

# Buzzards Bay Project National Estuary Program 1997 Biennial Review



Buzzards Bay Project

A summary of the successes of the Buzzards Bay Project in its efforts to facilitate the implementation of the Buzzards Bay Comprehensive Conservation and Management Plan

June 30, 1997

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## Preface

In 1985, Congress designated Buzzards Bay as an Estuary of National Significance, one of five estuaries so designated. The designation by Congress eventually led to the creation of the National Estuary Program in Section 320 of the reauthorized Clean Water Act of 1986. In 1987 the Buzzards Bay Project formally became a U.S. EPA designated National Estuary Program.

Between 1985 and 1990, the Buzzards Bay Project funded water quality and living resource characterizations and assessments of Buzzards Bay. Based on these findings, the Buzzards Bay Project examined management options to address the identified problems and conducted financial assessments of these management solutions. These efforts culminated when the Buzzards Bay Project wrote the draft **Buzzards Bay Comprehensive Conservation and Management Plan (CCMP)** in 1989, the first NEP to do so. This Management Plan was approved by Massachusetts Governor Weld in September 1990, and by the US EPA in April 1991.

The Buzzards Bay CCMP was one of the country's first watershed plans and one of the first to focus so strongly on non-point source pollution and the cumulative impacts of development on water quality and living resources. The Buzzards Bay CCMP broke much new ground including a nationally acclaimed nitrogen management strategy. Also unique is the fact that nearly three quarters of the recommendations contained in the Buzzards Bay CCMP are directed at local government. This fact is a reflection that under Massachusetts' environmental regulatory framework, and because of "home rule" laws empowering municipalities, it is local government that has the greatest authority for dealing with cumulative non-point impacts in Massachusetts.

Since the Buzzards Bay Project completed the CCMP, it has transformed itself into a technical assistance and implementation program unparalleled in the National Estuary Program. Historically the Buzzards Bay Project has always been one of the smaller and less funded Estuary Programs. The Buzzards Bay Project adapted to its many unique features and transformed potential weaknesses into assets and reformed itself into small, but highly effective program, with a remarkable track record at both getting things done and in securing state and federal funding. These accomplishments were achieved despite some unconventional approaches, such as the complete abandonment of the Project's Public Outreach program in 1994, including elimination of the Project's newsletter. The Project made a strategic decision to rely on the outreach activities of two not-for-profit organizations - Coalition for Buzzards Bay, a citizen's group, and Buzzards Bay Action Committee, an association of municipal officials. Rather than focus on public outreach, the Buzzards Bay Project would instead seek to fulfill the environmental technical assistance needs of Buzzards Bay municipalities. This approach was feasible only because both nonprofits were also committed to the implementation of the Buzzards Bay CCMP, an unsurprising fact since both groups were created as a result of the dissolution of the Buzzards Bay Project's Citizen Advisory Committee in 1988.

One downside of the abandonment of the Project's public outreach program is the fact that the Project's accomplishments are not widely known outside of the region. This report was written to detail for the first time the full inventory of achievements of the Buzzards Bay Project NEP.

SECTION I

**CCMP  
Implementation**



## Managing Nitrogen-Sensitive Embayments

### CCMP Goals

1. Ensure that no beneficial water uses will be lost, nor will ecosystems be adversely affected by excessive contributions of nitrogen to any embayment within Buzzards Bay
2. Restore any beneficial water uses and ecosystems lost or impacted by the excessive contribution of nitrogen to any embayment within Buzzards Bay

### CCMP Objectives

- To control the amount of nitrogen entering Buzzards Bay as a whole
- To limit new additions of nitrogen entering nitrogen-sensitive embayments
- To reduce the amount of nitrogen entering nitrogen-impacted embayments
- To develop and support the use of alternative technologies that achieve denitrification of wastewater.

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The Buzzards Bay Project identified the management of excessive nitrogen loading to small coastal embayments as a major component of its CCMP. Unlike other east coast estuaries such as Long Island Sound and Chesapeake Bay, central Buzzards Bay has fortunately not suffered from the impacts of excessive nitrogen loading. However, nitrogen inputs were identified in the Buzzards Bay Comprehensive Conservation and Management Plan (CCMP) as one of the greatest threats to the health of the Bay's more than 30 shallow, often poorly flushed, coastal embayments. Starting with a well-conceived strategy, the BBP has gone on to become a national leader in nitrogen management. Protocols developed by the BBP have been transferred to other National Estuary Programs as well as to neighboring Cape Cod where the Cape Cod Commission has adopted and applied the BBP's nitrogen management methodology as part of their overall Regional Policy Plan.

The first early success was passage of the **Buttermilk Bay Tri-town Nitrogen Overlay District** which was approved by town meetings in Plymouth, Wareham and Bourne in 1991. The district ensured that future nitrogen loading would not exceed the carrying capacity of Buttermilk Bay, a small embayment in the northeastern part of Buzzards Bay, by controlling development density in the watershed. This was the first time that a district was formed to manage cumulative sources of

nitrogen to a coastal embayment and the three towns received national pollution prevention awards for their efforts that were guided by the Buzzards Bay Project.

Since that time, the BBP developed two very useful screening tools that are used to assess nitrogen management priorities within the bay area. The first uses MassGIS landuse data to compute present and future nitrogen loading. This methodology allows for a general loading assessment without having to conduct a parcel level buildout analysis. The second is an embayment ranking system that utilizes the landuse methodology and combines it with embayment flushing rates and feasible management options. Released in 1994, a report entitled "**A Buzzards Bay Embayment Subwatershed Evaluation: Establishing Priorities for Nitrogen Management Action**" combined this land use and hydraulic data and established a ranking of embayments that continues to serve both the Project, municipal officials, and state agencies in setting priorities.

### Buzzards Bay Citizens Water Quality Monitoring Program

The Buzzards Bay Citizens' Water Quality Monitoring Program was initiated in 1992 to document and evaluate nitrogen-related water quality and long-term ecological trends in Buzzards Bay. Until the inception of the program, no comprehensive database existed on nutrient concentrations and the extent of eutrophication in the most sensitive areas of the Bay ecosystem.

In order to provide this critical water quality data to assist federal, state, and local environmental managers in setting priorities for management action, the Buzzards Bay Project, Woods Hole Oceanographic Institution, and the Coalition for Buzzards Bay, a citizens advocacy and education organization, collaborated to design a citizen based monitoring program. Involving citizen volunteers was the only cost-effective way to achieve the ambitious goal of monitoring all of the Bay's important embayments from the Westport River, at the west end of the Bay, to Quissett Harbor on Cape Cod. Such a program would have the dual benefit of collecting comprehensive water quality data while educating and empowering people to get involved and make a difference in the sound management and restoration of the Bay's resources. With funding and technical assistance from the Buzzards Bay Project, the Coalition for Buzzards Bay has recruited over eighty core volunteers throughout the Bay watershed and coordinated four seasons of data collection and analysis.

In August 1996, "**Baywatchers - Report of the Buzzards Bay Citizens' Water Quality Monitoring Program 1992-1995**" was released and discusses the results of the first four years of water quality monitoring data. In addition, the report includes recommended management actions based on these findings and the priority embayment rankings developed two years earlier by the Project. The availability of this data is providing the embayment-specific baseline data necessary to evaluate resource protection or restoration actions.

### Nitrogen Management Projects

Nitrogen assessment and management projects are now underway in **Westport (Westport River), Dartmouth (Allen's Pond), Fairhaven (Little Bay), Mattapoisett (Eel Pond), Wareham (Onset Bay), Bourne (Pocasset River and Hen Cove) and Falmouth (West Falmouth Harbor)**. Four of the five embayments these towns have chosen to manage are the top-ranked embayments as identified by the BBP through the embayment ranking process. These projects will use the Buttermilk Bay experience as a prototype and hopefully develop an equally successful management program.

The Project has used funding through its Municipal Grant Program to encourage parcel level buildout analysis and hydraulic flushing studies to calculate acceptable nitrogen loading limits for each priority embayment. In all cases the funding provided has allowed municipal officials and staff to focus on nitrogen land use planning for the first time. We have also been able to provide scientifically sound, embayment-specific flushing rates to ensure accurate estimation of critical nitrogen loading limits.

Buzzards Bay Project efforts will continue to focus toward the completion of these nitrogen management projects in the near future. Following completion of each of the embayment's

"Buzzards Bay Project has been extremely helpful in assisting us when we need detailed information on projects in our watershed area, be it landuse, water quality, or wetlands issues."

*Gay Gillespie, Executive Director,  
Westport River Watershed Alliance*

loading analysis, the Project will work with town officials on developing management strategies in a manner similar to the Buttermilk Bay effort to either restore or protect critical embayment uses.

The Project will also begin a new pilot project to **demonstrate the use of targeted land acquisition in the watershed's to nitrogen-sensitive embayments** in the fall of 1996 through a Section 319 grant from the Massachusetts Department of Environmental Protection. Traditional watershed management strategies have focused on zoning techniques and wastewater disposal alternatives to manage future growth from a nitrogen perspective. Working in the Slocums River (Dartmouth and New Bedford) and the Onset Bay (Wareham) watershed, the Buzzards Bay Project will develop a conservation restriction model for use in limiting future nitrogen inputs and apply the model to land conservation efforts in each watershed through partnerships with two local land trusts - the Dartmouth Natural Resources Trust and the Wildlands Trust of Southeastern Massachusetts.

## Managing On-site Wastewater Disposal Systems

### CCMP Goal

Prevent public health threats and environmental degradation from on-site wastewater disposal systems

### CCMP Objectives

- To enforce the provisions contained in Title 5 regulations
  - To upgrade pre-Title 5 systems suspected of contaminating groundwater or surface waters
  - To address the inadequacies of Title 5 through Board of Health regulations
  - To improve the Title 5 Code through recognition of nitrogen impacts, virus transport, and sensitive areas.
  - To promote innovative technology that will reduce nitrogen
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### Improving Local Ability to Manage Septic Systems

In 1992 when the BBP was beginning its implementation efforts a number of Bay watershed municipalities did not have a health professional on staff to oversee inspection of existing septic system or the siting of new systems. To meet this basic need, the BBP, through its municipal grant program, funded a cooperative effort between the towns of Marion, Rochester, and Acushnet to create the first ever **Regional Health District** between the three towns. This program also provided funding for the first year to hire a shared Health Agent for the District. This cooperative effort was an important accomplishment for the BBP as intermunicipal cooperation was a key goal of the CCMP development effort. The District remains in effect today and was the basis for the creation of a similar Conservation Agent position a few years later in New Bedford, Acushnet, and Rochester. With the increased management responsibilities of towns under the state's onsite wastewater disposal regulations ("Title 5"), the District should be expanded to provide for full-time health agents in each of the Bay communities.

The Buzzards Bay Project has been very active in working with local Boards of Health toward improving local Health regulations to address inadequacies in the state Title 5 code particularly prior to a wholesale revision of the Code by the Massachusetts Department of Environmental Protection in 1994. Viral transport rates in groundwater were found through studies compiled for the CCMP to far exceed the required 50 foot setback distance from septic system leachfields to waterbodies and wetlands. To address this, the BBP worked with Bay towns to increase the setback distance in local



health regulations to a minimum of 100 feet and adjust wastewater application rates to better protect against viruses. Today, only the Bay town of Acushnet retains a 50 foot setback.

The revisions to Title 5 in 1994 accomplished many of the changes to the Code recommended in the CCMP for the siting and design of septic systems. As noted above, one area that did not receive adequate attention was the setback of leachfields to wetlands and waterbodies. Changes in the system design and loading rates in the Code did however result in partial improvements to virus transport concerns expressed in the CCMP. Nitrogen impacts were included in the Code but no specific nitrogen sensitive embayments or special wastewater disposal standards for these areas were defined. A very positive result of the revisions as they relate to enhanced nitrogen removal was the code's new procedures for the development and acceptance of alternative/innovative septic system technologies. This action directly addresses the Department's CCMP commitment to promote such systems as a means of providing cost-effective nitrogen removal alternatives.

The BBP took an important step to assist local Boards of Health in the upgrade of failing or poorly functioning septic systems and the proper long term maintenance of septic systems through the

"SepTrack is fantastic! We are finding it useful to identify problems areas of the town. We look forward to using this software in conjunction with GIS."

*Albin Johnson, Chair  
Marion Board of Health*

development of **SepTrack - a septic system tracking computer program** jointly developed by the Buzzards Bay Project and Kyran Research Associates through a contract with Massachusetts Coastal Zone Management. This software was developed for municipalities within the Buzzards Bay watershed in order to assist Boards of Health in tracking the operation, maintenance and permitting of septic systems and other health related issues. To support the implementation of SepTrack, the Buzzards Bay Project through its municipal grant program also purchased computers for each area Board of Health. Finally, an intern was hired by the BBP to set up and install historic septic system information as well as current Assessor's data in each of the Bay towns.

## Buzzards Bay Project develops *SepTrack* software

In 1996, the Buzzards Bay Project provided computers and software to 11 municipal Boards of Health in the Buzzards Bay watershed. The purpose of this initiative was to better enable each Board of Health to track septic system permits, and inspection and maintenance information. The Project's goal of improving information management and regular inspection practices of Boards of Health was seen as fundamental to enhancing protection of public health and Bay water quality.

To achieve this end, the Buzzards Bay Project developed the concept for a Windows-based database management software program and hired a software development firm to implement the package. Project staff had a keen sense of what kinds of information Health Boards wanted to track, but to ensure that the software met the needs of area municipalities, the Project set up a panel of health officials to test and evaluate early versions of the software. The outcome of this effort is known as "SepTrack," an easy-to-use program that enables health officials to track information on every property in their community. More than 180 categories of information are tracked in the database ranging from septic system design, leach field type, number of bathrooms, presence of wetlands, pumpout frequency—essentially all the information routinely supplied to towns in building and health permits. At a click of a mouse button, data on any lot will be available to municipal staff, allowing them to be more responsive to information requests and help towns process permit applications more quickly. The program has the ability to display graphics files of site plans and engineering designs.

To help towns adopt and use the new software package, the Buzzards Bay Project paid for the Assessors Office data in each town to be transferred into the SepTrack database. The Project also hired a student intern to work on a rotating basis in each town to enter old permit information and septic pumping records. Once this historical information is entered, health office administrators merely have to spend a few minutes a day entering new permit data.

The development of SepTrack was timely from a statewide perspective as revisions to Massachusetts Title 5 Code were completed. Changes to the Code resulted in inspection requirements of septic systems at the time of real estate transfer as well as regular tank pumping. SepTrack is now being distributed to interested Boards of Health throughout Massachusetts in conjunction with the Massachusetts Department of Environmental Protection.

### **De-nitrifying On-site Septic Systems**

A related objective of the Buzzards Bay Project's strategy to manage nitrogen is the development of de-nitrifying on-site septic system technologies and their use in the watersheds to nitrogen sensitive embayments. The Project has been a pioneer in this area and has worked closely with the Department of Environmental Protection (DEP) and the Environmental Protection Agency (EPA) to construct and monitor alternative systems that will remove a greater proportion of nitrogen from wastewater than standard systems. With the revision of Title 5, the Massachusetts on-site wastewater disposal rules in 1994, procedures were established which provide for the use and permitting of alternative and innovative technology. Lack of monitoring data on many of these technologies however has stalled their widespread use.

