatment plants located in another watershed. This results in water withdrawals from the basin.

Ms. Lee recommended that the CRMC be included in this recommendation. She said that consumptive withdrawals affect the Bay and should be tied into federal consistency laws.

Ms. Karp said that the CRMC is already authorized by the Coastal Zone Management Act to review all hydropower projects. She said that it does not need expanded authority to get involved in this area. She said the Committee has already recommended that CRMC notify agencies that it wants to be advised of these programs.

Mr. Grant said that if there are sufficient problems with the river's volume of water, a moratorium should be declared and people who need to withdraw water for consumptive uses should be put on notice that they will need to find other places to get water.

Dr. Prager said that the word "moratorium" implies that it will eventually be lifted. He suggested using the word "prohibit."
Ms. Karp said that this would not be enforceable. She said that the Committee needs to leave room for legitimate, authorized growth in the region, which will inevitably require small increases in water withdrawals for drinking water purposes. She said prohibiting withdrawals cuts the area off to any further growth. She said the intent of the recommendation is to limit large proposals for withdrawals. She suggested setting a threshold for limiting withdrawals.

Mr. Mariscal asked if there was a basis for developing such a threshold.

Ms. Lee suggested establishing a minimum flow for the Blackstone, below which no withdrawals would be permitted.

Dr. Prager said that the Blackstone River is not the only source of water for the area. He suggested that additional water needs could be met by utilizing ground water sources or by developing other methods, such as collecting rainwater from rooftops.

Mr. Zingarelli pointed out that the wording in the recommendation referred to removing water from the Blackstone River watershed, whereas Committee discussion was referring only to the Blackstone River itself.

Ms. Lewis suggested that the recommendation be divided into two sections. She said that one section could address large consumers, such as hydroelectric plants, while the other section could address small towns which should first look towards conservation.

Ms. Kipp said that wording could be changed requiring agencies to develop criteria to set a threshold. She said that if the river is running above the threshold, all proposals for withdrawals would be evaluated. If the river is running below the threshold, all withdrawals would be prohibited.

Ms. Lewis said that it would not be possible to establish such a threshold.

Mr. Grant said that if the problem is serious enough to warrant a moratorium, than the recommendation should state that no further withdrawals be allowed until a safe threshold is determined.

Mr. Zingarelli said that the reason the river is dry at times is due to the removal of water by hydropower projects. He said that there is a series of other recommendations which intend to remedy this situation. He said that the Committee needs to consider that there are tradeoffs, and that a complete moratorium may not be an appropriate step at this time. He recommended establishing a system to evaluate withdrawal proposals.

Ms. Lee suggested a moratorium on withdrawals until an evaluation procedure is developed.

Ms. Karp summarized the Committee's comments. She said the recommendation should require that all concerned agencies sit down and within a set time period determine a minimum base flow which must be maintained year round in order to maintain water quality, habitat values, and fish and wildlife values. An agreement
would then need to be reached between the two states and the respective agencies that withdrawals shall not occur that will alter those values. She said a moratorium will be in effect until the minimum base flow is determined.

Mr. Brubaker said that if a minimum level is determined, water will be withdrawn right up to the minimum level.

Mr. Zingarelli said that the commission could establish criteria for evaluating benefits vs. impacts for any proposal. He said that the costs of alternatives need to be taken into consideration. For example, he said that it might be better to allow a hydroelectric plant to withdraw water from the river, rather than having the electricity be generated by a nuclear power plant.

Mr. Brubaker said that it is not realistic to set up commissions for each recommendation to balance pollution negatives against economic development positives.

Ms. Lewis suggested putting a moratorium on any withdrawal that would not return the water back to the river.

Ms. Lee supported Ms. Karp’s summary. She said a moratorium should be in place until a minimum threshold level could be determined.

Ms. Lewis reiterated that it is not possible to determine a accurate minimum flow threshold.

Ms. Lee pointed out that other states have done so.

Dr. Deacutis said that there are two types of changes in river flow. One type is the long-term flow level changes which are measured by recording the flow of the river over long periods of time. The other type is the dramatic hourly changes in water flow which are the result of the hydroelectric projects.

Dr. Prager reemphasized Mr. Zingarelli’s previous point that the recommendation refers to the watershed, whereas Committee discussion is focusing on the river. He said that if the Committee considers the whole watershed, then there are other sources of water which can be used for consumptive purposes. If the Committee only considers the river, then prohibition of consumptive use makes more sense.

Mr. Zingarelli also pointed out that a consumptive use that does not come out of the river is water that will not make it to the river. He said that these effects are the same, to some degree.

Mr. Grant suggested leaving the wording referring to the watershed the same, but making a provision prohibiting withdrawals from the river itself.

Dr. Prager agreed to Mr. Grant’s revision.
Mr. Zingarelli asked if the wording should be "prohibit" or "moratorium."

Ms. Lewis said it should be "prohibit."

Ms. Karp said that prohibiting withdrawals will cap growth, because new growth is dependent on having water that comes out of the Blackstone River.

Mr. Mariscal said that it would not stop growth, because water could be extracted from groundwater sources. He suggested putting a moratorium on river withdrawals and establishing a timeframe for the agencies to conduct studies. After the studies are completed, the agencies can determine whether the moratorium should be extended, or if withdrawals should be prohibited altogether.

Ms. Lee suggested revising the wording to read "prohibit consumptive withdrawals from the Blackstone River and tributaries until an interstate agreement is reached on threshold flows necessary to prevent adverse impacts on wildlife habitat."

Dr. Deacutis said that controlling the flow of a river is a very complicated legal issue, and that a legal opinion on water rights and water laws is necessary. He said that New England laws may need to be changed before any of these restrictions could be acted upon.

Ms. Lewis added that when the agencies are determining the river flow threshold level, the rights of people downstream who having been using the river must be taken into consideration.

Ms. Karp read a draft of a revision for the recommendation. She said the original language regarding the watershed would remain the same. A new sentence would be added stating: "There should be a specific prohibition on consumptive withdrawals from the Blackstone River and its tributaries until an interstate agreement is reached on minimum threshold flows necessary to prevent adverse water quality or habitat impacts."

Ms. Lee suggested changing the last phrase to read "to maintain or improve water quality..."

Mr. Grant asked if the new language was acceptable to everyone.

(Agreement)

Recommendation C3, page 20

Ms. Lee asked why the Federal Energy Regulatory Commission (FERC) was not incorporated into Recommendation A.4.d. She said that if the FERC is not included, it will be issuing permits to hydropower plants regardless of what new regulations are established.
Ms. Kristine Stuart (Soil Conservation Service) said that the Committee has already approved other recommendations regulating hydropower plants.

Ms. Lee asked if the recommendation pertains to renewal permits or to new permits for new hydropower plants.

Mr. Zingarelli said that this recommendation pertains to new plant permits. He said there is a different recommendation for negotiating for fish passage at those places where there are existing permits.