The Buzzards Bay Project has installed and performed detailed monitoring programs on **three de-nitrifying on-site septic systems in Fairhaven and Dartmouth** and has collaborated on another installation in Bourne. Each of the systems are retrofits to existing systems with the addition of denitrifying technologies. One effects removal through a four foot layer of peat, and the other works by recirculating the effluent four times through the tank's anaerobic environment and a sand filter bed. The Bourne system is a variation of the recirculating sand filter system. Results have been very encouraging. A fourth system demonstrating the use of a self-contained constructed wetland to polish effluent from an Orenco Trickling Filter is being installed in Dartmouth in the summer of 1997 in cooperation with the Massachusetts Audubon Society. This will be the first application of a constructed wetland on a single family dwelling in Massachusetts.

The Buzzards Bay Project is currently in the process of launching an even more ambitious project to test de-nitrifying on-site systems through an Environmental Technology Initiative grant from EPA. This project, with collaboration from the DEP, the Barnstable County Health and Environmental Department, and Woods Hole Oceanographic Institution will establish a **Testing/Demonstration Facility for Alternative On-Site Technologies** at the Massachusetts Military Reservation's wastewater treatment plant on Cape Cod. The Test Center will be constructed in early 1997.

The facility will provide an opportunity to test and evaluate performance in a consistent, controlled environment. It will also provide incentives to small businesses that are developing new technologies to have their products tested free of charge within a state sanctioned process. The facility will also establish a location where local, state and federal officials, system design and installation professionals, and other interested individuals will have the opportunity to view many different technologies at a single location. This project will also provide a statewide repository for performance information on alternative on-site systems.

## ETI Alternative Septic System Test Center

The Buzzards Bay Project received an US EPA Environmental Technologies Initiative (ETI) grant to construct and operate a testing center for alternative and innovative onsite wastewater treatment technologies. A primary goal of the Alternative Septic System Test Center is to test alternative and innovative onsite wastewater treatment systems appropriate for single family use under controlled conditions. The Center will provide vendors of innovative technologies with both the opportunity to accelerate Massachusetts regulatory approvals and to reduce the substantial cost of meeting the monitoring

requirements for permitted use of onsite systems in Massachusetts and elsewhere in New England. It is expected that the Test Center will contribute to the wider use of alternative technologies in the region.

The Test Center, to be located at the Massachusetts Military Reservation (MMR), Cape Cod, MA, is a cooperative project of the Buzzards Bay Project, MA Department of Environmental Protection (MA DEP) and the Barnstable County Department of Health and the Environment. As of June 30, 1997, the final design plans for the facility are being reviewed and construction is expected to begin in late summer 1997. Operation of the Test Center will be by the Buzzards Bay Project. Oversight for the Test Center is provided by a steering committee comprised of representatives from MA DEP, US EPA, US Department of Defense, MA CZM, Barnstable County Department of Health and the Environment, New England Interstate Water Pollution Control Commission (NEIWPCC), the University of Rhode Island (URI), the Town of Sandwich, MA, the Town of Falmouth, MA, and the Coalition for Buzzards Bay.

As an ETI project, the mission of the Test Center is to speed the introduction and approval of alternative and innovative onsite wastewater treatment technologies in Massachusetts and to reduce the financial burden that the approvals process entails. To accomplish this, the Test Center will provide independent, rigorous testing programs to measure the performance of alternative technologies, conducted under controlled conditions for a testing period of two years. The facility has the capacity to test six residential treatment technologies (in triplicate) in addition to three conventional septic systems which will serve as a benchmark for the other technologies.

Using residential wastewater from a sewer at MMR, the facility will conduct equal amounts of sewage to each technology. Effluent from each technology will flow to one-quarter size underlined, leach trenches where the removal of pathogens and biochemical parameters below the leach trench will be measured. The porewater pathogen measurements are of great interest to regulators as they are critical to the public health considerations that drive system design regulations. In addition to the analytical monitoring, the Test Center will also monitor and record the systems' operation and maintenance and project these costs over the life of the system.

Alternative and innovative septic systems hold the promise of increased removals of BOD, TSS, pathogens and nutrients which exceed the performance of standard septic systems. Further, though the design of a standard septic system has undergone little basic change for many years, the technologies employed in the alternative septic systems are continuing to evolve to achieve goals of better performance and lower operating and maintenance costs. To this end, the Test Center also will provide the opportunity for vendors to test and develop new designs prior to seeking a MA DEP permit.

Beyond the benefits to technology vendors, the Test Center will benefit the public in several ways. First, by speeding approvals of new technologies there should be an increase in the variety of systems available to the public. Second, the results of testing each technology will be released as public documents which will be available to homeowners and Boards of Health. The reports will include data on system performance, i.e. how well does the system remove standard domestic sewage contaminants? A record of operation and maintenance including power usage will also be summarized, so that homeowners will have a clear idea of the long-term costs of maintenance and monitoring for alternative systems. Information in these reports will be in a standard format and summarized in a form which will be useful to the lay person. The Test Center is expected to be a repository and clearing house for information on alternative technologies for Massachusetts and New England. This role may prove to be important to the wider acceptance and adoption of alternative and innovative systems in New England. Regionally, the Test Center is working closely with the URI Onsite Wastewater Training Center and NEIWPCC's ETI Onsite Wastewater Technology Data Review project, to speed the approval and introduction of alternative technologies in the New England region.

From an environmental standpoint, for many coastal areas the reduction of the nutrient nitrogen released by single family home septic systems is an important goal, both from the public health standpoint of protecting drinking water quality and from the standpoint of slowing or reversing the process of eutrophication in the coastal waters of New England. In inland areas, where protection of freshwater ecosystems is important, there is interest in evaluating technologies that remove phosphorus or that can use leach fields which require less than 4 feet of separation to ground water while still satisfying public health concerns. The Test Center offers a unique opportunity to compare the performance of multiple wastewater technologies with varied strategies, against the performance of a conventional septic system, and the outcome should benefit both vendors and the homeowner.

## Protecting and Enhancing Shellfish Resources

## CCMP Goal

Increase availability of shellfish resources for recreational and commercial uses

## CCMP Objectives

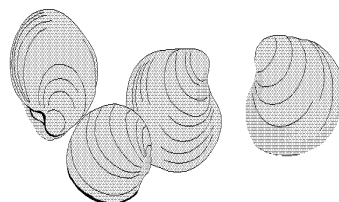
- To keep open all shellfish areas that have not closed and open priority areas that are closed.
- To enhance efforts to manage shellfish resources at both the state and local levels.
- To increase the capacity and commitment of municipalities to remediate identified pollution sources and to assist in conducting the sanitary survey program.
- To increase the ability of DMF to carry out the sanitary survey program and provide technical and financial assistance
- To expand use of conditionally approved classification for shellfish areas

In 1991 when the Buzzards Bay CCMP was completed, degradation of water quality due to pathogen contamination represented a serious and growing human health risk and economic loss to the Bay's historically strong shellfishery. In that year, the Bay saw 13,816 acres closed - the greatest number of bed closures in history. This figure had grown quickly moving from only 4,358 acres closed in 1970 and doubling to 8,052 acres by 1980. Throughout the 60s, 70s, and 80s, shellfish beds in Buzzards Bay were being closed due to fecal coliform contamination at ever increasing rates, and these closings were one of most pressing concerns with area residents.

By the end of 1996, however, the Bay had regained over 4,000 acres of shellfish harvest area, returning the Bay to a closure figure that had not been seen in the Bay since 1984. This improvement is due to both real improvements in water quality and increased use of conditional closures in many areas along the Bay's coastline. The most striking achievement was the reopening of 700 acres of shellfish beds in Clark's Cove in April 1992.

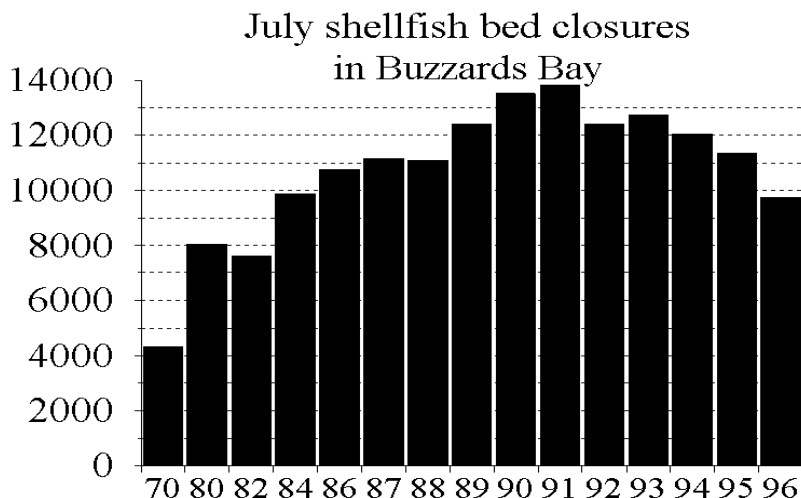
While the Buzzards Bay Project contributed to this turn around, the real credit belongs to by the State Division of Marine Fisheries (DMF) and numerous municipal officials who have worked together to identify and remediate pollution sources. The Project however helped form the wave of new thinking on what

the problems and solutions were to the shellfish bed closure problem. In fact the Project's emphasis on stormwater as the principal source and conveyance of fecal coliforms in many embayments and harbors would result in new state programs to help towns fund solutions to the



**Keeping Shellfish Beds Open**

stormwater problem and spawned similar initiatives in the Project's sister NEP, the Mass Bays Program.



The Buzzards Bay Project's efforts began in 1989 with a series of Project workshops that brought together scientists, agency staff, municipal officials and citizens to discuss the ever increasing shellfish bed closures in the Bay. The workshops were meant to both educate and to formulate recommendations for the Management Plan.

These early meetings made clear that the increasing shellfish bed closures in Buzzards Bay were not the result of municipal wastewater plants, but rather the result of cumulative impacts of local land uses. So called "non-point sources" of pollution like failing septic systems, stormwater discharges, farm animal wastes, agricultural sources, boat discharges, pets, and even waterfowl (especially where populations were encouraged by human feedings) were the more likely culprits. Of these sources, water quality monitoring had shown that in many embayments, stormwater was often the major conveyor and source of fecal coliforms causing these closures.

These findings prompted several important recommendations in the CCMP. First, towns should adopt the goal of allowing no further direct discharges to surface waters and wetlands. Second, those discharges contributing to shellfish closures should be prioritized for remediation. Finally, the Division of Marine Fisheries should work with area municipalities to allow "rainfall conditional openings." That is, DMF should allow shellfishing during dry periods, in areas where it has been demonstrated that fecal coliform concentrations are low enough so that shellfish are safe to consume.

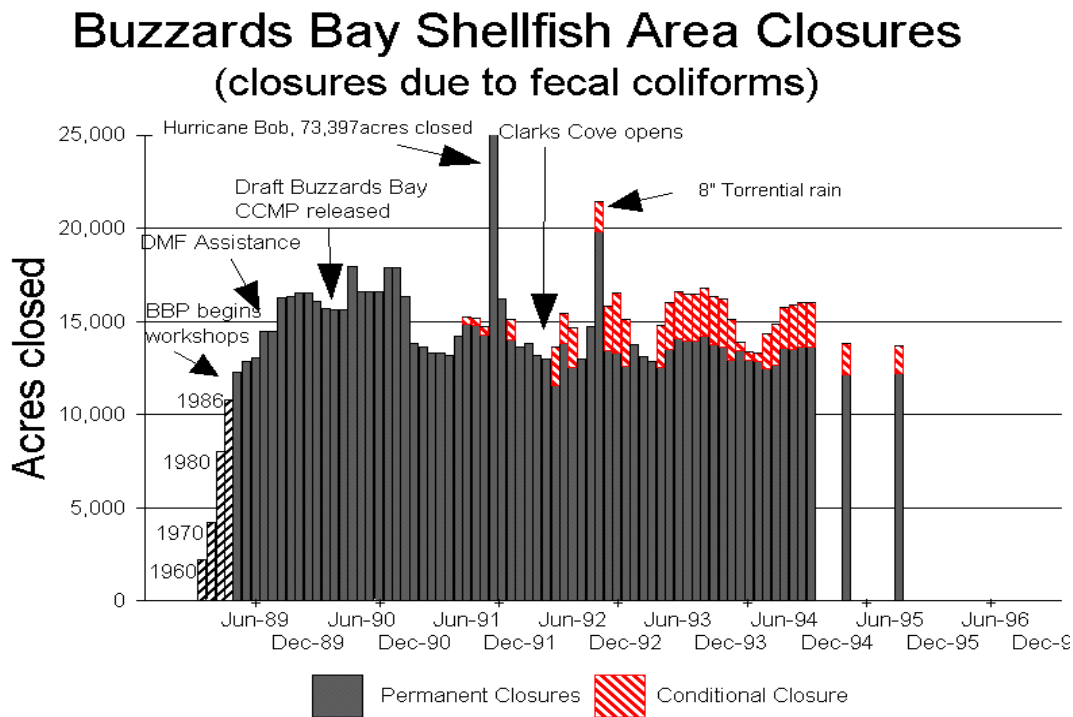
The first challenge to keeping shellfish beds open in Buzzards Bay occurred in 1989 when new monitoring and sanitary survey requirements imposed by the US Food and Drug Administration could not be met by the DMF because of insufficient manpower and laboratory capacity. In the face of potential widespread management closures of the Bay, the Buzzards Bay Project supported a DMF proposal to upgrade area laboratories to handle the additional water sampling needed. Specifically the project gave \$35,000 in grants to the City of New Bedford and Barnstable County Health Department to upgrade their laboratories and to pay for the analysis of extra samples collected by DMF. To meet federally imposed deadlines, DMF staff also trained local officials to assist with the sanitary surveys in their communities.

The upgrade of area laboratories and the closer coordination between DMF and municipal officials were to have long-term benefits for Buzzards Bay. Most important, by 1991 DMF was

able to begin implementing a rainfall conditional closure strategy for selected Buzzards Bay embayments.

## Conditional Closures

The expanded use of the Conditional Closure by the Division of Marine Fisheries has been responsible for the majority of bed openings since 1991. Defined as one of the primary goals in the Buzzards Bay CCMP, conditional openings recognize that elevated bacteria counts in many of the Bay's embayments are directly related to surface runoff during rain events. Shellfish beds in the Westport River, Clark's Cove, and Little Bay in Fairhaven have all been moved from closed to conditional in the past five years. This management technique establishes a rainfall threshold unique to each embayment by which the local shellfish warden raises a red flag adjacent to the shellfish beds alerting fishermen that the area is closed.



**Figure 1 Monthly closures in Buzzards Bay showing role of conditional closures. Data not obtained for 1995 and 1996.**

In support of this reclassification and remediation effort in the Westport Rivers, the Buzzards Bay Project provided \$10,000 to the town of Westport Board of Health in cooperation with a local watershed organization to **establish a detailed bacterial monitoring program in the Rivers** - one of the Bay watershed's most historically productive shellfisheries. Westport was the first Bay community to begin the use of conditional closure management in 1990. Funding from the BBP worked to support the expansion of both cleanup and bed management activities by creating a certified laboratory operated by the town Health Director to focus on regular and detailed bacteria testing. The data generated by the town of Westport continues to target hot spots for remedial activities along the rivers shoreline.

The interconnectedness of each of the Buzzards Bay CCMP's Action Plans is not exhibited anywhere better than in the Project's goals regarding shellfish resources. The work of the Buzzards Bay NEP in this area has been undertaken largely under the umbrella of bacteria focused water quality restoration efforts through stormwater remediation, onsite wastewater management, and managing boat wastes. The restoration of the Bay's abundant shellfish habitats for harvest is an end product of many of the initiatives undertaken by the Project in the past five years.

### Clark's Cove Reopened to Shellfish Harvest after nearly a Century of Closure

Clark's Cove is located on the western shore of Buzzards Bay between the town of Dartmouth and the City of New Bedford. Regular discharges of raw sewage from New Bedford's antiquated sewer system had closed all of the City's shellfish harvest area. Beginning in the late 1980s, the City's Wastewater Division began extensive work on the Combined Sewer Overflow (CSO) system and by the early 1990s had stopped all dry weather CSO flows to the Cove.

This work was supported by three Buzzards Bay Project awards to the City totaling \$77,500. First, Estuary Program funds were provided for enhanced water quality sampling and analysis in Clark's Cove to accurately define when and where the Cove was experiencing pathogen contamination. This Sanitary Survey support documented real water quality improvements in the Cove and laid the groundwork for a shellfish harvest management strategy protective of public health. To meet the goal of reopening as much of the Cove as possible, The Buzzards Bay Project also funded the repair of a CSO Sluice Gate as well as in depth investigations and remediation of illegal residential sewer cross connections to stormdrains discharging to the Cove.

The resulting improvements to dry weather fecal coliform counts as a result of the City's efforts prompted the Massachusetts Division of Marine Fisheries to allow for the upgrading of the Cove from Prohibited status to Conditional Approval after 91 years of closure. Within five months of reopening, Clark's Cove yielded approximately \$364,000 in quahogs employing more than two dozen full time fishermen. Applying a conservative multiplier to this figure, the ripple effect on the local economy from this harvest amounts to over \$1.5 million.



## Controlling Stormwater Runoff

### CCMP Goals

1. Prevent new or increased untreated stormwater flows to Buzzards Bay that would adversely affect shellfish harvesting areas, swimming beaches, water quality, and wetlands
2. Correct existing stormwater runoff problems that are causing or contributing to water quality degradation or shellfish bed closures in Buzzards Bay

### CCMP Objectives

- To institutionalize at the local level (through education and regulation) the use of Best Management Practices (BMPs) for stormwater control in newly developed areas
- To develop a regional and local program to execute appropriate mitigation measures for existing stormwater discharges. The program would include construction, operation, and maintenance of stormwater control structures

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### Remediation of Existing Stormwater Discharges

By far the greatest amount of federal and state financial resources associated with Buzzards Bay Project implementation efforts, as well as Project technical assistance, have been spent on remediation of existing stormwater discharges contributing to shellfish bed closures and water quality degradation throughout the Bay watershed. Funding for these projects has been provided by the Buzzards Bay Project through its EPA funded Municipal Grant Program, by the Massachusetts Department of Environmental Protection through the federal 319 program, and by the Massachusetts Office of Coastal Zone Management's Coastal Pollutant Remediation Program. The Buzzards Bay Project staff continues to assist local officials in the identification of funding sources and the development of successful projects. This has allowed the BBP and local communities to leverage Estuary Program funds far beyond their limits. Rough estimates on the remediation of all of the Bay's untreated discharges were estimated at \$10 million in the CCMP Financial Plan.

The Project has been greatly assisted in this work through a **partnership with the USDA Natural Resources Conservation Service** in which NRCS staff works with the Buzzards Bay Project in design and review of various forms of stormwater remediation facilities. These projects have included such varied forms of stormwater BMPs as traditional stormwater infiltration structures,

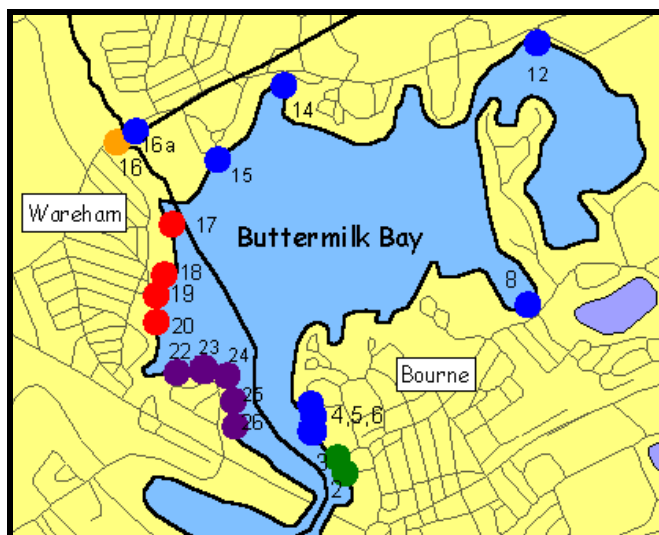
innovative constructed wetland systems, improved agricultural management practices, and urban sewer/stormwater cross connection remediation.

In addition to structural solutions to urban runoff, the BBP also provided public education funding to the citizens' volunteer organization, the Coalition for Buzzards Bay, to stencil stormwater catch basins throughout the Bay watershed with the message, "**Don't Dump, Save Our Bay**" in 1993. In portions of New Bedford with a large bilingual population, the message was printed in Portuguese. In addition to the stenciling work, the Coalition also coordinated a BBP funded mapping project by interns from the Massachusetts Maritime Academy to locate and describe all stormwater catch basins, conveyance piping, and discharges in most of the Bay area. This information is being refined and digitized by the Town of Wareham onto a Geographic Information System (GIS) through a grant from the BBP. Plans to convert this data baywide into a GIS format are under development by the BBP.

The project has also extensively worked in assisting town boards have adequate regulations to address new and existing stormwater discharges, and our "unified stormwater regulations for all boards are included in Appendix B. Below are highlights from just a few of stormwater remediation projects facilitated by the Buzzards Bay Project.

### Buttermilk Bay

Extensive work in Buttermilk Bay at the northeast corner of the Bay between the towns of Wareham and Bourne early in the CCMP development process revealed a total of 20 stormwater discharges (see map) which were delivering the majority of bacterial and other pollutant loadings to the embayment. As a result, large portions of Buttermilk Bay were closed to the harvest of shellfish. After nearly a decade of work, all but the most minor discharges to Buttermilk Bay have or are currently being remediated. Due to availability of sandy soils along the shores of Buttermilk, infiltration of stormwater was the preferred alternative at all of the sites. Stormwater remediation has proved more difficult in the western portions of the Bay watershed where soil impermeability and high groundwater have ruled out infiltration as a viable alternative.



### FUNDING BUTTERMILK BAY

- Electric Avenue, Wareham \$100,000 (EPA)
- Buttermilk Bay Stormwater 319, Bourne \$144,000 (MA DEP 319 Nonpoint Pollutant Remediation Program)
- Red Brook, Wareham \$65,000 (EPA)
- Indian Mound Beach, Wareham \$111,562 (MCZM Coastal Pollutant Remediation Program)

\*Grant awards represent Federal and State funding support and do not include local contributions.

### Onset Bay

Driven in large part by a \$1.9 million investment by the Town of Wareham to extend municipal sewer service to portions of Onset village, the Buzzards Bay Project assisted town managers in pulling together funding and technical assistance toward coordinating the installation of stormwater BMPs in conjunction with planned sewer installation. The result has been a comprehensive remediation of all wastewater and stormwater flows contributing to the closure of 111 acres of shellfish harvest beds in the East River, Broad Cove, and Muddy Cove. At present Muddy Cove is classified as Prohibited to harvest and East River/Broad Cove is Seasonally Approved for partial harvest of shellfish. Once complete this work will have addresses all primary pollution sources to the Coves and is expected to reopen much of the area to harvest.

Riverside & Onset Design, Wareham \$15,000 (BBP Municipal Grant Program)

Riverside & Onset Construction, Wareham \$100,000 (BBP Municipal Grant Program)

Point Independence Construction, Wareham \$71,600 (MCZM Coastal Pollutant Remediation)

Point Independence Design, Wareham \$15,000 (MCZM Coastal Pollutant Remediation Program)

\* Grant awards represent Federal and State funding support and do not include local contributions.

### Spragues Cove Constructed Wetland for Stormwater Treatment

Spragues Cove is located on the western side of Sippican Harbor in the Town of Marion. The Cove's shellfish beds, immediately adjacent to the town's only public bathing beach, are closed due to bacterial contamination from stormwater runoff. Two stormdrain systems currently discharge into Spragues Cove, the largest of which drains a 64 acre area of roads and driveways in the densely developed lower portions of Marion village.

In 1991, the Town of Marion and the Buzzards Bay Project began exploring options for treating this stormwater runoff prior to discharge. The result was the design (provided by NRCS) and construction of a 3 acre manmade wetland system to treat the "first flush" of stormwater entering the Cove. Stormwater contaminants such as bacteria, sediments, and nutrients are removed through natural physical and biological processes within the staged wetland and open water system. Along with the water quality benefits, the Spragues Cove stormwater wetland provides enhanced wildlife and fish habitat and replaces a filled parking area that was formerly a saltmarsh.

The system was constructed in 1995 with funding from the Buzzards Bay Project, an EPA/DEP 319 Nonpoint Source Pollution grant, the Town of Marion, US Fish and Wildlife

"Without the construction of the Spragues Cove Wetland system, we may have been forced to close the cove to shellfishing."

*Frank Germano, Senior Biologist  
Massachusetts Division of Marine Fisheries*

Service, and private contributions. Once the construction was completed, a large citizen effort was mobilized to plant the system with a variety of wetland species such as cattail, bulrush, and lily in order to make the system function like a wetland to remove contaminants. The Spragues Cove Project has been and continues to be not only an extremely successful stormwater remediation project but an equally important community environmental education and wetlands restoration

effort. Initial water quality monitoring during the summer of 1996 has revealed large reductions in fecal coliform bacteria by the system.

"The Sprague's Cove drainage remediation project presented the designers and engineers with the Buzzards Bay Project with some unique challenges...These challenges were met head on with careful study and planning, which has produced a very effective drainage remediation project. The results are better than anyone expected. In addition to being an efficient treatment of urban runoff, the Town is left with an extremely pleasing site filled with wetland plants and flowers, the return of native wildlife, and a please citizenry. The introduction of fish in the deep lagoon and improved habitat has reduced the summer mosquito population and has not resulted in a single neighborhood complaint. This is a unique cooperative project in that it combined the resources of the NRCS, Massachusetts DEP, MCZM, US Fish and Wildlife Service, and the Town of Marion."

*Ray Pickles*

*Executive Secretary Town of Marion*

## PROJECT SUMMARY

### Spragues Cove Constructed Stormwater Wetland Project

In 1990, the town of Marion, concerned with shellfish closures in Spragues Cove and elevated coliform levels at the town beach, submitted a proposal to the Buzzards Bay Project to remediate coliform discharges from Spragues Cove creek, the primary pollution source to the Cove. The Buzzards Bay Project was unable to fund this initiative, but due to the merit of the project, prepared for the town a joint application to the DEP 319 Non-Point Source Pollution program. The application was also cosponsored by the USDA Natural Resources Conservation Service (formerly the Soil Conservation Service) which had committed to providing site plans and engineering design work for the town. The town itself had committed land and manpower to implement the effort, and the Buzzards Bay Project agreed to do monitoring and coordinate activities surrounding the stormwater project. The Project also helped the town obtain an additional \$15,000 from the US Fish and Wildlife Service, and the town committed an additional \$9,000 at Town Meeting in 1994 to meet shortfalls in state and federal funding together with a contribution of \$10,000 from the Cove Charitable Trust.

In 1994 the USDA completed designs for a constructed wetland for the site. A constructed wetland was the selected option due to the presence of high groundwater at the site. The proposed site was formerly a salt marsh that was filled in when the harbor was dredged in the 1950's. The town commenced construction of the wetlands in February of 1995 and completed the project in June, with additional wetland plantings in the summer of 1995, 1996, and spring of 1997.

The Spragues Cove Stormwater Remediation Project covers three acres and consists of three major components. First stormwater from a 64 acre watershed is conveyed over Front St. and via a stormwater pipe into a Settling Basin. The principal function of this basin is to allow sediments and associated pollutants to settle. The stormwater leaving the settling basin then passes to the first shallow marsh. The wetland vegetation in this marsh filter the water and improve its quality. Next the stormwater enters a so-called "deep pool". The primary function of this deep pool is to provide a refuge for fish populations over winter. These fish populations are important for mosquito control. The deep pool is also an important feature for increasing the residence time of the system, which is approximately 10 days. It is important that water be held in the constructed wetlands over many days to enhance the removal and treatment of pollutants. After the water leaves the deep pool, it then enters the second marsh, and eventually discharges through a pipe into Spragues Cove.

Before and after construction, the Buzzards Bay Project has been testing the effectiveness of the constructed wetlands for removal of fecal coliforms, the contaminant that is the cause of shellfish bed closures in Spragues Cove.

When evaluating the effectiveness of this stormwater system it is important to realize that discharges to Spragues Cove are now detained for many days in the wetland. To evaluate the effectiveness of the constructed wetlands, water volumes and pollutant concentrations must be documented both entering the system and leaving it over the residence of the water in the system. Formerly stormwater discharged to the old drainage ditch was immediately discharged to Spragues Cove, and what came into the ditch flowed into the Cove with little pollutant removal. Prior to construction of the wetland, stormwater was monitored in the ditch on several dates. In general we observed lower fecal concentrations during winter and dry periods, and higher concentrations in summer and during wet periods. Of note were the exceptionally high fecal levels observed (20,000 fecal coliforms per 100 ml) on September 10, 1993 after a very heavy rain following a prolonged dry period. Fecal coliforms flowed through the ditch to Spragues Cove with little attenuation. Under less extreme conditions when the front street discharge was lower in fecal coliforms, but often counts were above 1000 fecal coliform.

During the first summer after construction of the wetland, a heavy rain occurred after a prolonged dry period, much like the September 1993 sampling. The results of this sampling is shown in the Figure, the constructed wetlands worked exceptionally well, and met our expectations with a 95% reduction in fecal coliform just on the first day of the rainfall (input to the wetland=15,000 fc/100ml, output = 800 fc/100 ml). Even during dryer periods during the first year, the wetland proved effective (input to the wetland=150 fc/100 ml, output = <10 fc/100 ml).

In contrast to the 1995 monitoring, water quality data from 1996 showed often markedly worse conditions in the wetlands on some dates than the inputs to the wetlands. We believe the high levels observed in parts of the wetland were largely to waterfowl, especially Canada geese, that had taken residence in the wetland, and from saltwater intrusion the base of the system causing dye off of freshwater algae. To address these problems, a new flapper gate was installed in 1996, and the vegetation is no longer mowed on the banks and are now allowed to naturalize. Geese fear predators that lurk in high grass and brush and we expect that with denser vegetation, the geese will no longer remain resident. The Project is further testing the system in the summer of 1997. Samples will also be taken this summer and fall to evaluate the effectiveness of the constructed wetlands in removing nutrients, metals, hydrocarbons, and other contaminants.

Monitoring and the construction of a public educational sign were funded by the Massachusetts Environmental Trust.