Dr. Deacutis asked if there were plans for any new hydropower plants.

Mr. Zingarelli said that preliminary permits have been issued for a number of locations. These permits "hold a place in line" for applicants if they choose to apply for a real permit at a later time. He said he is unsure of whether there is a legal basis for requiring fish passage on a renewed permit.

Ms. Kipp said that Strategy C4 in the original briefing paper pertains to negotiations for fish passage at hydropower operations with existing permits. She said that at this time there is no authority to go into existing permits and stipulate the need for fish passage, so the process has to be a negotiation. She said that Recommendation A.4.d stipulates fish passage for all permits issued from now on.

Ms. Karp suggested revising the wording to read "new or reissued" permits.

Ms. Lee said that the recommendation should not only require fish passage, but should require that hydropower operations abide by the minimum flow agreement which is to be determined between the two states.

Ms. JoAnne Sulak (EPA-Region I) said that Recommendation C2 on page 35 in the original document already requires this.

Mr. Zingarelli said that it is also already specifically required in Recommendation A.4.a on page 30.

Ms lee said that there is again a confusion about whether these refer to new permits or reissued permits.

Mr. David Abedon (URI) commented that the document is too difficult to follow if the reader always has to cross reference to other recommendations.

Ms. Lee said that there will be a problem with enforceability if the document is laid out in a confusing manner, requiring several cross references.

Ms. Karp said that the briefing paper is organized clearly, by objectives. She said that for this meeting, items which required Committee discussion were cut and pasted together.

Mr. Zingarelli added that related recommendations are cross referenced.
Ms. Karp added that the Division of Planning will translate the document into planning language and insert cross references throughout.

(Agreement)

Recommendation C.5, page 21

Ms. Lee said that the recommendation was definitely within the scope of the NEP.

Mr. Zingarelli said that the Committee discussed the issue of the scope of the NEP at its last meeting and there was agreement that these recommendations were within the scope.

Mr. Grant asked if there was any debate.

(Agreement)


Mr. Grant said that comments on this recommendation also involved the scope of the NEP. He asked if there were any objections to approving it.

(No objections.)

II. Schedule of Upcoming Meetings:

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<tr>
<th>DATE/TIME</th>
<th>BRIEFING PAPER</th>
<th>LOCATION</th>
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<tbody>
<tr>
<td>Wednesday, September 18</td>
<td>Land Use</td>
<td>Field's Point</td>
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<tr>
<td>1:00 PM - 4:00 PM</td>
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<tr>
<td>Wednesday, October 25</td>
<td>Critical Resources</td>
<td>Field's Point</td>
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<td>1:00 PM - 4:00 PM</td>
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<tr>
<td>Wednesday, October 2</td>
<td>CCMP Governance</td>
<td>Field's Point</td>
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<tr>
<td>1:00 PM - 4:00 PM</td>
<td>Water Management: Supply, Use, and Treatment</td>
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<td>Wednesday, October 9</td>
<td>Control of Nutrient Inputs</td>
<td>Dept. of Admin.</td>
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<td>Wednesday, October 16</td>
<td>Nonpoint Source Pollution</td>
<td>Dept. of Admin.</td>
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<td>1:00 PM - 4:00 PM</td>
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Ms. Morrison requested that Committee members make more of an effort to start meetings on time.

Mr. Grant said that he has been delaying the start of meetings because people arrive late. He said at future meetings he won't wait as long to begin.

Mr. Ken Kubic (East Passage Yachting Center) said that business people who are volunteering their time to attend meetings need them to start on time. He said he would rather have meetings scheduled from 3:00 PM - 6:00 PM. He also said he would rather stay later and review more than one briefing paper per meeting.

Ms. Karp said that from now on the Committee will make an attempt to discuss more than one paper per meeting. She said that if time remains at the end of the discussion of a briefing paper, the Committee will move on to the next one.

(Meeting adjourned)
APPENDIX B:

SUMMARY OF MANAGEMENT COMMITTEE DECISIONS

SEPTEMBER 11, 1991
SUMMARY OF MANAGEMENT COMMITTEE DECISIONS

Decisions made at the Management Committee meeting on September 11, 1991:

BLACKSTONE RIVER

GOAL: Improve the water quality, ecological health, and commercial and recreational uses of the Narragansett Bay by eliminating the adverse impacts caused by flows of the Blackstone River, and protect and improve the Blackstone itself. The goal shall be achieved through improving the water quality of the river and its tributaries, eliminating or remediating contaminated sediments in the river, and maintaining and restoring fish and wildlife habitat and aesthetic and recreational uses of the river and its watershed.

OBJECTIVE A: The states of Massachusetts and Rhode Island shall improve the water quality of the Blackstone River and its tributaries to meet existing water quality standards for each stream segment, or, in the case of those segments currently classified as Class C, to meet Class B or Class B-subcategory water quality standards.

[Note: A Class-B partial use subcategory can be established when intermittent discharges (i.e., CSO's) cause occasional short-term use impairments. Such designations recognize that CSO abatement measures, other than sewer separation, are designed for a specific capacity, and a finite probability remains that discharge would occur that could result in non-attainment of designated uses.]

PROPOSED STRATEGIES:

1. Point source abatement.

   a. The Massachusetts Department of Environmental Protection (MADEP), the Rhode Island Department of Environmental Management (RIDEM), and the U.S. Environmental Protection Agency (USEPA) should, as discharge permits issued to wastewater treatment facilities (WWTFs) in the Blackstone River watershed under the NPDES/RIPDES program are reissued, incorporate water quality based effluent limits for nutrients and toxics, as well as effluent toxicity limits. USEPA should be the lead agency in insuring that these permits contain consistent and enforceable limits and monitoring requirements.

As NPDES/RIPDES permits are reissued to WWTFs, these permits should include effluent limits on nutrients and toxic metals and organics, where appropriate. It should be noted that recent permits issued for the Blackstone, including the recent draft permit of the Upper Blackstone Water Pollution Abatement District (UBWPAD), does include stringent water quality based
limits and toxicity limits. This process should continue as other NPDES/RIPDES permits are reissued. For this and all recommendations concerning permit limits, USEPA should also ensure that the permit limits are sufficient to meet water quality standards in both states.

b. MADEP, RIDEM, and USEPA should evaluate, as part of the Triennial Review of Water Quality Regulations, whether site-specific criteria for toxics should be developed for use in NPDES/RIPDES permits issued to WWTFs in the Blackstone River watershed.

The national aquatic life criteria established by USEPA and adopted by MA and RI are based on laboratory toxicity tests in which aquatic organisms were exposed to known concentrations of toxicants in laboratory water and, thus, may not adequately represent site water and effluent effects. Aquatic life criteria are established solely for the protection of aquatic life and are independent of the water quality classification or intended uses of a waterbody. The aforementioned effects may include possible antagonistic or synergistic interactions of several chemicals within the effluent or receiving water. Thus, the national aquatic life criteria may be either underprotective or overprotective of aquatic life. If development of site-specific aquatic life criteria is considered appropriate for the Blackstone River, they should be developed subject to the restrictions outlined in the Toxics briefing paper (Penniman et al., 1991).