Preventing new direct untreated discharges to surface waters is one of the most important goals outlined in the Buzzards Bay CCMP. It was common sense when considering the high cost of remediating existing discharges; it is simply true that an ounce of prevention is worth a pound of cure. At the time of completion of the CCMP, all of the towns surrounding Buzzards Bay had regulations on the books addressing the construction of new stormwater conveyance systems to control flooding or stormwater volume. In many cases these rules required that stormwater be delivered as quickly and as directly as possible to the nearest water body or wetland without any attention paid to the quality of the stormwater and its effect on water resources and shellfish habitat. Only if both stormwater quantity and quality are addressed can a town expect to prevent new problems with shellfish bed closures and water quality degradation. Another problem the BBP observed was that requirements among town boards were not consistent and sometimes even contradictory. To address these problems, the Buzzards Bay Project developed a model stormwater management regulation entitled, **Unified Rules and Regulations for Stormwater Management for use by Planning Boards, Boards of Health, and Conservation Commissions**, which was released in January 1996. These rules were the result of two years of review and modification and include specific design standards for various forms of stormwater treatment as well as a Permit Applicant checklist. Once released the Buzzards Bay Project completed work with the towns of **Rochester and Marion** in incorporating these rules into local regulations. Both towns adopted the BBP model in early 1996. To support the successful implementation of these rules, Buzzards Bay Project and NRCS staff have been actively involved in assisting the towns in reviewing stormwater management in new subdivision plans. Three additional towns - Westport, Fairhaven, Wareham - are currently working on amending their existing rules based on the BBP model.

## Managing Sewage From Boats

### CCMP Goal

Eliminate the discharge of wastewater from all boats in Buzzards Bay embayments

### CCMP Objectives

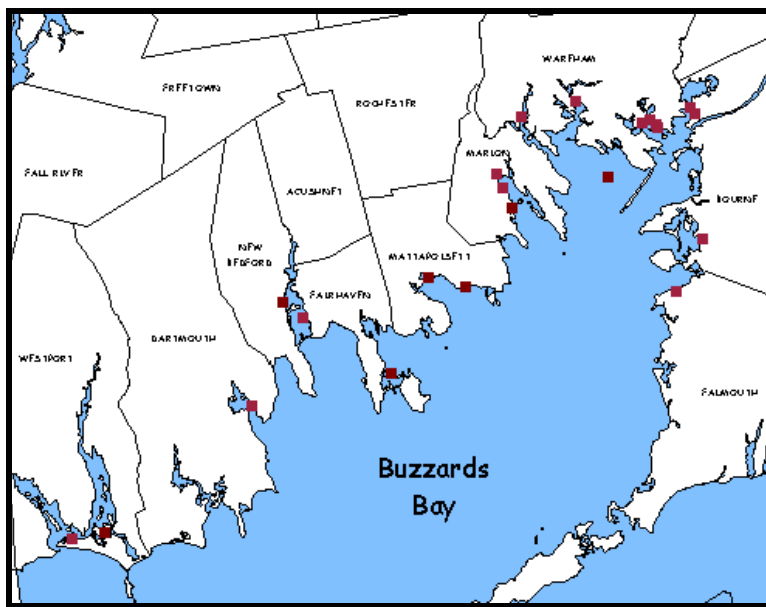
- To build more pumpout facilities and to promote their use by educating boaters, making facilities more accessible, and enforcing the regulations
- To develop financially self-sustaining pumpout programs at the town level
- To designate embayments in Buzzards Bay as No-Discharge Areas (NDA)

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### **Expanding Boat Pumpout Facilities**

At the time of CCMP completion in 1992, only 11 publicly available boat pumpout facilities existed in the entire Bay and they were significantly underutilized. Research conducted by the BBP during CCMP development and elsewhere in the US showed that water quality surrounding marinas often showed elevated fecal coliform bacteria during peak periods of boat usage. The Buzzards Bay Project endeavored early on to remedy this situation by both establishing more pumpouts and raising public awareness of the convenient and cheap (often free) availability of them. Buzzards Bay Project funding was awarded to a number of towns to establish or upgrade pumpout facilities throughout the Bay.

In 1994, the federal Clean Vessel Act (CVA) began providing states and local coastal communities with grants for the construction of pumpout facilities. The creation of the CVA grant program allowed the Buzzards Bay Project to refocus its limited Municipal Grant Program funding to other CCMP tasks while still providing a mechanism to provide adequate, well distributed pumpout facilities in all corners of the Bay. In Massachusetts, the CVA Program is administered by the Department of Fisheries, Wildlife, and Environmental Law Enforcement in cooperation with MCZM. The program is funded by a portion of the fuel and equipment tax paid by boaters. With BBP and CVA funding assistance, Buzzards Bay boaters in 1996 are never far from available public pumpout facilities. The Bay now has full pumpout coverage with a total of 23 pumpouts making this CCMP Action Plan one of the most complete. Groundwork in identifying the needs of Buzzards Bay municipalities were key in ensuring that Buzzards Bay receiving a large share of CVA money in Massachusetts, and Massachusetts being one of the first states to tap into the CVA funds.



Location of Marine Pumpout Services in Buzzards Bay - 1997

### Enhancing Pumpout Programs and NDA designations

The Coalition for Buzzards Bay has provided a valuable boater education component to this effort through regularly updated boat pumpout guides and fact sheets. Also due to the increase of adequate pumpout facilities two Buzzards Bay municipalities - Wareham and Westport - have applied for and received **No-Discharge Area designation** for all waters under their jurisdiction prohibiting both treated and untreated discharges. The future focus of Buzzards Bay Project work in completing the Managing Boat Waste Action Plan will be to assist the remainder of Bay towns in applying for No-Discharge Area status. In addition, boater education to expand the usage of the pumpouts will remain an ongoing effort.



## Managing Sewage Treatment Facilities

### CCMP Goal

Achieve Water Quality Standards and Protect Natural Resources at all POTW Discharge Points

### CCMP Objective

- To improve POTW efficiencies by setting limits on chlorine residual discharges and monitoring for effective effluent disinfection, encouraging industrial pollution prevention and pretreatment efforts, and reducing nitrogen inputs.
- 

There are six Publicly Owned Treatment Works (wastewater treatment facilities) in the Buzzards Bay drainage basin. One of these facilities discharge to groundwater (Falmouth); the others discharge to surface waters. Since 1991, no new discharges have been pursued. The New Bedford and Dartmouth facilities discharge to the open waters of the Bay while the Fairhaven, Marion, and Wareham facilities all discharge to shallow embayments. Nitrogen management at these facilities was of primary concern to the BBP when it began its implementation efforts.

The **Marion Wastewater Treatment Plant** discharges to Aucoot Cove through a small freshwater stream at the head of the Cove. In 1991, the Buzzards Bay Project funded a comprehensive water quality monitoring study by scientists at the Woods Hole Oceanographic Institution to assess nutrient related impacts from the Marion POTW on Aucoot Cove. The results of this study showed that nitrogen loading relative to the depth and circulation characteristics of the Cove was not having a significant effect on water quality. In addition to nitrogen related work in Marion, the town discontinued use of chlorine for disinfection - an important part of the Buzzards Bay CCMP's objectives for POTWs - in exchange for ultraviolet disinfection. Similarly at the **Dartmouth Wastewater Treatment Plant**, the town's completed upgrade of its facility included the use of UV disinfection.

Both the **Wareham and Fairhaven Wastewater Treatment Plants** discharge to tidally restricted, shallow embayments. Neither plant has discontinued use of chlorine for disinfection, nor have they completed adequate evaluations of nitrogen related impacts from their discharges on the Wareham River estuary and inner New Bedford Harbor respectively. Both embayments continue to exhibit eutrophic conditions as evidenced in water quality monitoring results produced as part of the Buzzards Bay Citizens Water Quality Monitoring Program. The Buzzards Bay Project is currently participating in a review of the discharge permit for the Wareham facility as federal and state regulators consider establishing nitrogen limits for the discharge.

The **Falmouth Wastewater Treatment Plant** serves the densely developed town center and village of Woods Hole and discharges this waste via groundwater in the West Falmouth Harbor drainage basin. Therefore, the facility delivers pollutant loadings to the harbor in excess of what watershed land uses produce. This has resulted in the early signs of eutrophication in the upper reaches of West Falmouth Harbor where nitrogen is entering the Harbor through a concentrated groundwater plume. In 1995 the Buzzards Bay Project partially funded a water quality analysis and detailed flushing study of West Falmouth Harbor and continues to participate in the development of nitrogen management strategies for the West Falmouth Harbor watershed in cooperation with town officials and Cape Cod Commission staff. Since then, the Buzzards Bay Project has produced several reports outlining nitrogen management needs for the West Falmouth Harbor watershed and these documents are expected to change discharge limits for the 1999 permit renewal as well as other changes in how Falmouth manages non-point sources of nitrogen.

Finally, the greatest improvement in wastewater treatment in Buzzards Bay occurred during the summer of 1996 with the completion of a **\$100 million Secondary Treatment Plant in the City of New Bedford**. Mandated under a Consent Decree filed under the Clean Water Act, plant construction began in 1994. The Buzzards Bay Project has supported wastewater treatment initiatives in New Bedford through its ongoing efforts to reduce and prevent toxic industrial inputs to the collection system through its Toxic Use Reduction Program (discussed in Reducing Toxic Pollution section). In addition, Bay Project staff assisted in the review of the plant's discharge for possible nitrogen related impacts in 1993.

### **Buzzards Bay POTWs and Improvements since CCMP completion**

<b>Town</b>	<b>Capacity</b>	<b>Pop. Served</b>	<b>Treatment</b>	<b>Improvements since CCMP</b>
Dartmouth	2.8 MGD	10,000	Secondary	Ultraviolet Disinfection
Fairhaven	5.0MGD	15,000	Secondary	none
Falmouth	0.8MGD	1,500	Tertiary	none
Marion	0.6MGD	2,100	Secondary	Ultraviolet Disinfection
				Aucoot Cove N-management study
New Bedford	30MGD	102,000	Secondary	Upgrade from Primary Treatment
				N-management study of outfall
Wareham	1.8MGD	10,000	Secondary	none

## Reducing Toxic Pollution

### CCMP Goal

Protect the public health and the Bay ecosystem from the effects of toxic contamination entering Buzzards Bay

### CCMP Objectives

- To reduce the amount of toxic contamination entering Buzzards Bay
- To reduce hazardous leachate from landfills and to minimize other nonpoint sources of toxic contaminants to the Bay
- To meet all state, federal, and local action levels for water and seafood

In the three years that the Buzzards Bay Project Toxics Use Reduction (BBP/TUR) program has been in existence, the program has contributed to the education and availability of resources to local manufacturers and service industries contributing to the wastestream processed by the New Bedford Publicly Owned Treatment Works (POTW). We believe that our "localized initiative" has been, in part, responsible for making both the public and private sector aware of the significant environmental improvements in New Bedford and has educated the city's industrial community to the concepts of Toxic Use Reduction as well as the positive impact pollution prevention makes upon the environment.

In December of 1993 an advisory committee for the toxic use reduction was formed that included the following members: The Buzzard Bay Project's Executive Director Dr. Joseph Costa, Frederick M. Kalisz BBP/TUR program coordinator, the Department of Environmental Protection was represented by Carl Natho, City of New Bedford Wastewater Division Director Ron Labelle and Industrial Pollution Pretreatment Coordinator Vincent Furtado, Bill Napolitano of SRPEDD, Jeffrey Osuch - Town of Fairhaven, Economic Development Director of the New Bedford Chamber of Commerce Michael Travers, Industry representation was from Brittany Dye & Printing Corp. Bob Cruise, Acushnet Co. Jack Bailey, Aerovox Corp. Peter Szwaja, and Codman & Shurtleff (Johnson & Johnson Professional) Steve Hemingway.

### **Development and Facilitation of Workshops**

The TUR program developed the *Buttonwood Workshop Series* through which 15 different workshops have been presented to local industries. These workshops were specifically designed to address the Toxic Use Reduction needs of industry. Workshops topics included Materials Management and Chemical Reporting, Sustainable Manufacturing, Impacting Water Use, Clean Air Conference for Drycleaners, Metals recovery and abatement, Fats, Oils and Greases in the wastestream, Making Compliance work for you, Pollution Prevention for Marinas and Boat Repair Facilities, Pollution Prevention Day, Solvent Degreasers, Wastewater Treatment in New Bedford and BOD Discharge into the wastestream for fish processors.

## Development and Distribution of Printed Materials

The TUR program has created brochures aimed at making area industries aware of award opportunities for toxic use reduction. Beginning with the development of a repository of EPA and State environmental agency documents we have as well publicized the Governor's Award for Toxic Use Reduction and we were successful in the fact that several companies we encouraged actually applied and two were the recipients of the award. We made companies aware of innovative toxic use reduction strategies through our monthly newsletter *Options*. We also enlightened readers about grant programs and award opportunities. *Options* was also responsible for informing companies about the Nice<sup>3</sup> (National Industrial Competitiveness through Energy, Environment, Economics) Award that Brittany Dye & Printing Co. received after learning about it through *Options*. The promotion of the NICE<sup>3</sup> program also demonstrated the ability of the BBP/TUR to work within the community with other agencies that simply the state's EOE and the federal EPA. The efforts in conjunction with DOE's award created a very direct energy savings to the company as well as P2 initiative which will go a long way on minimizing negative impacts to the new POTW while remaining economically competitive in global markets and further stimulating the local economy. The TUR program offers brochures on the Nice<sup>3</sup> award, Governor's Award, Buzzards Bay Project, Buzzards Bay Project's Toxic Use Reduction Program, and Environmental Electronic Networking - a compilation and directory of "Internet" locations on P<sup>2</sup> and TUR, and about our workshop series. Last and certainly not least was the development of a *TUR Guide for Manufacturing, Commerce and Institutions* intended to be a desk top reference handbook on the Massachusetts TUR Act as well as support regulatory and non-regulatory local, state

## Technical Assistance

The BBP/TUR program has worked closely with the Office of Technical Assistance for Toxic Use Reduction of the Executive Office of Environmental Affairs of the Commonwealth of Massachusetts. Together, OTA and BBP/TUR, have provided companies with localized and easily accessible information regarding the reduction of toxics while enhancing and building relationships with the same through the non-regulatory relationship afforded to this effort by the Massachusetts Legislature. The BBP/TUR coordinates site visits with OTA and inform them about companies that need their assistance. This was most successfully demonstrated by the assistance offered to the Revere Sink Company. Revere was assisted by the BBP/TUR when due to complications in highly technical submission requirements they were found to be in violation of basic state TUR laws. By networking with professional environmental consultants and serving as an intermediary between state regulatory agencies, Revere was able to correctly submit TUR plans, come into compliance with state law, and finally minimize the financial impact of fines and penalties initially understood to have been levied against the operation. The company which had and continues to operate environmentally safe most importantly was able to continue economically viable as an employer within the community.

## Informational Packets

The BBP/TUR also responded to a request for information from the Massachusetts Autobody Association. We prepared packets that included information about the Pitstop Program to promote the EPA auto body program. The packages included, a brief letter introducing the TUR program, as well as handouts describing the actions that can be taken to reduce the release of toxics in the autobody industry in large and small scale autobody operations.

The Buzzards Bay Project/Toxics Use Reduction Program also contacted local primary lending institutions to present them with applicable pollution prevention information. The Northeast Waste Management Officials' Association (NEWMOA) recently published *"Pollution Prevention and Profitability"* directed towards educating commercial lenders about the effects of pollution prevention enhancing traditional loan evaluation criteria. Pollution prevention generates profitability, competitiveness, reduces environmental liabilities and results in direct and indirect cost savings. We sent this publication to commercial lending institutions in order to provide more information regarding pollution prevention in hopes that they will consider this type of loan more favorably in the future. In addition, BBP/TUR has presented itself as a resource for financial institutes.

### **Governor's Award**

The BBP/TUR believes that positive public recognition is essential to successfully promote toxics use reduction efforts as environmentally responsible and cost saving management strategies. Thus, the BBP/TUR has taken an active role in encouraging businesses and industries to apply for the Governor's Award Program for Outstanding Achievement in Toxics Use Reduction. We are proud that we have assisted interested companies and as a result of our assistance two area firms won. We furnished informational packages about the award to businesses on our mailing list. These packages include: a letter offering our services and support, brochures explaining the award, background on past recipients, and the entry form. Through site visits, we can assess and suggest to candidates that they are eligible to be recognized for their implementation of TUR reform. We guide the selected companies through the applications process. Two companies that utilized this type of assistance were Johnson and Johnson Professional Inc. (JJPI), (1994 Governor's Award recipient) and Star Plating (1995 Governor's award recipient). The public recognition given to Johnson and Johnson Professional Inc. and Star Plating Company has prompted other businesses to apply for the award. This positive public exposure was extremely helpful to both companies. The award gives business an opportunity to be recognized for their toxic use reduction efforts.

The applications we submitted this year were from the following; Coyne Laundry Services and Textiles, Frionor USA, New Bedford Wastewater Division, and ourselves, the Buzzards Bay Project's Toxic Use Reduction Program.

The processes that each business/institution adopted contributed to a significant reduction of toxic use and by products. The Frionor package was presented because of their reduction of toxins entering the wastestream. Frionor USA is a food processor, in their processing the waste they generate is mostly breadings. To reduce the amount of waste released into the wastestream, Frionor implemented a system of installing metal traps in their floor drains. In the past all solids and particulate entered the Wastewater Treatment System. Due to density this adversely impacted the municipal wastewater treatment system. The food products clogged in the pipes caused a release of high level of toxics every time the system was routed. The introduction of this metal trap system has saved the company money and stopped high level releases of toxics into the wastestream.

Coyne Services and Textiles is an industrial laundry service company that serves metal bending, automotive repair shops, printers and various other industry where it is common for the shop rags to be contaminated with oils, grease and other solvents. Coyne recently purchased a one million dollar wastewater pretreatment system. In addition, Coyne also developed an innovative technology in which every 100 pounds of shop rags is compressed in order to yield 30 pounds of liquids before

being put through the wastewater pretreatment system. This Pre-treatment Recovery system has greatly enhanced the efficiency of their on-site wastewater treatment system prior to municipal wastewater system.

New Bedford Wastewater Division submitted an application for the Governor's Award for upgrading of the contaminated municipal collection system and the implementation and the successful management of their Industrial Pretreatment Program (IPP). The City has adopted a comprehensive approach to improve the water quality of the wastewater discharged from the municipal wastewater treatment facility. The city has almost finished the construction of a new secondary treatment plant that for the first time the City will biologically treat the city's wastewater. In addition to this, the city has replaced much of a highly contaminated collection system that would have continued leach toxic contaminants if not replaced. Another effort has been the aggressive Industrial Pretreatment Program that has works with industries to ensure they meet established discharge limits for toxic materials. The IPP has implemented a strict monitoring system for industries, and has been successful in identifying facilities that have had difficulties consistently meeting the permitted discharge limits. For the first time the City has improved the toxicity of sludge from its wastewater facility from Class III, to Class I, enabling use such as soil amendments in public areas.

Since the Buzzards Bay Project's Toxic Use Reduction Program started we have been a "door opener" between industry and regulatory agencies. The program has held thirteen workshops, attended numerous training sessions, conducted thirty-five in depth site visits of area firms. We have an industrial mailing list totaling over 170 firms. The BBP/TUR program has introduced companies to various, innovative toxic use reduction strategies through our promotion of various awards programs. We encourage and assist companies on our mailing list to apply for these types of awards.

We also sponsor local recognition ceremonies to honor their accomplishments. We try to instill in the local community the importance of pollution prevention before they experience challenging regulatory issues. Some companies would have never been aware of solutions to toxics use problems if it weren't for the BBP/TUR's intervention.

### **NICE<sup>3</sup>**

The grant program NICE<sup>3</sup> (National Industrial Competitiveness through Energy Environment, and Economics) provides funding to state and industry partnerships for project that develop advances in energy efficiency and clean production technologies. Since 1991, NICE<sup>3</sup> has sponsored 40 projects, totaling \$ 12.3 million funded by the Department of Energy. Industry applicants must submit projects proposal through a state energy, pollution, prevention or business development office. Funds are awarded to state/industry partnerships that can match the federal funds at least dollar for dollar. Awardees receive a one-time grant of up to \$ 400,000 for the proposed project. After the initial funding, the awardee is expected to commercialize the process or technology.

The Buzzards Bay Project Toxics Use Reduction Program committed itself to the promotion of NICE<sup>3</sup>. We learned about this program through a mailing was sent to our office. In the February 1995 issue of our newsletter, *OPTIONS* information regarding the NICE<sup>3</sup> grant was included. We responded to a request for more information about NICE<sup>3</sup> from Brittany Dye and Printing Corporation. The BBP/TUR program was instrumental in arranging a meeting between Ken Joblon and Bob Cruise of Brittany Dye Corporation and OTA. We tracked their progress, reviewed their efforts, and aggressively presented their case. The BBP/TUR is pleased to announce that Brittany Dyeing & Printing Corporation of New Bedford has been awarded a United States Department of

Energy grant \$425,000, to perform the major process modifications necessary to implement innovative textile finishing. Preliminary notification was made to the Buzzards Bay Project by Congressman Barney Frank. Congressman Frank in conjunction with BBP/TUR worked to bring the NICE<sup>3</sup> grant as economic development to the New Bedford Area. The process introduced in the grant application will allow for the modernization of processes at Brittany that will make them more competitive in the global market. The process will allow them to reduce their energy consumption by half. This process will increase the amount of cloth they process while decreasing the amount of toxics discharged into the municipal collection system.

## Preventing Oil Pollution

### CCMP Goals

1. Reduce the amount of petroleum hydrocarbons entering Buzzards Bay
2. Minimize the occurrence of oil spills in Buzzards Bay, large & small
3. Minimize the environmental effects from oil inputs to Buzzards Bay

### CCMP Objectives

- To promote a regional strategy for preventing and managing oil spills
- To implement a source-reduction plan for chronic inputs of PAHs
- To provide adequate facilities for collection of waste oil from cars & boats

Buzzards Bay is a major transit route for small tanker and barge traffic transporting heating and industrial oil and gasoline into greater Boston and northern New England markets. Between 1969-1989, it is estimated that over 1600 tons of petroleum entered Buzzards Bay from oil spills.

Buzzards Bay has been the site of several catastrophic oil spills. The send largest spill occurred in 1969 when approximately 155,000 gallons of #2 fuel oil spilled when the barge Florida ran aground off West Falmouth. The largest spill occurred in 1974 when 165,000 gallons of #2 fuel oil spilled when the tanker Buchard 65 struck bottom near Cleveland Ledge. In recent years, improvements to navigation and more rigorous pilotage requirements are believed to be minimizing risks of future spills in Buzzards Bay. Nonetheless, smaller spills from barge and vessel groundings in the Bay have continued during the 1980s and 1990s. One of the more memorable of these was the grounding of the Queen Elizabeth II in 1993. Most recently, the January 1996 grounding of the barge North Cape off Moonstone Beach in Rhode Island has raised concerns of local officials about oil preparedness.

In 1994 12 Buzzards Bay watershed municipalities signed an Oil Spill Mutual Aid Agreement to share equipment and personnel in the event of an oil spill. This was an important goal in achieving improved local response to oil spills. At the same time, the Buzzards Bay Project

committed CCMP implementation funding to provide oil spill response equipment to each municipality. The goal of the grants was to allow individual towns to protect their most critical coastal resources and complement the response activities of federal and state agencies responding to a catastrophic spill. Today, the Bay Project is actively working with the US Coast Guard and NOAA officials to provide response training and additional oil spill equipment.

"Without the Buzzards Bay Project the coordination between the towns to purchase compatible oil spill response equipment would never have gotten off the ground. "

*Gary Sherman, Westport Shellfish Warden  
and Oil Spill Coordinator*

In 1997, the Buzzards Bay Project awarded an additional \$25,000 to Buzzards Bay municipalities ensuring that each town had the minimally required number of survival suits, street drain covers, and



boom or other equipment. In the spring of 1997, the Buzzards Bay Action Committee provided basic HAZWOPER training to area municipal officials and volunteers and during this summer and fall the Buzzards Bay Project will provide \$5,000 in training courses to bolster municipal training experience and coordination.

With regards to reducing risks of spills, in the early 1990s, the Coalition for Buzzards Bay aggressively lobbied for and was successful in initiating new pilotage legislation by Massachusetts, and also encouraged policy changes by the USCG. The Coalition also fought to keep a key navigation beacon in place in Buzzards Bay that was initially proposed for elimination by the Coast Guard. These changes now ensure qualified pilotage and safer transit through the Cape Cod Canal and Buzzards Bay. In 1997, MCZM is promoting new state legislation more carefully regulating barge transport in Massachusetts' coastal waters, and this legislation is pending.

It is difficult to determine the effectiveness of the pilotage and navigation changes. Clearly Buzzards Bay has not had the large spills that seemed to have occurred more frequently in the 1960s, 70s and 80s. Improved municipal training will also be difficult to judge in the absence of a large spill but with regards to smaller spills, Buzzards Bay municipalities have already put the BBP funded equipment and their new training to work.

With regards to collection of waste oil from boats and cars nearly every municipality now has a facility and most have hazardous waste drop-off events once or twice per year. Most municipalities with wastewater treatment plants and large industrial components have in place pretreatment program to reduce inflows of oils, PAHs and other toxic compounds. The effectiveness of these programs can be documented through contaminant concentration trends in effluent discharges. New Bedford has been highly successful in this regard and its sludge has been reclassified from Class 3 to Class I, enabling its use for fertilizer and soil amendments in public areas.

Boat oil waste is only an issue in New Bedford harbor, a commercial fishing port. Some policy changes by the City such as pursuing harbor dumpers has resulted in increased volume of waste oil collected in the Harbor, but much presumably is still dumped at sea. The Project has renewed calls to the City to provide adequate facilities and provide further incentives for the collection of oil.

## Protecting Wetlands and Coastal Habitat

### CCMP Goal

Long-term increase of high-quality wetlands and coastal habitat in Buzzards Bay

### CCMP Objectives

- To protect existing wetlands
- To encourage restoration of wetlands (and allow replication as a last resort)
- To improve enforcement of wetlands laws
- To upgrade the capability of local conservation commissions
- To encourage non-permitting options as a supplement to the issuance of permits whenever possible
- To protect and restore habitat used by threatened, rare and endangered coastal species and anadromous and catadromous fish

One of the major themes of the Buzzards Bay CCMP is to achieve better wetlands and habitat protection. In Massachusetts, because of the "home rule" provisions of the state constitution, it is the municipal Conservation Commissions that are the "first line of defense" and principal authority in implementing the state's wetland regulations or more stringent local bylaws. Unfortunately, like many municipal boards, Conservation Commissions members are unpaid volunteers that receive little training in either interpreting wetland regulations or in identifying wetland boundaries. Conservation Commissions are also an appointed board, subject to local political pressures. It is for these reasons the Buzzards Bay Project has spent a considerable amount of time providing training and technical assistance to Conservation Commissions.

In 1993, the Buzzards Bay Project initiated a wetlands technical assistance program. Since that time the Buzzards Bay Project has conducted more than 100 training workshops improve the expertise of local officials. At the request of the municipalities and concerned residents the Project has conducted numerous site visits and reviewed dozens of engineering plans. Project staff have also provided legal testimony at Wetland Adjudicatory hearings. Also, as part of the state match to the Project's federal funding, in 1991 the Project pushed to have the Buzzards Bay basin one of the first areas of the state to have "core wetlands" mapped as part of the state's then newly renewed "Wetlands Conservancy Program." These maps have proved invaluable in identifying areas where core wetlands are located and where wetlands have been altered.

## The Acushnet wetlands permit form and the tri-town conservation district

A little known wetlands case in the Town of Acushnet had important consequences for the Buzzards Bay Project and as result, important consequences for Buzzards Bay municipalities. This case cuts to the heart of some of the major issues in protecting wetlands around the Bay.

The story begins in 1989 when a report was prepared for the Buzzards Bay Project to help develop wetlands protection recommendations in the Buzzards Bay Management Plan. This report identified a lack of consistency by area Conservation Commissions in the enforcement of state and local wetland regulations. The report also noted that most Buzzards Bay municipalities lacked conservation agents, and this lack of professional staff appeared to play a large part in how consistently the towns enforced wetland regulations. Included in the report was a notation that the town of Acushnet was using an unusual permit application form.

The Acushnet wetlands issue did not garner further attention at the Buzzards Bay Project until 1991, when the Project received calls by area residents concerned about the wetlands permitting process in the town. The Project quickly determined that the town indeed had a unique wetlands application form (a so-called "AF1" form) that was not consistent with state regulations. Moreover, virtually no state required wetland "Requests for Determinations" permit forms had ever been submitted, by the town to the state, since the state wetlands permit process was set up in 1978. Should the absence of what would seem to be to the average citizen as an arcane, bureaucratic permit form, be of concern in a town where more than 40% of the land is classified as wetland?

The Project was concerned and felt this was an important issue for several reasons. Most importantly, the town permit process appeared to lack due process and appeal. In contrast, the state-defined permit process included advertised public meetings. If an abutter or ten residents disagreed with the local

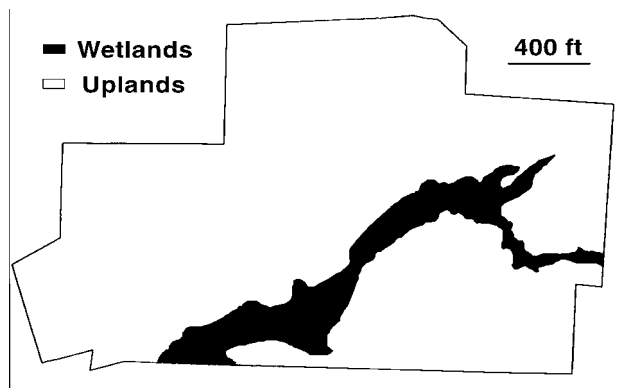
"The assistance of the Buzzards Bay Project in the teaching of conservation commissions has been invaluable. We rely on them to assist the Massachusetts Association of Conservation Commissions on our goal of increasing the professionalism of conservation commission in Massachusetts."

*Sally Zelinski, Executive Director*

*Massachusetts Association of Conservation Commissions*

boards decision, they may submit an appeal within ten days to the Department of Environmental Protection (DEP). DEP could also initiate an appeal on its own if irregularities occurred. In contrast, using the Acushnet AF1 form, an applicant could receive a "negative determination" (that is be told that no state permit is required), often without a public hearing, and with no opportunity for an appeal of the boards decision. We believed that such a process posed financial and legal liabilities to both the town and property owners. For example, suppose a town board gives an approval for a project but later finds that decision was not legally binding and offered no protection under state law?