[Note: Methodology for the development of site-specific criteria for four metals by UBWPAD has been approved by USEPA Region I. The proposed methodology involves comparison of toxicity between site water and laboratory water to adjust the national aquatic life criteria; the resulting site-specific criteria will then be used for setting permit limits for UBWPAD.]

c. MADEP, RIDEM, and USEPA should jointly conduct water quality monitoring and modeling for the Blackstone River, and use that modeling as a basis for preparing a waste load allocation of metals and nutrients (including BOD) for point source dischargers to the Blackstone River system.

Because of the limited dilution and multiple sources of loadings in the Blackstone River, the potential exists for overlapping impacts from point sources. In order to establish effluent limitations that will result in the achievement of water quality standards for the Blackstone River system, water quality modeling should be developed for the entire length of the river (whether a new model or the extension of an existing state model), and a waste load allocation conducted for metals and nutrients (including BOD). Development of a waste load allocation, a means of distributing the assimilative capacity of a waterbody between all dischargers to that waterbody, taking into account any overlapping impacts, should provide an equitable
distribution for the dischargers in both states that will enable compliance with all designated water quality criteria (whether national or site-specific).

d. All WWTFs in the Blackstone River watershed should evaluate the appropriateness of their disinfection practices, as described in the Toxics briefing paper.

The "Disinfection" section of the Toxics briefing paper (Penniman et al., 1991) outlines the trade-offs between the competing desires for effective disinfection of effluent discharges from WWTFs, and the elimination of chlorine toxicity impacts in receiving waters. Chlorine toxicity has been identified as a potential problem in the Blackstone River, particularly downstream of the UBWPAD (A. Cooperman, pers. comm.). Similarly, there are many direct uses of the Blackstone River (e.g., canoeing, fishing) that require effective disinfection of WWTF effluents. Therefore, the procedure outlined in the "Disinfection" section of the Toxics briefing paper (Penniman et al., 1991) should apply to all WWTFs in the Blackstone River watershed.

e. USEPA, RIDEM, and MADEP should review pretreatment requirements for WWTFs in the Blackstone River watershed. The agencies should evaluate whether pretreatment programs should be instituted at WWTFs which do not currently have programs, requiring new pretreatment programs where warranted, and evaluate the effectiveness (including local limits evaluations) where programs are currently in place.

The importance of pretreatment programs in limiting toxic discharges was documented in the Toxics briefing paper (Penniman et al., 1991). Active pretreatment programs are important in the Blackstone River watershed to reduce loadings of metals and organics to the river. In particular, a local limits evaluation should be conducted for the pretreatment program of the UBWPAD. [Also note that several recommendations for ensuring compliance with existing pretreatment programs are contained in the Toxics briefing paper.]

f. USEPA and the States of Rhode Island and Massachusetts should emphasize pollution prevention and source reduction as the preferred means of reducing toxics loadings to the Blackstone River.

The Toxics briefing paper (Penniman et al., 1991) outlined a comprehensive strategy to reduce toxics loadings to the Narragansett Bay. Measures utilizing pollution prevention and source reduction were identified as preferable to treatment measures, since treatment measures typically serve simply to shift toxic pollutants to other media (e.g., sludge, air). Although pollution prevention and source reduction alone are typically not sufficient for meeting effluent limits that will be developed using strategies a. through e. above, and treatment measures will likely be needed in some cases as well, pollution
prevention and source reduction strategies are preferred to treatment when choices exist. The strategies identified in the Toxics briefing paper (Penniman et al., 1991) are considered quite important to reducing loadings to the Blackstone River. Specific strategies for the Blackstone River include:

- **USEPA and the States of Massachusetts and Rhode Island should continue to provide financial support to the RI Hazardous Waste Reduction Project (HWRP) and the Blackstone Project. The two projects should coordinate their activities in the Blackstone River watershed to the maximum extent possible.** The HWRP and Blackstone projects provide technical assistance to firms in the area of pollution prevention and source reduction measures. This assistance enables firms to use more effective processes that reduce their use or discharge of materials. These projects should continue to be supported by their respective states. Since both projects at times provide similar assistance to firms within the watershed, they should attempt to coordinate their activities as much as possible. Joint activities such as workshops held jointly by the two projects for firms in the Blackstone watershed might expand their capabilities for providing technical assistance.

- **The States of Massachusetts and Rhode Island should establish procedures for coordinated permitting and inspections across all disposal media for dischargers to the Blackstone River or its tributaries.**

Existing permitting and inspection procedures may result in firms attempting to meet confusing or even conflicting regulations relating to different disposal media, i.e., water, air, and land disposal. The states of Massachusetts and Rhode Island should, to the maximum extent possible, attempt to coordinate the development of regulations, issuance of permits, and conduct of inspections for the separate disposal media for the purpose of minimizing conflict and confusion. The long-term goal, as outlined in the Toxics briefing paper (Penniman et al., 1991), should be to test and establish procedures for issuing facility-based permits, i.e., each participating industrial user should receive a single permit covering discharges, releases and off-site waste transfers to all media rather than separate permits for discharges to air, land and water.

**g. [Recommendation deleted by Management Committee.]**
h. USEPA, RIDEM, and the Blackstone Valley District Commission (BVDC) should take every step possible to ensure that the facilities planning, design, and construction of CSO abatement measures for the BVDC CSO discharges to the Blackstone River are completed on schedule.

As noted previously, 18 of the CSO discharges under the jurisdiction of the BVDC discharge to the Blackstone River. Surveys taken during wet weather periods (Wright et al., 1990) documented a 100-fold degradation of the water quality in the Blackstone River, as measured by fecal coliform levels. Abatement of these CSO discharges is critical to the water quality of the Blackstone River, Providence River, and, potentially, the Upper Narragansett Bay. USEPA, RIDEM, and BVDC should take every effort to complete the draft facilities plan by May of 1992, as scheduled, and continue with design and construction as rapidly as possible thereafter.

i. USEPA and MADEP should evaluate the effectiveness of the Worcester CSO abatement project by examining the data gathered through the monitoring program conducted by the City of Worcester.

The NPDES permit issued to the City of Worcester in December of 1990 required that the city develop a monitoring program adequate to assess impacts of the CSO treatment facility on water quality and compliance or non-compliance with water quality standards for the receiving waters. USEPA and MADEP should carefully review the data gathered through this monitoring program, to determine if the project is effective in complying with water quality standards.

j. MADEP and the City of Worcester should periodically sample the Mill Brook Conduit to identify and eliminate illegal sanitary or industrial connections to that conduit.

The Mill Brook flows underground through much of Worcester, where it is referred to as the Mill Brook Conduit. It has been speculated that there may be historical connections to the conduit in Worcester that discharge industrial or sanitary waste during dry weather (Save The Bay, 1990). The portion of the conduit south of Salisbury Pond was rebuilt in the 1980's as part of the CSO abatement project (see above), and any illegal discharges in that portion should have been identified and eliminated as part of that reconstruction. Therefore, the portion of the conduit north of Salisbury Pond should be monitored to identify and eliminate illegal discharges in that portion. After elimination of illegal discharges in the northern section of the conduit, the entire length should be monitored to determine if any illegal discharges remain.
k. MADEP and RIDEM should periodically conduct shoreline surveys of the Blackstone River and its tributaries during dry weather periods, to identify and eliminate illegal industrial or sanitary discharges to the river. The states should take advantage of data gathered by citizen groups such as the River Rescue Program or the Blackstone River Watershed Association to help identify problem areas or potential sources that require more detailed data gathering and regulatory action.

The Blackstone River has historically been used as a discharge source for industrial and sanitary wastes for over one hundred years. A program to systematically determine if any unpermitted (and thus illegal) discharges remain, and then to eliminate those discharges, should be conducted by MADEP and RIDEM. An additional benefit of shoreline surveys may be the ability to locate and identify the magnitude of nonpoint source inputs to the Blackstone River (see Strategy A.2.a. below).

2. Nonpoint source abatement.

a. MADEP, RIDEM, USEPA, and other interested parties should conduct a synoptic wet weather water quality survey for the Blackstone River to identify the location and magnitude of nonpoint source inputs.

A synoptic wet weather water quality survey for the Blackstone River has also been identified as needed to estimate the relative importance of bottom sediment resuspension and runoff under wet weather conditions (Wright et al., 1991). MADEP, RIDEM, and USEPA, as described in Strategy D.2.1, should cooperate to perform a wet weather synoptic survey for the Blackstone River.

b. USEPA, MADEP, and the City of Worcester should expedite the development of stormwater permits for Worcester, that will produce effective reductions in runoff related loadings to the Blackstone River.

The City of Worcester, located at the headwaters of the Blackstone, is the largest city in the Blackstone River watershed. The National Urban Runoff Program (NURP) study conducted for Lake Quinsigamond in Worcester identified phosphorus loadings to the lake as a major concern. Sewage contamination through improperly functioning septic systems, infiltration of sanitary sewers into storm sewers, and leakage at manholes was also identified as a major problem (USEPA, 1983a). As a result of the findings of the NURP study, the City of Worcester enacted its Wetlands Protection Ordinance, which places stormwater systems jurisdiction under the Conservation Commission. Stormwater permits should be issued that will resolve the identified problems and other possible areas of concern (e.g., toxic metals and organics).
c. MADEP and RIDEM should develop and implement a feasible and comprehensive sediment remediation plan for the entire length of the Blackstone River.

As described in a. above, sediment resuspension may be an important factor in observed water quality, particularly in wet weather conditions. Steps toward sediment control should be undertaken, as described in Objective B below.

d. MADEP and RIDEM should develop and implement a pilot program for identifying and reducing loadings from landfills and other nonpoint sources.

Runoff and leachate from landfills and other sources (e.g., scrap metal yards, agricultural land) potentially represent a major loading source for nutrients, metals, and toxic organics to the Blackstone River. MADEP and RIDEM should establish a pilot program that, as a minimum, captures and samples runoff from one or more suspected sources, to quantify loadings and make recommendations for reducing those loadings. A potential location for the pilot program would be the former City of Worcester landfill, which is located adjacent to the UBWPAD treatment plant. The leachate, which flows into the former UBWPAD discharge channel, is suspected of containing high levels of metals. Sampling of the landfill runoff will help determine the need for reducing nonpoint source loadings to the Blackstone River.

3. Water quality classifications.

a. The State of Rhode Island should upgrade the classification of the Blackstone River and its tributaries which are currently listed as Class C waters, to Class B or a Class B-subcategory.

Under 40 CFR 131.10(j), the classification of water bodies as Class C is illegal in the absence of a use attainability analysis that has been approved by USEPA. Class C waters are, by definition, inconsistent with the Clean Water Act goal of "fishable, swimmable." A use attainability analysis is the approved means by which a state can demonstrate that it is impossible for a waterbody to reach "fishable, swimmable." Since use attainability analyses have not been conducted for the Blackstone River or its tributaries in RI which are Class C (see Appendix 1), they should be upgraded to Class B or a Class B-subcategory, regardless of whether they currently comply with Class C standards. [Note: A Class-B partial use subcategory can be established when intermittent discharges (i.e., CSO's) cause occasional short-term use impairments. Such designations recognize that CSO abatement measures, other than sewer separation, are designed for a specific capacity, and a finite probability remains that discharge would occur that could result in non-attainment of designated uses.] Without the conduct of a use attainability analysis, USEPA should not
approve a triennial review of water quality standards that contains Class C river segments.

4. Regulation of water withdrawals.

a. The Federal Energy Regulatory Commission (FERC), the U.S. Fish and Wildlife Service (USFWS), RIDEM, and MADEP should ensure that any new or reissued permit for the development of a hydroelectric power project on the Blackstone River or its tributaries does not allow any storage or withdrawal of flow from the river. Diversions of flow from the river should be of the minimum length necessary for the generation of power and should not harm any significant physical, cultural, or biological resources in the river.

Water withdrawals, and subsequent releases, for hydropower generation that are beyond the normal flow pattern of a river can create serious water quality impacts in that river. Periods of low flow can be responsible for decreases in dissolved oxygen and the loss of instream fish habitat through the drying up of valuable habitat areas. Similarly, sudden flow releases can cause sediment resuspension, resulting in increased levels of metals, organics, and BOD (Wright et al., 1991). All new or reissued hydropower permits issued by FERC should be for "run-of-the-river" projects, with specific minimum flow requirements that are protective of water quality and physical habitat. The states should insure through the water quality certification process that any hydropower project does not adversely affect the river's resources. The installation of flow gages by the permit applicant should also be required as a condition of the state water quality certification for new FERC permits (see b. below).

b. FERC, RIDEM, and MADEP should enforce the requirements contained in current hydropower permits through the following actions:

- RIDEM and MADEP should continue to review the requirements included in FERC permits for facilities in their respective states, and the associated state water quality certifications, to determine the minimum flow and diversion stipulations included.

The flow and diversion stipulations in FERC permits can vary widely depending on when the permit was issued, and the level of controversy the permit generated when applied for. The states should continue to review the permits for dams in their state to determine the stipulations in force at each dam.
• RIDEM and MADEP should continue to periodically assess fluctuations in streamflow at the USGS gage in Woonsocket, to determine when illegal storage or discharge operations may be occurring. RIDEM and MADEP should also evaluate the feasibility of supplementing the USGS gage by supporting additional USGS gages at Northbridge and Millville, and/or by installing low-cost real-time reporting flow gages at several locations along the Blackstone River to provide immediate notice of flow fluctuations.