Exacerbating the problem was that Acushnet did not have a conservation agent. Like many small towns in the area at the time, funding a full time conservation agent could not be financially justified. Wetlands identification was made by commission members untrained in wetland



Approximate wetland boundaries submitted by applicant to Conservation Commission in 1990.

delineation. Often only one or two Commission members had time to visit a site. Complaints were beginning to come into the Project alleging that the Conservation was allowing development in wetlands.

In meetings, phone calls and in a letter to the Conservation Commission and Board of Selectmen, the Project encouraged the town to abandon the AF1 permit form and adopt the state process. The project also identified areas where wetland permits should have been required to minimize wetland impacts.

The Commission defended its past performance and use of its form. Consequently the Project then filed a permit on a lot where complaints were made with construction in what appeared to be wetland. When the town issued the Project a "Negative Determination" (that is, said that no state permit was required), the Project submitted an appeal to DEP for intervention. This action had several consequences.

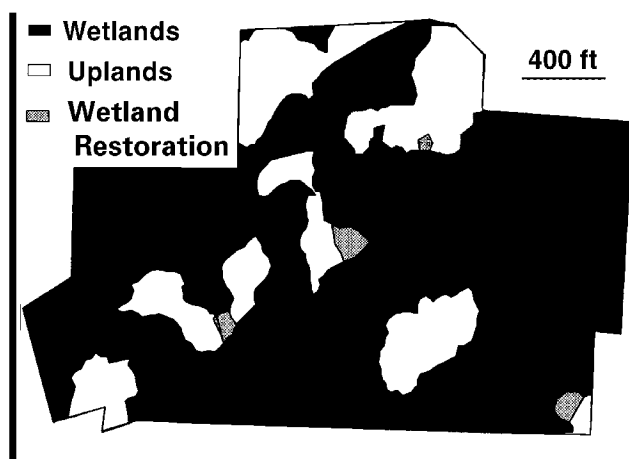
Most importantly, soon after the Buzzards Bay Project's legal appeal, the town abandoned its wetlands AF1 form. Another outcome was that the Project, recognizing that many towns in the watershed had a need for professional staff, set up a grant program for the formation of Conservation Agent districts. In 1992, the town of Acushnet, joined with Rochester and Marion to apply to the Buzzards Bay Project for funds to hire a shared conservation agent. After receiving one year of seed money from the Project, all three towns were so pleased with the benefits of a shared agent that they continued to fund the position for another two years. In 1995, for financial reasons the town of Marion dropped out of the district and was replaced by New Bedford. In 1997, the towns of Rochester and Acushnet recognized that the work load for three municipalities is too great for one person, and the tritown district has now dissolved, and these two communities now share a single agent, and the city of New Bedford is now hiring its own. Today only the towns of Marion and Mattapoisett now lack part time or full time agents for their Conservation Commissions.

### The Holly Woods Case

The Buzzards Bay Project believes that one of the greatest causes of wetland loss and degradation in the region is this misidentification of wetland boundaries by municipal conservation commissions through error or oversight. When wetland boundaries are incorrectly identified, homes, septic systems, and driveways may be sited in wetlands and flood zones with all too predictable consequences. In several area communities, new developments were allowed in wetlands during past 30 years. For some of these developments that were unsewered, septic system failure was apparent from backed up toilets and overflowing sewage in yards. Sometimes the scale of the problem was so great that towns were forced to sewer these developments at taxpayer expense. The filling of the wetlands in these areas are worsened flooding and water quality problems downstream. The scope of the problem of local misidentification of wetland boundaries is illustrated by case below.

In the Spring of 1993, the Buzzards Bay Project received several calls from Mattapoisett Residents about wetlands being filled by heavy equipment in a new 93-acre development known as "Holly Woods Road East." Specifically, 6 ft tall mounded septic systems were purportedly being constructed in areas with standing water. In June, the Project brought these complaints, as well as other information to the attention of the Mattapoisett Conservation Commission, but were informed that no wetlands had been identified at the areas of construction when the permit for the work was issued three years earlier, and little could be done at this late date. Consequently, the Buzzards Bay Project filed a formal "Request of Determination of Applicability" of the state wetland regulations to the Mattapoisett Conservation Commission notifying them that state Wetlands Conservancy Maps showed that wetlands were far more extensive than the previously approved engineering plans showed, and that the permit had in fact expired two months earlier. Despite this new information, the Mattapoisett Conservation

Commission still indicated that no wetlands were impacted or present and that no action was warranted. In an unusual move, the Buzzards Bay Project, joined by 20 Mattapoisett, jointly submitted an appeal to DEP regarding the local decision.



Approximate final wetland boundaries submitted by applicant to MA DEP in 1995.

As a result of this appeal, the state DEP conducted site visits, overturned the local decision, and issued an enforcement order for the restoration of wetlands. After the issuance of the enforcement order, the developer and engineer agreed to work with the Buzzards Bay Project to identify wetland boundaries. Through meetings and negotiations, the developer submitted new

plans to DEP that agreed with the position of the Buzzards Bay Project that wetlands were far more widespread on the site than identified in the 1988 plans submitted by the town (compare the two maps below). Specifically, the developer agreed that 65 acres or 2.8 million sq. ft of wetlands were overlooked in the original 1988 plans.

When the Buzzards Bay Project initiated this appeal against a Buzzards Bay community, it was criticized by many for taking such an action and second guessing a town board. For a time, attitudes of some town boards were tense toward the Project. However, when the case was settled and the outcome became known, the Buzzards Bay Project received widespread praise for calling attention to the problem of inadequate local wetlands identification training. Today the Buzzards Bay Project has a good working relationship with the Mattapoisett Conservation Commission and has provided assistance on several projects.

In August, 1992, the Buzzards Bay Project was requested to assist the Rochester Conservation Commission in the writing of a local wetlands protection bylaw. Over the next two years, the Project worked with the commission to create a bylaw that would fit their needs. Rather than simply rewrite a "model bylaw," the Project custom-made a bylaw tailored for the peculiarities of the town. The bylaw was passed at the 1994 Annual town meeting with only three dissenting votes out of over 200 people present. The bylaw extended protection to isolated wetlands, standardized the format of permit applications, provided a legal framework to allow the commission to perform environmental assessments at the request of the landowner for small projects, and enabled the commission to require consultant fees to be paid by the applicant for large projects.

"Without your tireless efforts I do not believe that Falmouth Conservation Commission would have been able to make the deadlines required. And even if we had made then deadlines, the regulations would never have been as complete and powerful as those drafted by the Buzzards Bay Project."

David C. Potter, Chairman  
Falmouth Conservation Commission

Since 1992, the Buzzards Bay Project has written regulations/bylaws for the Rochester Conservation Commission, Rochester Planning Board, Fairhaven Planning Board, Westport Planning Board, New Bedford Conservation Commission, Marion Planning Board, and Marion Conservation Commission.

## Restoration of Anadromous Fish Runs

Anadromous fish species like alewives (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) have declined dramatically during the past century in Buzzards Bay. Not only are these fish historically important as a fishery in Buzzards Bay, they are also an important food species for many fish, whales, and coastal birds such as the roseate tern (*Sterna dougallii*), a US endangered species whose largest colony in North America resides in Buzzards Bay.

Today, many of the herring runs in Buzzards Bay support only a fraction of their estimated maximum annual population. Reduced herring populations in any particular river or stream system can be caused by a number of factors including physical obstructions to migration, overfishing, poor water quality, or inadequate spawning habitat. Of these, physical constraints in the form of dams, roadway construction, and other water control structures are by far the greatest impediment to herring migration in Buzzards Bay rivers.

The Buzzards Bay Project has invested considerable effort in helping to improve herring runs in the Bay's most productive river systems and continues to work closely with the Massachusetts Division of Marine Fisheries (DMF) to identify where anadromous fish improvements are needed and will provide the most benefit. Together the Project and DMF have identified two river systems in the Buzzards Bay watershed as priorities for herring restoration - the Mattapoissett and Weweantic.

### The Mattapoissett River

The Mattapoisett River which begins at Snipatuit Pond in Rochester and flows 20 miles south to its discharge into Mattapoisett Harbor, has historically contained the Bay watershed's most productive and abundant herring populations. At its peak at the turn of the century, the river had an estimated annual sustainable yield of 3000 barrels, or approximately 1.4 million fish, with the total fish stock estimated at 1.8 and 1.9 million fish per year. During this century, the fish stock has drastically declined until the fishery was almost extinguished. Local efforts, starting in the mid 1980's, have allowed the herring fishery to begin a slow recovery and the total fish stocks for 1989, 1990, and 1991 were 43,000, 51,000, and 65,000 herring, respectively. Although the population is increasing, the total stock is still less than 3% of the former population.

Near the river's headwater spawning area in Snipatuit Pond, five culverts beneath Snipatuit Pond Road were small in diameter (30") and submerged. Because herring typically migrate during daylight hours and lighted passages are required for migration, these long darkened culverts presented a significant obstacle to their upstream migration. The solution to the problem was the replacement of the small culverts with a single large box culvert, which would allow for more light to reach the interior of the culvert and eliminate the existing obstacle to migration. The Buzzards Bay Project funded this project and construction was performed by the Rochester Highway Department.

Near the river's mouth at the Route 6 dam, additional problems were impeding fish passage on the Mattapoisett. The fishway at the dam restricted upstream passage of alewives as it was both too steep and too turbulent. In addition, water elevations at the dam which are controlled for municipal water supplies required better management during normal operating conditions and during herring run season (March through May). In order to accomplish these connected goals of improving the fish ladder and improving water management, the towns of Mattapoisett, Marion, Rochester, and Fairhaven joined together to seek funding for the project. Improvements to the dam structure were funded by the Commonwealth of Massachusetts with local support from each of the towns. Additional funds for the fishway were provided by the Buzzards Bay Project. The new fish ladder is a denil-type structure and was installed at the dam in December 1996.

### The Weweantic River

Beginning in the town of Wareham, the Weweantic River system is one of the Bay areas largest subwatersheds encompassing 55,438 acres in the towns of Wareham, Carver, Rochester, and Middleborough. Land use is dominated by cranberry production and the upper reaches of the Weweantic are intermingled with bog operations. The Weweantic River currently has no significant population of herring. The major spawning area on the river is Horseshoe Pond which is a relatively short distance from the farthest extent of tidal influence. The entrance into the Pond for migrating herring is obstructed by a dam which prevents the river system from sustaining its maximum herring population. According to estimates performed by the Massachusetts Division of Marine Fisheries, the river has an estimated possible annual production of approximately 100,000 fish per year.

In 1996, the Buzzards Bay Project in cooperation with DMF and the Town of Wareham applied for and was awarded funding from the Massachusetts Department of Environmental Protection s.319 program to construct a denil-type fish ladder in the Weweantic at Horseshoe Pond. The ladder was

designed by fishway engineers at the US Fish and Wildlife Service to be installed in the dam structure and will remove the single most important impediment to fish migration in this system. As part of this project, DMF will stock Horseshoe Pond with 5000 herring to boost the population and an educational display will be created highlighting the herring restoration efforts in the Bay drainage area to be used on a rotating basis in town halls, libraries, and schools. Construction of this project will begin in the first part of 1997.



## Land Use Management

### CCMP Goal

To manage and direct growth so that critical resource areas are protected from cumulative impacts

### Open Space Planning Assistance

Population in the Buzzards Bay drainage basin increased nearly 49% between 1950 and 1986 and is still growing. Between the years 1970 and 1995, population growth slowed slightly but continued to support a very large increase in residential development. Most of this development has and continues to occur in low and medium density areas, indicating a move towards suburban sprawl and away from more established urban centers. The ability of the Bay environment to sustain its relatively healthy water quality and resources is being threatened as growth expands into these previously undeveloped forests and coastal areas.

These recently developed areas are contributing new pollutant loads to the Bay ecosystem from increased runoff from roads and lawns and increased wastewater disposal through onsite septic systems or increased loads to municipal wastewater treatment facilities. Imprudent development will ultimately impact coastal systems by providing pollutants such as bacteria, viruses, heavy metals, hydrocarbons, and nutrients with pathways to the Bay. Development in flood zones, near wetlands, and on barrier beaches threatens the Bay's natural abilities to attenuate pollutants and reduces habitat for both marine and terrestrial wildlife.

The Buzzards Bay Comprehensive Conservation and Management Plan (CCMP) recognizes the importance of land conservation and community open space planning in protecting the Bay watershed's most sensitive water resources and critical habitats from inappropriate development. Such resource areas include coastal and freshwater wetlands, river and stream corridors, and watersheds to nitrogen-sensitive embayments and public drinking water supplies.

In December 1994, the Buzzards Bay Project applied for and was awarded funding through Section 104(b)(3) of the Federal Water Pollution Control Act to initiate a technical assistance program to assist a minimum of three Bay watershed municipalities in developing comprehensive Open Space Plans. The focus of the Buzzards Bay Project's involvement under this grant would be to help develop Open Space Plans that enhance wetlands and water quality protection. This application was based on the Buzzards Bay Project's experience in assisting the Town of Marion with an update of their Open Space Plan in 1993.

In early 1996, the Buzzards Bay Project released a Request for Planning Assistance to Buzzards Bay communities to fulfill their Open Space Planning needs. While the response was overwhelming, the Project was only able to offer assistance to five

"Your advice during the preparation of the (Copicut watershed land conservation) application and your help in compiling the necessary supporting documentation was invaluable. I consider the city fortunate to have (the Buzzards Bay Project) as our consultant."

*Alfred Lima*

*Fall River Open Space Planning Committee*

communities. While the end result of each of these plans is based largely on the individual community's natural resources and public input process, development of each of the plans involves a detailed examination and mapping of presently protected areas, an assessment of environmentally sensitive areas within the town deserving of conservation protection, public opinion surveys or workshops to determine the communities open space needs, and most importantly, the translation of these needs into a concrete strategy for targeting and acquiring sensitive lands for conservation.

#### Profiles - Communities working with Buzzards Bay Project on Open Space Planning

**Fall River:** The City of Fall River is working on its first ever Open Space Plan. While the majority of the city is heavily urbanized and drains to Mount Hope Bay; the eastern, largely undeveloped, part of the City lies within the Buzzards Bay drainage basin. Fall River's Plan will focus on preservation of this area as well as coastal and recreational access within the city's main population centers.

**Westport:** An agricultural community whose landscape is dominated by the Westport River system. Previous Open Space Plans in Westport have focused on preservation of working farmland and the update is not likely to alter that priority. Protection of the Westport Rivers, which suffer from non-point source runoff, will also feature prominently in the Plan.

**Mattapoisett:** Mattapoisett's residential atmosphere and summer beach communities are only part of this town's landscape which includes vast forested tracks. The Mattapoisett River Valley covers the western portions of the town and supplies drinking water to the town and two nearby municipalities. The Open Space Plan will focus on protection of river watershed lands.

**Wareham:** The Town of Wareham had already begun work on updating their Open Space Plan when the Buzzards Bay Project was asked to assist the town in mapping and definition of their Implementation Goals. Open space goals will focus on protection of water quality and habitat in the town's major river systems - the Weweantic and Agawam.

**Plymouth:** Like Fall River, only a portion of Plymouth lies within the Buzzards Bay drainage basin (the remainder of the town drains easterly to Massachusetts Bay). The Project provided Geographic Information System (GIS) mapping assistance to Plymouth of all permanent and temporarily protected land parcels.

The Massachusetts Division of Conservation Services, a state agency under the Executive Office of Environmental Affairs, approves *Open Space and Recreation Plans* for five year intervals making the town eligible for grant funding to purchase land for conservation under the Commonwealth's Self-Help and Urban Self-Help Programs as well as the Federal Land and Water Conservation Fund. In the Spring of 1996, a \$300 million Open Space Bond Bill was passed in the Massachusetts legislature. Communities with accepted Open Space Plans will be eligible for funding to support local land acquisition initiatives. The Buzzards Bay Project's Open Space Planning Initiative will better enable Buzzards Bay municipalities to take advantage of these funds.

## Geographic Information Systems (GIS)

The Buzzards Bay Comprehensive Conservation and Management Plan (CCMP) identified local governments within the Bay watershed as having the primary responsibility for the implementation of land use and natural resource management measures necessary to protect and restore water quality and living resources in the Bay. Comprehensive watershed planning, growth management, as well as natural resource protection and utilization efforts all require access to accurate information in formats that can be related to one another for analysis. In the Bay watershed, most towns did not have adequate inventories of coastal and inland natural resources or the baseline parcel ownership information in formats that could be interpreted together. In response to this need, the Buzzards Bay Project made available funding from its Municipal Grant Program to encourage the development and expansion of town and regional computerized Geographic Information Systems (GIS).

GIS enables the user to organize, maintain, visualize, analyze, and disseminate maps and spatial information. Going beyond digital representation of maps, GIS systems allow for the analysis of this map data by referencing spreadsheet or tabular information connected to individual features on a map. For example, town parcel maps can be linked to assessors data on a particular parcel making information such as lot size, owner, assessed value, and land use code available to anyone working with the parcel map coverage. Similar links can be made with town building permit, septic system upgrade, or any other database with references to town parcels. Environmental monitoring data can be similarly linked to natural resource features such as surface waters, wetlands, and living resources.

Municipal GIS systems have proven valuable tools for communities to improve town land use inventories, mapping, and data management capabilities. From the Buzzards Bay Project's coastal water quality planning perspective GIS meets a number of important planning needs. Build-out analysis and other parcel level calculations are greatly aided by the use of GIS. Once GIS hardware and software are in place within the town, digitized town parcel data can be used to identify watershed development densities, characterize natural features and pollutant loadings, locate undeveloped areas or areas serviced by sewer or town water within a defined boundary, and numerous other forms of information useful in the development of informed landuse decisions.

In 1993, the Buzzards Bay Project provided \$24,000 to the Town of Dartmouth to pioneer a shoreline GIS mapping project. The project was designed to map parcels near the coast, shellfish areas by type and status, coastal wetlands, sewer lines, public access points, and protected open spaces. A similar project was funded by the Buzzards Bay Project

in West Falmouth that same year. The interest generated by these projects among other towns prompted the City of New Bedford and the Town of Fairhaven to join together the following year to extend the Dartmouth mapping effort up the coast to the Mattapoissett border. Again, this work was supported by a \$19,000 grant from the Buzzards Bay Project's Municipal Grant Program. Other towns within the Bay watershed soon recognized the value of GIS and requested that the Project

"The Buzzards Bay Project support has been critical to the natural resource mapping for the town of Fairhaven. The use of their expertise and equipment has made a difference in natural resource protection in Fairhaven."

*Wayne Fostin,*

*Fairhaven Building Inspector/Conservation Agent*

focus \$80,000 of its 1996 Municipal Grant budget toward expanding basic GIS coverages for the remainder of the drainage basin.

In response to computer equipment and training requests, the Buzzards Bay Project devoted \$4,500 to each town developing GIS capabilities to purchase a computer workstation. The Project also provided a two day training course in ArcView™ GIS software to 30 municipal planning, health, and conservation staff from throughout the Bay watershed in August 1996.

The towns of Westport, Acushnet, Fairhaven, Rochester, Marion, and Wareham all responded to the Buzzards Bay Project's Request for GIS Mapping Proposals in early 1996. Of these, each town was seeking development of its parcel and wetlands data coverages as the basis for all future data development. GIS mapping work was completed independently of this initiative in Wareham, Bourne, and Falmouth. Completion of these new town projects in June 1997 will result in near complete parcel and wetlands coverages in the Buzzards Bay watershed.

The Buzzards Bay Project is in the process of developing and reproducing the first in a series of CD-ROMs containing all GIS data available in the Buzzards Bay watershed. Working together with MassGIS and the Cape Cod Commission, this compact disk will consolidate this information in one easy to use format. Coverages to be included on the disk will be data developed by the BBP such as baywide eelgrass coverages and subwatershed boundaries, MassGIS data selected for the area, shellfish classification areas from the Division of Marine Fisheries, as well as the Dartmouth, New Bedford, Fairhaven coastal zone mapping projects discussed above. Release of Volume I of the Buzzards Bay Watershed GIS CD is expected in August 1997.

The BBP will follow up the general data on Vol. I with more detailed GIS data in a second CD to be released in the Fall of 1997. Volume II will include all data currently under development in Bay towns such as town-wide Assessors parcel and Wetlands Conservancy Map data for Westport, Dartmouth, Acushnet, Fairhaven, Rochester, Mattapoisett, Marion, Wareham, Bourne, Falmouth, and Massachusetts Military Reservation. Image data of bay watershed aerial photographs shot in 1995 will also be included on Vol. II.

"The seed money from the Buzzards Bay Project was used to develop an award winning GIS system. (Massachusetts Chapter, American Planning Association, 1996 Municipal Planning Implementation Award). The standards developed in the initial project were used to expand into a regional product."

*Mike O'Reilly*

*Town of Dartmouth Environmental Affairs Coordinator*



SECTION II

# Environmental Results



## General Approach

To document “environmental results”, that is, to measure whether actions are resulting in improved habitat, living resources, or water quality, the Buzzards Bay Project relies both on direct environmental assessments such as measures of water quality or acres of shellfish bed closures. For other environmental assessments, such as increased use of boat pump-out facilities, the Project relies on documentation of human behavior (i.e. number of gallons pumped) instead of water quality. This is necessary in this instance because it has been well established that illegal dumping of raw sewage by boats, while representing an important health risk, is very difficult to document through routine fecal monitoring programs.

For the most part, the Buzzards Bay Project relies on existing monitoring programs, and this approach was outlined in the BB CCMP Monitoring Plan. For example, even with the upgrade of the New Bedford wastewater treatment facility to secondary wastewater treatment, nitrogen loading is still an important issue. The City of New Bedford has agreed to Buzzards Bay Project requests to continue monitoring nitrogen discharges so that the Project can adequately document loadings to the Bay.

Similarly, with regards to the PCB Superfund cleanup in New Bedford, requirements for monitoring water, sediments, and animals before and after the cleanup are expected to meet CCMP monitoring recommendations.

With regards to the management and reduction of fecal coliform loadings, monitoring of swimming beaches by municipal boards of health, and the monitoring of shellfish beds by Massachusetts Division of Marine Fisheries will be adequate to document whether management action is making a difference.

With the preparation of the state Wetlands Conservancy maps as part of the state’s match to the BBP in 1992 and 1993, core wetlands have been mapped and new wetland losses can now be documented with these maps and through the permit process. More importantly, the BBP’s efforts to upgrade the GIS capabilities of most towns in the watershed not only means that even finer resolution of wetland coverages can be followed over time, but efforts by towns to protect open space and special habitat areas can now be monitored for the first time.

The joint Project-Coalition citizen’s monitoring program is a vital ingredient for documenting progress or lack thereof on nitrogen management. While project and agency funding support have been strong during the past 5 years, EPA funding cutbacks now threaten this program, and this year the Project and Coalition were unable to meet all funding goals for the first time, and significant monitoring elements were cut back, and nutrient monitoring will be conducted in 1997 only in the five embayments where the Project is working with municipalities on nitrogen management plans. Because changes in nitrogen loading and ecosystem response tend to be gradual over several year, biennial monitoring of some embayments can be justifiable in terms of both scientific analysis of the problem and in light of fiscal restraints.

Eelgrass Bed monitoring, funded by the Project in the early 1980’s is now being updated by the state DEP and NOAA, and this data too will be a vital part of the effort to interpret environmental changes resulting from changes in nitrogen loading. At this time there are no specific goals for eelgrass coverage in Buzzards Bay, but once the latest eelgrass coverages are complete, the Project

will compare the 1980s and 1990s data and develop specific eelgrass targets for selected embayments that appear to be impacted by nitrogen loading.

With regards to data management, the Buzzards Bay Project maintains and makes available data from the Citizens Monitoring Program (kept in Quattro, but exportable into any standard spreadsheet format). GIS data is maintained by the Buzzards Bay Project which has become a repository for watershed data. This GIS data is being archived onto CD's in the format of the widely used ArcView software package. The Buzzards Bay Project also collates and analyzes state data, like the MA DMF information to create the Buzzards Bay summaries. Below we provide added detail on our two main monitoring concerns, nitrogen loading and shellfish bed closures.

### Nitrogen Loading

In 1990, the Buzzards Bay Project developed nitrogen management recommendations to protect and restore water quality and living resources in more than 30 coastal embayments in Buzzards Bay. The recommended strategy to manage point and non-point sources was empirically based on a synthesis of previous studies and embayment comparisons of nitrogen loading versus ecosystem response. Existing nitrogen loads to the Buzzards Bay embayments were based on land use data contained in a Geographic Information System, and a well-defined set of nitrogen loading assumptions for different kinds of land uses and sewage disposal. Drainage basins to each embayment were delineated by either land surface topography or groundwater elevations as appropriate. Recommended embayment loading limits (expressed as Total Maximum Annual Loads or TMALs) were established with a tiered system that incorporated embayment area or volume and hydraulic turnover time, depth, and existing regulatory water quality classifications so that embayment specific TMALs were established.

Because the appropriateness of these recommended nitrogen loading limits was in question by some state and local environmental regulators, a citizen based water quality monitoring program was established in 1992 to better document existing conditions in each embayment. This program, which was a partnership between the Project and the Coalition for Buzzards Bay, would also establish baseline data for trend assessment, enable comparisons among embayments around Buzzards Bay, and ultimately enable the evaluation of the Buzzards Bay Projects methodology.

In 1996, a report ("Baywatchers") was jointly issued by the Buzzards Bay Project and Coalition summarizing the findings of the Citizens Water Quality Monitoring Program over a four year period. This report is included in Appendix B. This report has been a great success in not only documenting conditions and trends in embayment water quality, but has been a powerful outreach piece for both the Project and Coalition.

One important finding from the data contained in this report is the fact that average summertime total nitrogen concentrations and a Eutrophication Index scores (an indicator developed by the Buzzards Bay Project) show a good correlation with estimates of nitrogen loading derived from land use data and supported the Buzzards Bay Project's characterization of loading in its subwatershed nitrogen evaluation (see Appendix B). Some findings were unexpected, and these are expected to result in the Project revising components of its nitrogen management strategy in the Fall of 1997.



The 1996 "Baywatchers" report showed that water quality was very variable in the embayments around Buzzards Bay, with some embayments clearly more eutrophic than others. Only a few embayments showed improved water quality (notably Clarks Cove), most others showed annual variability without clear trends, but some clearly showed declining water quality. Some of these latter embayments such as Wareham River and West Falmouth Harbor have been receiving increased loading from municipal wastewater treatment plants and the Buzzards Bay Project is working on identifying the appropriate nitrogen discharge limits for each wastewater treatment facility.

The shallowness and bathymetry of an embayment are two of the most important factors in defining an embayment's response to nitrogen loading. Appreciable declines in eelgrass distribution and production have been documented in Buzzards Bay and the south shore of Cape Cod in response to nitrogen loading. Concurrently, accumulations of unattached "drift algae" have been documented in many eutrophic embayments.

While eelgrass decline has been documented in many Buzzards Bay embayments during the 1970s, 80s, and 90s, one embayment, Clarks Cove, has bucked this trend, and for good reason. Clarks Cove is a deep well flushed embayment surrounded by a highly urbanized watershed. The Cove receives many sizable pollution discharges, including seven combined sewer overflows (CSOs). It also contains one of the most significant quahog fisheries in Buzzards Bay and contains two extensively used public beaches (Dartmouth's Jones Beach and New Bedford's West Beach).

During the past six years, the City of New Bedford has made remarkable progress in eliminating dry weather discharges from its CSOs. This effort has resulted in Clarks Cove being reopened to shellfishing in 1992 for the first time in nearly eighty years. The elimination of the CSO dry weather discharges has apparently resulted in a reduction of nitrogen loadings as well.

Most of the dry weather discharge elimination occurred between 1991 and 1993. Unfortunately the citizens monitoring program examined all parameters only in 1994 and 1995. In these years, the inner portions of Clarks Cove showed very good and improving water quality. However, anecdotal information from the City's shellfish warden indicate that the upper portions of the Cove have shown dramatic improvements in water transparency since the dry weather discharges were eliminated in the early 1990s. More over eelgrass beds have made a dramatic increase in abundance colonizing areas where they have not been for more than 30 years. In the 1980's, eelgrass beds were documented by the Buzzards Bay Project to have been restricted to the clearer waters at the tip of Clarks Point on the New Bedford side and south of Ricketsons Point on the Dartmouth side are now spreading throughout the Cove. Now these beds are spread to both Clarks Cove and the outer portions of New Bedford Harbor.