Streamflow fluctuations have been previously noted that were likely the result of upstream hydropower operations (Wright et al., 1991). Flow records for the Woonsocket gage at one time showed an increase of flow from 500 cfs to 2300 cfs in less than one hour, which was believed likely to be associated with hydropower operation (RIDEM, 1990). Fluctuations such as these must be observed as they happen in order to determine at which facility or facilities the storage or discharge is occurring. The feasibility of providing state support for the currently inactive USGS gages in Northbridge and Millville, and/or utilizing real-time flow gages (the use of which has become popular for automated flood warning systems) to provide immediate notice of possible storage or discharge operations, should be evaluated by RIDEM and MADEP. RIDEM and MADEP should also require the installation of flow gages by the permit applicant, as a condition of the state water quality certification for new FERC permits (see a. above).

• RIDEM and MADEP should report hydropower activities that are contrary to permit stipulations to FERC for appropriate action. If FERC does not take action, RIDEM, MADEP, USEPA, and USFWS, should consider legal action to require FERC to take disciplinary action.

Illegal hydropower operations should initially be reported to FERC, who should then take appropriate action toward the permittee. (Such action could include notice to cease and desist, fines, and, ultimately, revocation of the FERC permit.) Although the states have expended considerable effort in attempting to document problems through the above actions, FERC has rarely taken enforcement action in the past, largely due to the prior inability to levy fines and related measures. However, they have recently shown more interest in pursuing enforcement actions if detailed evidence of violations is available (D. Ryan, pers. comm.). If FERC fails to take action against a permittee for documented permit violations, the state agencies, in conjunction with the USFWS, may be required to consider legal action against FERC and/or the permittee.
c. The USFWS, RIDEM, and MADEM should negotiate cooperative agreements with current hydropower dam owners having no minimum flow release requirements to ensure adequate minimum flow is maintained at all times.

Some existing FERC hydropower licenses do not contain specific minimum flow releases, or allow diversions from a significant length of the river (e.g., approximately one mile in the case of Tupperware Dam). In those cases, USFWS, RIDEM, and/or MADEM should attempt to negotiate agreements with the dam owners to maintain minimum flow releases.

d. MADEM and RIDEM should carefully evaluate proposals for interbasin water supply withdrawals or consumptive water uses from the Blackstone River watershed, to consider both the water quality and habitat impacts of withdrawals from the Blackstone. There should be a specific prohibition on consumptive water withdrawals from the Blackstone River and its tributaries until an interstate agreement is reached on minimum threshold flows necessary to maintain or improve water quality and fish and wildlife habitat.

Withdrawals from the Blackstone River for the purpose of water supply or consumptive water uses potentially pose a severe threat to plans for improving the water quality of the river. Since the Blackstone already fails to meet water quality criteria, additional withdrawals from the river could likely serve only to exacerbate current problems. Additionally, withdrawals may have impacts to physical habitats directly from reduced flow quantities in the river. MADEM and RIDEM reviews of water withdrawal proposals should evaluate both water quality and physical habitat effects. At the present time, there is not an established minimum threshold flow for the Blackstone River and its tributaries, agreed upon by Massachusetts and Rhode Island, that is necessary for water quality and fish and wildlife habitat. Minimum threshold flows should be established by agreement of the states as a baseline against which water withdrawal proposals can be measured. Until the threshold flows are established, no consumptive water withdrawals should be allowed from the Blackstone River and its tributaries.

e. Comprehensive plans prepared for the Blackstone River that address the issue of regulation of water withdrawals or the maintenance of instream water quality should be submitted by the sponsoring agency to the Federal Energy Regulatory Commission for recognition.

Under Sections 10(a)(1) and (2) of the Federal Power Act, FERC is required to consider the recommendations of all such comprehensive plans recognized by FERC when evaluating any proposed permit for hydro power. Plans that should be submitted to FERC for recognition include the Cultural Heritage and Land Management Plan for the Blackstone River Valley National Heritage Corridor, the Blackstone Region Water Resources Management Plan.
of the State of Rhode Island, the Blackstone River Basin Plan developed by MADEM, and (when completed) the Comprehensive Conservation and Management Plan for the Narragansett Bay being prepared by the Narragansett Bay Project, of which the recommendations contained in this briefing paper, when approved by the Management Committee, will be a part.

f. The United States Congress should amend the Federal Power Act to require that all hydropower projects, regardless of when initiated, require FERC licenses. RIDEM and MADEP should also include stipulations in water quality certifications granted for FERC licenses that allow for the reopening of the certification if the hydropower operation is found to be inconsistent with the Clean Water Act.

Although the Federal Power Act and the FERC license process allows for extensive public and agency comment on proposed permits for hydropower projects, several circumstances adversely affect the use of FERC licenses in maintaining water quality. For example, projects that have been in continuous operation since before 1936 do not require a license from FERC (D. Ryan, pers. comm.). Additionally, licenses typically run for periods of 30 to 50 years, and can not be reopened unless the original stipulations of the license have been violated. Thus, hydropower operations being conducted under perfectly legal conditions (either unlicensed or with a valid license) may have severe impacts on stream water quality. The U.S. Congress should amend the Federal Power Act to require that all hydropower operations, even those in operation prior to 1936, be required to obtain a FERC license. In issuing water quality certifications, MADEP and RIDEM should insert "reopener" clauses similar to those included in NPDES/RIPDES permits, which allow for revision if needed to remain consistent with the Clean Water Act. Although a standard article in FERC licenses allows for consideration of modifications to projects, it is a more involved process than reopening of water quality certifications.

**OBJECTIVE B:** The states of Massachusetts and Rhode Island shall remediate the adverse impacts from contaminated sediments in the Blackstone River on the biota and water quality of the Blackstone River and Narragansett Bay.

**PROPOSED STRATEGIES:**

1. MADEP and RIDEM should establish a "demonstration" sediment remediation project along the Blackstone River, to evaluate the feasibility of remediation of highly contaminated sediments.

In 1990, Massachusetts and Rhode Island applied to NOAA for a CZMA Section 309 interstate grant. The original proposal called for work on the Taunton River and
Mount Hope Bay, and funds to design and implement a sediment control pilot project for the Blackstone River. Due to funding limitations, the Blackstone portion of the grant request was removed. The states should actively pursue further Section 309 grants or other funding which may be made available (e.g., Coastal America Initiative) to conduct a pilot program. The pilot program should be conducted at a contaminated site which appears to have manageable solution(s) and is unlikely to be recontaminated by sediment resuspension from other sources. Demonstrated success by a pilot project is needed to generate widespread support for a comprehensive sediment control plan for the entire Blackstone River. The Assessment and Remediation of Contaminated Sediments (ARCS) Program established by the Great Lakes National Program Office, an integrated program for the development and testing of assessment and remedial action alternatives for contaminated sediments, may provide an appropriate model for action.

2. MADEP should continue to proceed with the "bioengineering" streambank protection demonstration project planned for the Blackstone River.

A proposal was developed by the Massachusetts Association of Conservation Districts to conduct a demonstration bioengineering streambank protection project at several sites along the Blackstone River. This proposal has been approved for funding by MADEP through a USEPA Section 319 grant. Although the direct purpose of the project is to provide streambank protection, it is believed that prevention of streambank erosion in certain areas will also serve to limit sediment resuspension. If the demonstration proves successful in limiting sediment resuspension, MADEP should consider expanding the project to additional sites.

3. MADEM and RIDEM should actively investigate the ownership of failed or unstable dams along the Blackstone within their respective states, and require repair of those dams by their owners if their repair is believed likely to avert sediment resuspension or other adverse environmental impacts. Dam repair should be used only as a short-term solution until a long-term sediment remediation plan is developed (see Strategy B.5. below).

Many dams along the Blackstone River are in various states of disrepair. Should a dam fail, the sudden flows created by the failure, as well as the exposure of previously undisturbed areas, could cause increased sediment resuspension. MADEM, through its Office of Dam Safety, and RIDEM, through its Freshwater Wetlands Division, Dams Office, should establish a program to: (a) inventory existing dams on the Blackstone River; (b) establish the ownership of all existing dams; (c) examine prior inspection records for or inspect all dams to determine the likelihood of dam failure; and (d) require the owners of unsafe dams to implement repairs, if repair is considered necessary to prevent the resuspension of identified contaminated sediments or other adverse environmental impacts from a dam failure. (RIDEM's current program covers all four actions, but from a safety, rather than water quality, standpoint.) As part of any repair, the owner should be required
to provide for fish passage and to meet the minimum flow requirements to be established under Strategy A.4.d. above.

4. An agreement should be negotiated between the owners of Fisherville Dam and the Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement (MADFWELE), to repair the dam and restore a permanent impoundment and marshes behind the dam.

The sluice gate of the Fisherville Dam was welded open in 1986 to prevent possible undermining of the dam. The former impoundment is now exposed, leaving a shifting river bed which is believed to be eroding contaminated sediments during high river flows. Negotiations have been conducted with the owner of the dam, USACOE, and MADFWELE for its repair and restoration of a permanent impoundment. These negotiations have currently reached an impasse, however. The owner has agreed to deed the dam to MADFWELE, who could then reach an agreement with USACOE to repair the dam. However, due to its state of disrepair, the dam is listed as "high hazard," and MADFWELE will not accept the deed as long as the dam is listed as such. The USACOE, meanwhile, can only become involved in repairing the dam if it is in public ownership, not as long as it is held by its current (private) owner. Some agreement should be reached by all parties involved that will result in this important dam and impoundment being restored. As part of the restoration plan, all alternative sediment remediation measures should be evaluated, and an analysis conducted to identify the potential for bioaccumulation of toxic materials if the dam were to be restored. As part of any repair, the owner should be required to provide for fish passage and to meet the minimum flow requirements to be established under Strategy A.4.d. above.

5. MADEP and RIDEM should evaluate all available data, to develop and implement a feasible and comprehensive sediment remediation plan for the entire length of the Blackstone River. The plan should identify locations where remediation should (or should not) be undertaken, and identify whether in-place or removal remediation measures are appropriate at each location.

In developing a comprehensive sediment control plan for the Blackstone River, the recommendations in the McGinn report (1981) should provide a starting point. Specific recommendations should be reconsidered based on new sediment contamination data currently being analyzed by Dr. John King and the results of demonstration projects (Strategies B.1. and B.2.). The control plan should identify preferred solutions and potential funding sources for carrying out the proposed remediation.
OBJECTIVE C: The states of Massachusetts and Rhode Island shall maintain and restore fish and wildlife habitat and aesthetic and recreational uses of the Blackstone River and its watershed.

PROPOSED STRATEGIES:

1. A comprehensive program to improve the water quality of the Blackstone River, in order to provide for the maintenance and restoration of habitat, should be implemented.

A program to improve the water quality of the Blackstone River will be critical to efforts to maintain and restore fish and wildlife habitat in the river. The strategies of Objective A will provide improvements in habitat throughout the river.

2. A program to maintain flows in the Blackstone River needed for the maintenance and restoration of habitat, should be implemented.

A program to maintain adequate flow volumes and patterns in the Blackstone River and its tributaries that will sustain fish and wildlife habitat should be established and implemented, as outlined in Strategy A.4. (a. through f.) above.

3. The USFWS, MADEP, and RIDEM should require that all new or reissued FERC permits for hydropower operations in the Blackstone River watershed require stipulations for the provision of fish passage at the permit location.

Although the Blackstone River does not currently support anadromous fish, the states of Massachusetts and Rhode Island have a long-term goal of restoring anadromous fisheries to the Blackstone. Since hydropower permits issued by FERC can be for thirty years or longer, and are difficult to reopen once issued, stipulations for the provision of fish passage at Blackstone River dams must be required as permits are issued or renewed, so as not to preclude future achievement of this goal. USFWS and RIDEM have been requiring fish passage in new FERC licenses on the Blackstone River, and should continue to do so.

4. The USFWS, MADFWELE, and RIDEM should negotiate for the provision of fish passage at hydropower operations in the Blackstone River watershed which have existing FERC permits, as those river segments approach the capability of supporting anadromous fisheries.

As stated above, FERC permits for hydropower operations can last thirty years or longer. Permittees whose permits do not specifically state the requirement to provide fish passages can not be mandated to do so, but may be willing to allow their construction, particularly if funding for construction can be identified. In order to leave sufficient time to negotiate agreements and identify funding, USFWS,
MADFWELE, and RIDEM should begin to negotiate agreements prior to individual stream segments actually achieving the needed water quality.

5. Communities in the Blackstone River watershed should establish programs for the protection of valuable resource areas.

Communities in the Blackstone River watershed, with the notable exception of Worcester, have faced a significant amount of development in recent years. Development pressures in the area are expected to continue to increase, particularly with the planned Route 146/Massachusetts Turnpike interchange. It is important that communities now establish the growth management framework by which they will manage development pressures which could adversely impact valuable resources (e.g., wetlands, open space, habitats), as well as directly affecting the water quality of the Blackstone River. An integrated program of land use planning, such as the land use strategy of the BRVNHC, including a comprehensive program of acquisition and conservation restriction of land to be preserved as open space, is vital to the protection of key resources. Community programs, including Local Comprehensive Plans developed by communities under the Rhode Island Comprehensive Planning and Land Use Regulation Act, should contain elements on open space and natural resources. The communities should utilize, participate in, and build upon the planned acquisition of land for the establishment of a Blackstone River Greenway by the Blackstone River Valley National Heritage Corridor and the states of Massachusetts and Rhode Island.

6. The Blackstone River and Canal Commission (BRCC) should continue its cooperative approach toward ensuring that development projects are consistent with the goals for the Blackstone River and Canal.

The BRCC, through the Chapter 155 of the Acts of 1988 (Massachusetts), is notified of all proposed projects that might impact upon the Blackstone River and Canal. Although they can not require modifications to any proposal, the Commission has had success in negotiating modifications to proposals before they are finalized. This cooperative approach should be continued.

**OBJECTIVE D:** The states of Massachusetts and Rhode Island, USEPA, and other interested organizations shall develop and implement a program to increase understanding of the environmental quality of the Blackstone River.

**PROPOSED STRATEGIES:**

1. MADEP, RIDEM, USEPA, and other interested parties should conduct a synoptic dry weather water quality survey for the Blackstone River.
The need to conduct a synoptic water quality survey for the Blackstone River has been identified in the *Blackstone River 1990 report* (Wright et al., 1991). MADEP, RIDEM, and USEPA have initiated efforts geared toward conducting a dry weather survey for three periods in the summer of 1991, with the ultimate goal of utilizing the data gathered in developing a dry weather wasteload allocation for the Blackstone River. To the extent possible, the agencies should take advantage of the sampling capabilities of the River Rescue Program or other citizens monitoring groups to maximize the potential data coverage of the survey. The following activities are planned to (and should) be conducted:

- Effluent sampling for WWTFs
- Instream water quality sampling
- Flow monitoring and time of travel analysis
- Effluent toxicity testing
- Instream toxicity testing
- Sediment toxicity testing
- Sediment chemistry
- Biological community analysis (fish and macroinvertebrate)

2. **MADEP, RIDEM, USEPA, and other interested parties should conduct a synoptic wet weather water quality survey for the Blackstone River.**

A synoptic wet weather water quality survey for the Blackstone River has also been identified as needed to estimate the relative importance of bottom sediment resuspension and runoff under wet weather conditions (Wright et al., 1991). MADEP, RIDEM, and USEPA, after successful completion of the dry weather survey, should cooperate to perform a wet weather synoptic survey for the Blackstone River. The proposal submitted by RIDEM under the 104(b)(3) program would fund sufficient data gathering for use in a wet weather wasteload allocation. To the extent possible, the agencies should take advantage of the sampling capabilities of the River Rescue Program or other citizens monitoring groups to maximize the potential data coverage of the survey. The following activities are recommended:

- Effluent sampling for WWTFs and CSOs
- Instream water quality sampling
- Flow monitoring
- Effluent toxicity testing
- Instream toxicity testing
- Sediment trap placement (transport analysis)

3. **MADEP, RIDEM, and USEPA should conduct water quality modeling for the Blackstone River, to identify the relative importance of toxics and nutrient loadings from point source discharges, runoff, and sediment resuspension.**

A major unanswered question in addressing the water quality problems of the Blackstone River is the relative importance of toxics and nutrient loadings from
various sources, during both dry and wet weather conditions. While violations of water quality criteria have been documented in both dry and wet weather conditions, it is difficult to determine which sources create the greatest impact. An appropriate water quality model (e.g., QUAL2E), whether a new model or extension of an existing state model, would allow for a stronger effort in those areas expected to achieve the greatest return, e.g., the development of dry weather wasteload allocations for the Blackstone River, with subsequent wet weather analyses, if necessary. Water quality modeling will also allow for a post-audit of the decision to implement advanced treatment at the UBWPAD (Wright et al., 1991).

4. The Massachusetts Turnpike Authority (MTA) and MA Department of Public Works (MADPW) should prepare an Environmental Impact Statement (EIS) that evaluates all potential environmental impacts from the proposed Massachusetts Turnpike interchange with Routes 20 and 146. The EIS should be conducted through the National Environmental Policy Act (NEPA) and Massachusetts Environmental Policy Act (MEPA) processes.

A proposal is currently being developed for a new interchange on the Massachusetts Turnpike with Routes 20 and 146 in Millbury. This proposal has the potential for financial and environmental impacts throughout the Blackstone River Valley that would extend well beyond the immediate construction impacts from the project. An EIS should be developed by MTA and MADPW that will evaluate the long-term impacts of the proposed project on water quality, land use, and sediment stability in the Blackstone River watershed. Preparation of an EIS that fully documents the effects likely to occur will provide the opportunity for public comment on and mitigation of adverse impacts from a project of great importance to the Blackstone River Valley. Since the project is likely to have a significant environmental impact, and is funded through both federal and state sources, it should be reviewed through both the NEPA and MEPA processes.

5. The USEPA, in conjunction with the Narragansett Bay Project, should develop a comprehensive library, bibliography, and database of studies and reports describing the Blackstone River.

Extensive research has been conducted over the years studying the Blackstone River area. As part of its Blackstone River Initiative, and following up on the initial efforts conducted by the NBP’s Blackstone River Round Tables, the USEPA should collect as many of these materials as possible to a single location. A bibliography should also be published by USEPA, listing all available documents and their location, if not kept at a single repository (many reports may be out of print). These documents should be indexed in the Narragansett Bay Data System as the documents are acquired and catalogued by USEPA, and important data should be incorporated into the database.
6. The USEPA, in conjunction with the states of Massachusetts and Rhode Island and other interested parties, should establish a public information program geared toward outlining the need for cooperation in cleaning up the Blackstone River.

The process of improving the water quality of the Blackstone River will require participation from many levels--Federal and state agencies, local communities, business and industry, and private individuals. A public information program, established as part of the Blackstone River Initiative being conducted by USEPA, could be an important step in achieving the needed participation. Together with both states and groups such as the Blackstone River Watershed Association and Save the Bay, public awareness of the need to clean up the Blackstone could be greatly improved. The use of facilities developed as part of the Blackstone River Valley National Heritage Corridor, the Blackstone River Heritage State Park in MA, and the Blackstone River State Park in RI should be strongly considered for portions of this program.

**OBJECTIVE E:** The states of Massachusetts and Rhode Island, USEPA, and other interested organizations shall develop a collaborative interstate approach to protecting the Blackstone River.

**PROPOSED STRATEGIES:**

1. The New England Interstate Water Pollution Control Commission (NEIWPC), in conjunction with the USEPA and the states of Massachusetts and Rhode Island, should establish a permanent Blackstone River Task Force to address interstate pollution problems in the basin.

An interstate Blackstone River Task Force is essential to proper coordination on the issues that impact the Blackstone River in both Massachusetts and Rhode Island. NEIWPC, an interstate commission experienced in establishing similar task forces (e.g., a prior interstate task force for the French and Quinebaug Rivers), is the most appropriate organization to establish the task force. Membership, at a minimum, should include USEPA Region I (through its Blackstone River Initiative), NBP, RIDEM, MADEP, MADEM, BRVNHCC, and other interested parties identified through the Blackstone River Round Tables or through other means. The Task Force should be focussed on identifying and carrying out solutions to manageable interstate issues affecting the Blackstone River. Potential topics to be addressed by the Task Force include:

- Permit issues--criteria, pretreatment programs, consistency between states, etc.
- Water withdrawals and water management.
- Sediment remediation.
- Habitat protection and restoration.
• Data and technology transfer (prior studies).
• Funding sources (Federal, regional, state, local, or private).

2. The states of Rhode Island and Massachusetts should include the other state on the automatic review list for all permit reviews or other major actions within the Blackstone River watershed. The USEPA should include both states on all such review lists for permits under its jurisdiction.

Due to the true interstate nature of problems on the Blackstone River, each state should automatically coordinate all proposals and reviews for programs potentially affecting both states. Such programs include NPDES/RIPDES discharge permits (including development of site-specific criteria), water withdrawal permits, major habitat or wildlife restoration efforts, and sediment remediation plans. USEPA should also ensure that any permit limits for any discharger likely to impact interstate waters are appropriate to meet water quality standards in both states.

3. MADEP, RIDEM, USEPA, and other interested parties should continue to cooperate in conducting synoptic water quality surveys and other field and modeling efforts for the Blackstone River.

As mentioned previously, a joint effort has been established to conduct a synoptic dry weather water quality survey for the Blackstone River from Worcester to Pawtucket. Further data gathering and modeling needs, as outlined in Objective D, should continue to be conducted in a comprehensive, river-long basis.

4. The states of Rhode Island and Massachusetts, as well as communities within the corridor, should support the environmental conservation goals and objectives of the Cultural Heritage and Land Management Plan for the Blackstone River Valley National Heritage Corridor.

The BRVNHNC Cultural Heritage and Land Management Plan outlines goals that require the cooperation of state and local entities within the corridor for them to be achieved. The establishment and use by the public of the Blackstone River Valley National Heritage Corridor will, by increasing awareness of the Blackstone River, provide public and political interest in continuing to clean up the Blackstone. The environmental conservation objectives of the plan are:

• Improve the water quality of the Blackstone River
• Identify natural sites that are threatened, in need of action or assistance, and/or important to the completion or enhancement of state heritage parks
• Protect open space within the Corridor
• Support state, local, private and individual efforts to enhance the environment

5. The Blackstone River Valley National Heritage Corridor Commission (BRVNHCC), in conjunction with the National Park Service, USEPA, and other
federal agencies, should establish a consistency review program to ensure that federal activities are consistent with the goals and objectives of the Cultural Heritage and Land Management Plan for the Blackstone River Valley National Heritage Corridor.

Public Law 99-647, which established the Blackstone River Valley National Heritage Corridor, requires under Section 9 that federal agencies coordinate their activities which may directly affect the Corridor with the BRVNHCC. The BRVNHCC should establish a consistency program to ensure that all activities are consistent with the goals and objectives of the Cultural Heritage and Land Management Plan for the Corridor.
APPENDIX C:

MANAGEMENT COMMITTEE ATTENDANCE

SEPTEMBER 11, 1991
Management Committee Attendance at Sept. 11, 1991 Meeting

Attended:

Mr. David Abedon
Cooperative Extension Specialist
University of Rhode Island

Mr. Greg Feldberg
Principal Policy Analyst
RI Governor's Office

Mr. Malcolm J. Grant (Chair)
Assistant Director of Administration
RI Department of Environmental Management

Mr. Roger Greene
Assistant to the Director
RI Department of Environmental Management

Ms. Caroline A. Karp
Project Manager
Narragansett Bay Project

Ms. Katrina V. Kipp
Project Officer
Region 1
US Environmental Protection Agency

Ms. Virginia Lee
Coordinator of Domestic and Environmental Programs
Coastal Resources Center
University of Rhode Island

Ms. Susan P. Morrison
Chief, Office of Systems Planning
Division of Planning
RI Department of Administration

Mr. Thomas E. Mulhearn
Executive Vice President
RI Association of Realtors, Inc.
Sent Alternate:

Mr. Ken Kubic for  
Ms. Holly A. DesRosiers  
R.I. Marine Trade Association

Ms. Kristine Stuart for  
Mr. Anthony T. Dore  
Soil Conservation Service  
US Department of Agriculture

Dr. Christopher Deacutis for  
Mr. James W. Fester  
RI Department of Environmental Management

Dr. Jan Prager for  
Dr. Norbert A. Jaworski  
Environmental Research Laboratory - Narragansett  
US Environmental Protection Agency

Mr. Erich Salomon for  
Mr. Dennis B. Ledbetter  
Armbrust Chain Company

Mr. Juan Mariscal for  
Mr. Paul Pinault  
Acting Director  
Narragansett Bay Comission

Mr. Kevin Brubaker for  
Mr. H. Curtis Spaulding  
Save The Bay

Did Not Attend:

Mr. Eddie Agin  
Board Member  
RI Shellfishermen's Association

Mr. Roy B. Anderson  
Director of Utilities  
Newport Water Department

Mr. Daniel Beardsley  
Executive Director  
RI League of Cities and Towns
Mr. Allan D. Beck
Reserve Manager
Narragansett Bay-National Estuarine Research Reserve

Mr. Robert L. Bendick, Jr.
Deputy Commissioner
NY Department of Environmental Conservation

Senator John J. Bevilaqua
RI Senate Majority Leader
Rhode Island State Senate

Mr. Thomas E. Bigford
Division Chief
National Marine Fisheries Service
National Oceanic and Atmospheric Administration

Ms. Priscilla Chapman
Executive Director
New England Chapter
Sierra Club

Mr. Robert A. Cioe
Representative
RI Builders Association

Dr. Walter S. Combs, Jr.
Associate Director, Environmental Affairs
RI Department of Health

Mr. Alan N. Cooperman
Environmental Engineer
Technical Services Branch
MA Department of Water Pollution Control

Mr. David C. DePetrillo
Director of Tourism
RI Department of Economic Development

Mr. David A. Fierra
Director, Water Management Division
Region I
US Environmental Protection Agency
Mr. Grover J. Fugate  
Executive Director  
RI Coastal Resources Management Council

Mr. Thomas Hall, III  
President  
Ocean State Fishermen's Association

Rep. Donald J. Lally, Jr.  
RI State Assembly

Dr. Scott W. Nixon  
Director  
RI Sea Grant

Mr. Lawrence R. Oliver  
Environmental Resources Specialist  
Environmental Resources Branch  
US Army Corps of Engineers, New England Division

Dr. Judith Pederson  
Principal Policy Analyst  
MA Coastal Zone Management Program

Mr. R. Daniel Prentiss, Esq.  
Attorney-at-Law

Mr. David L. Rocha  
Assistant Executive Director  
Manufacturing Jewelers & Silversmiths of America, Inc.

Mr. Gary S. Sasse  
Executive Director  
RI Public Expenditures

Mr. John A. Stolgitis  
Chief, Division of Fish & Wildlife  
RI Department of Environmental Management

Mr. Terence J. Tierney  
Special Assistant Attorney General  
RI Attorney General's Office

C-4
Dr. Harold R. Ward
Director
Center for Environmental Studies
Brown University