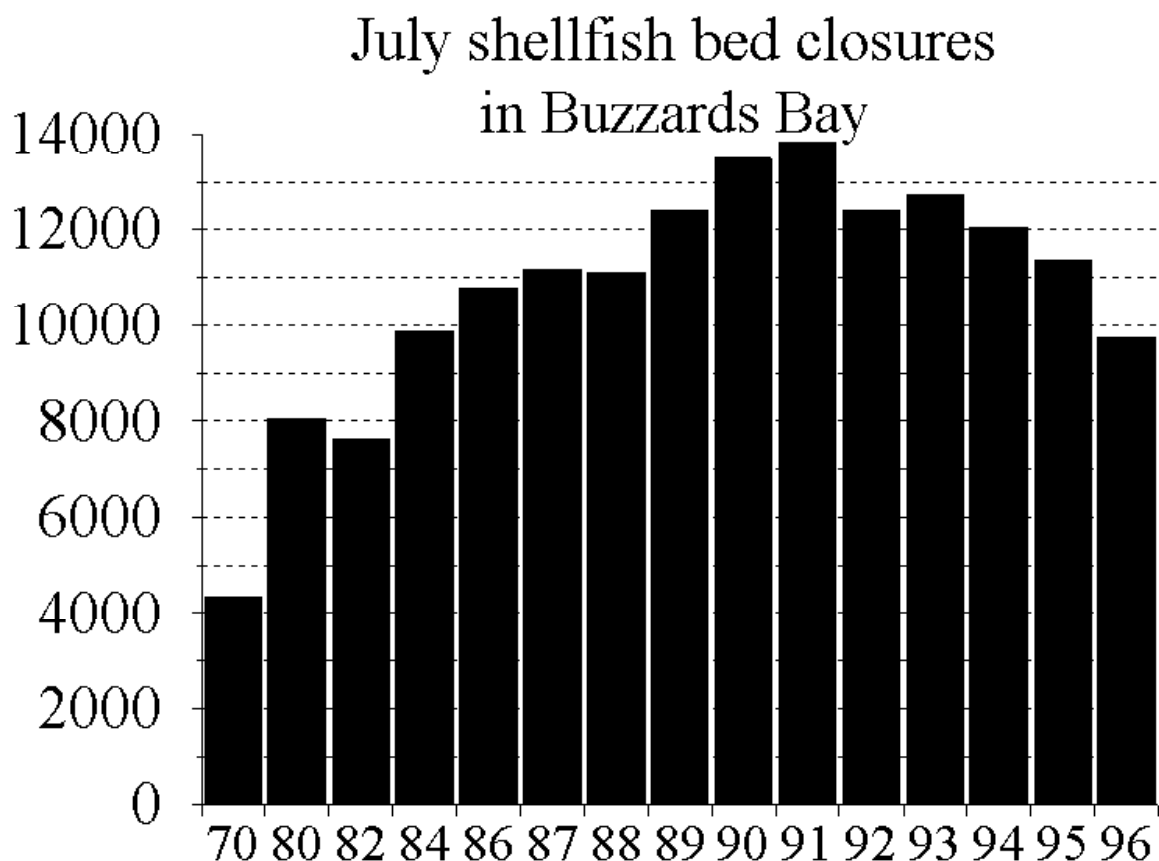
In 1996, New Bedford's new advanced secondary Treatment Facility was completed and came on line. This facility is expected to further improve water quality around New Bedford in terms of both fecal and nitrogen loading. The town of Dartmouth, which shares the coasts of Clarks Cove with New Bedford, is also managing stormwater discharges to the cove and their efforts are also expected to further reduce nitrogen and fecal loadings to the Cove. Inner New Bedford Harbor (Acushnet River) continues to have poor water quality, in part because of discharges

from the Fairhaven Wastewater treatment facility. In the coming year the Project will meet with state DEP and Fairhaven officials about the appropriate loading limits for that wastewater facility to help improve water quality there.

### Shellfish Bed Closures

As noted earlier in this report, in 1991 when the Buzzards Bay CCMP was completed, degradation of water quality due to pathogen contamination represented a serious and growing human health risk and economic loss to the Bay's historically strong shellfishery. In that year, the Bay saw 13,816 acres closed - the greatest number of bed closures in history. This figure had grown quickly moving from only 4,358 acres closed in 1970 and doubling to 8,052 acres by 1980. Throughout the 60s, 70s, and 80s, shellfish beds in Buzzards Bay were being closed due to fecal coliform contamination at ever increasing rates, and these closings were one of most pressing concerns with area residents.

At the end of 1996, however, the Bay has regained over 4,000 acres of shellfish harvest area, returning the Bay to a closure figure that had not been seen in the Bay since 1984. This improvement is due to both real improvements in water quality and increased use of conditional closures in many area along the Bay's coastline. The most striking achievement was the reopening of 700 acres of shellfish beds in Clark's Cove in April 1992.



While the Buzzards Bay Project contributed to this turn around, the real credit is deserved by the State Division of Marine Fisheries (DMF) and numerous municipal officials who have worked

together to identify and remediate pollution sources. The Project however helped form the wave of new thinking on what the problems and solutions were to the shellfish bed closure problem. In fact the Project's emphasis on stormwater as the principal source and conveyance of fecal coliforms in many embayments and harbors would result in new state programs to help towns fund solutions to the stormwater problem and spawned similar initiatives in the Project's sister NEP, the Mass Bays Program.

## SECTION III

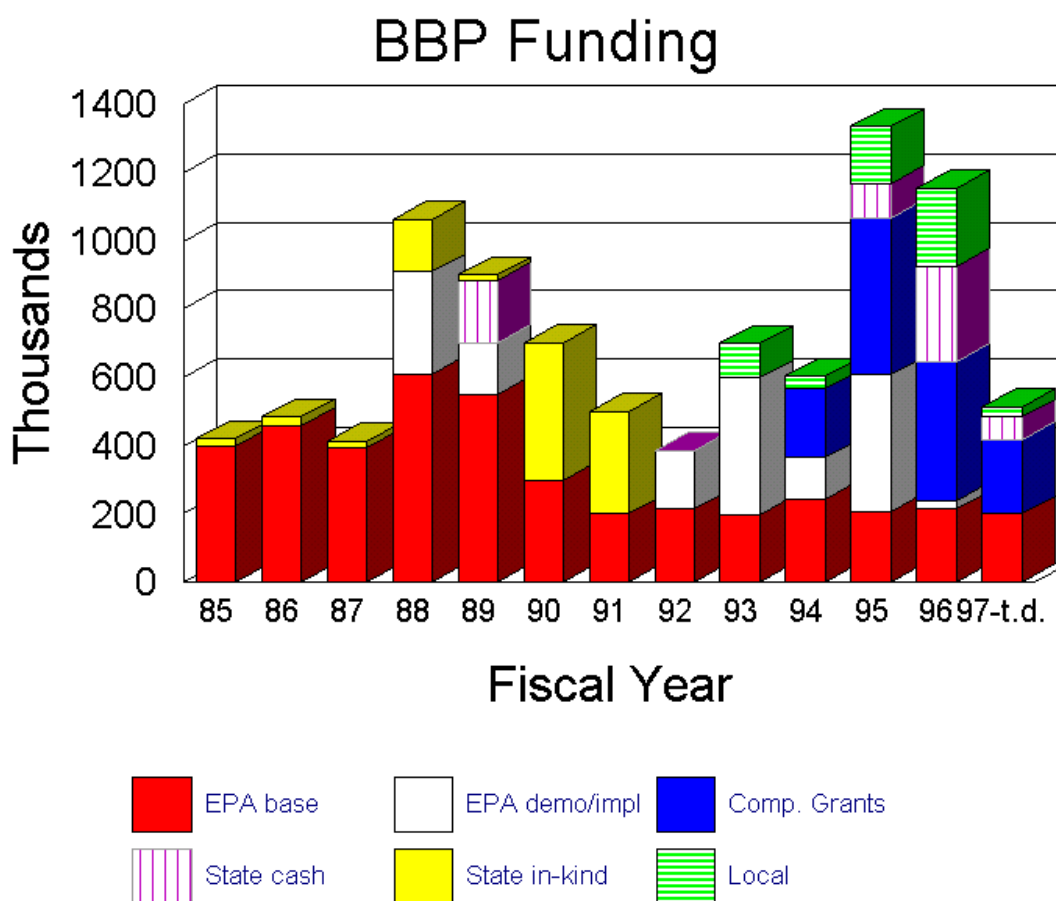
# Resources



The Buzzards Bay Project has had a highly effective municipal grant program in place since

1990. This program has been funded through EPA Section 320 demonstration project funds, Congressional Add-on funding through section 320, state match programs like the Coastal Facilities Improvement Program, and State Transportation Bond Issues. The Project has also been highly successful in securing state and federal competitive grants that have been either directly awarded to the municipalities or reissued by the Buzzards Bay Project in a competitive grant program.

The financing of implementation activities and leveraging CCMP actions was the result of an aggressive strategy by the Buzzards Bay Project to tap into various state and federal financial and technical assistance. The effectiveness of this strategy is illustrated in the graph below. It is clear from this figure that modest federal “base funding” through the NEP has paid big dividends for Buzzards Bay. With funding of project staff secure, the Buzzards Bay Project was able to focus its grant proposal writing on securing funds for municipalities, or specific implementation initiatives. However, with base funding in recent years becoming insufficient to maintain project staff, the Buzzards Bay Project has begun a strategy of securing a portion of relevant staff on each new grant proposal received. In the future, it is projected that 25% of project staff funding will derive from outside competitive grants, exclusive of Section 320 funds from EPA. The following is a list on outside federal and state funding acquired by the Buzzards Bay Project for specific town implementation projects.



Beginning in 1996, the Buzzards Bay Project has made a new collaboration with the **MASSACHUSETTS ENVIRONMENTAL TRUST**, a quasi-public environmental

philanthropy established by the Massachusetts legislature in 1988 through the settlement of a federal lawsuit over the pollution of Boston Harbor. The Trust funds environmental restoration and education projects focusing on coastal issues. Recognizing the value of the Commonwealth's two National Estuary Programs - the Buzzards Bay Project and the Massachusetts Bays Program - the Trust established a challenge fund to provide match funding for federal grants pursued by the NEPs for implementation activities. In the first year of the agreement, the Buzzards Bay Project has utilized Trust funding to match successful federal s.319 and ISTEA awards for land conservation and stormwater remediation projects.

## The Future

The Buzzards Bay Project expects continued success in securing state and federal competitive grants, Massachusetts Environmental Trust funding, and state bond moneys to fund specific implementation projects. Moreover, state and federal agencies are increasingly willing to dedicate their own limited internal resources to help implement the recommendations contained in the CCMP.

"The Buzzards Bay Project has provided valuable resource to my office and the constituents I represent in promoting water quality and natural resource protection affecting Buzzards Bay."

*State Representative William M. Straus*

## Buzzards Bay Project Success in Securing Post-CCMP Implementation Funding -- The Sources

Year	Funding Source	Project	Municipality	Awarded Funds
1995	s.319 Non-Point Source Pollution Program	Broadmarsh River Stormwater Design & Construction	Wareham	\$88,450
1994	104(b)(3) Water Quality Program	Stormwater Assessment - Sconticut Neck	Fairhaven	\$50,000
1995	s.319 Non-Point Source Pollution Program	Spragues Cove Constructed Stormwater Wetland	Marion	\$25,000
1995	US Fish & Wildlife Service	Spragues Cove Constructed Stormwater Wetland	Marion	\$10,000
1994	Cove Trust (private)	Spragues Cove plantings	Marion	\$10,000
1997	Mass Environmental Trust	Spragues Cove Outreach/ monitoring	Marion	\$5,350
1996	S.319 Non-Point Source Pollution Program	Buttermilk Bay Stormwater Design & Remediation	Bourne	\$144,000
1994	USEPA S.320 NEP TMDL Program	Allens Pond, Little Bay, Onset Bay Flushing Study	Dartmouth, Wareham, Fairhaven	\$20,000
1997	S.319 Non-Point Source Pollution Program	Weweantic River Herring Restoration	Wareham	\$38,000
1994	USEPA S. 320 NEP IIAP Program	Stormwater tech assistance, specific implementation projects	Watershed- wide	\$200,000
1994	Mass Environmental Trust	WQ Monitoring, proposal written for Westport River Watershed Alliance	Westport	\$10,000
1997	s.319 Non-Point Source Pollution Program	Land Conservation/Nitrogen Management Project	Dartmouth, Wareham	\$33,000
1997	Mass Environmental Trust	Cash match to 319 grant above	“ “	\$19,500
1996 1997	104(b)(3) Wetlands Protection	Open Space Planning	Plymouth, Wareham, Mattapoissett, Westport, Fall River	\$54,000
1997	Transportation Enhancement Activities (ISTEA)	Stormwater Priority Ranking and Remediation Design	Watershed-wide	\$137,000
1997	Mass Environmental Trust	Cash Match for ISTEA grant	Watershed	\$30,000
1996 1997	s.319 Non-Point Source Pollution Program	Allens Pond Alternative Septic System Demonstration	Statewide	\$19,500
1995- 1997	USEPA Office of Pollution Prevention	Toxic Use Reduction Program	New Bedford	\$196,500
1997	USEPA Environmental Technol. Initiative (ETI)	Alternative Septic System Test Center	Statewide	\$459,000
1995	State Transportation Bond	Stormw. Remediation Cash Match obtained by BBP	Watershed-wide	\$250,000
1996	EPA Region I discretionary	Support for Toxics Program	Watershed-wide	\$30,000
1993	Congressional Add-on*	Municipal grants and assistance	Watershed wide	\$400,000
1995	Congressional Add-on*	Municipal grants and assistance	Watershed-wide	\$400,000
<b>TOTAL EXTERNAL FUNDING SECURED</b>			<b>\$2,629,300</b>	

\*a collaborative effort with the Buzzards Bay Action Committee

## Summary of Municipal Grant Program 1992-1997

### *Buzzards Bay Project National Estuary Program*

Controlling Stormwater Runoff							
Year	Project Name	Municipality	Purpose	Cost	Buzzards Bay Project Funds		Local Share
					Federal	State	
1997	Barlows Landing Stormwater Remediation	Bourne	Construct subsurface stormwater infiltration facilities to treat runoff impacting shellfish beds at Barlows Landing in Pocasset	\$101,850	- 0 -	\$54,000 (CPR)	\$47,850
1997	Indian Mound Stormwater Design & Remediation	Wareham	Design and construct subsurface stormwater infiltration facilities to treat runoff discharging through four discharges contributing to shellfish bed closures in Buttermilk Bay	\$162,746	- 0 -	\$111,562 (CPR)	\$51,184
1997	Point Independence Stormwater Construction	Wareham	Construct subsurface stormwater infiltration facilities to treat runoff from a densely developed watershed contributing to shellfish bed closures in Broad and Muddy Coves in Onset	\$84,306	- 0 -	\$56,485 (CPR)	\$27,821
1997	GIS Mapping of Stormwater Network	Wareham	Map and digitize all catch basins, conveyance piping, and discharges of municipal stormwater network for use in remediation planning and design	\$8,500	\$6,000	- 0 -	\$2,500
1997	Little Bay StormTreat™ Demonstration	Fairhaven	Treat runoff discharging to Little Bay from small suburban watershed through installation of 3 StormTreat™ systems	\$27,000	\$20,000	- 0 -	\$7,000
1997	Cross Connection Elimination	New Bedford	Disconnect 15 residential sewer connections from 2 combined sewer overflow discharges	\$95,000	\$35,000	- 0 -	\$60,000 (cash)
1997	Eel Pond Stormwater Design & Remediation	Bourne	Treat runoff from 4 discharges discharging to Eel Pond in Bourne through a combination of subsurface infiltration and surface detention	\$82,975	\$17,975	- 0 -	\$65,000 estimate/incomplete
1997	Riverside-Oneset Remediation	Wareham	Construct subsurface stormwater infiltration structures for 14 discharges to Broad and Muddy Coves in Onset	\$164,472	\$100,000	- 0 -	\$64,472
1997	Cross Connection Elimination	Acushnet	Disconnect 7 residential sewer connections from a stormdrain discharging at the Head of the Acushnet River Estuary and recon-nect to	\$97,425	\$70,625	- 0 -	\$26,800



			New Bedford sanitary sewer system				
1997	Municipal Complex Stormwater Design	Wareham	Design a stormwater treatment system for the Wareham Town Hall, High School, and Middle School to remediate stormwater discharges contributing to shellfish bed closures in Broadmarsh River	\$17,772	\$13,000	- 0 -	\$4,772
1997	Red Brook Stormwater Design & Construction (Buttermilk Bay)	Wareham	Design & construct stormwater infiltration systems to treat runoff from large suburban watershed discharging to Red Brook, the largest freshwater input to Buttermilk Bay	\$84,000	\$64,000	- 0 -	\$20,000
1996	Barlows Landing Stormwater Design	Bourne	Design stormwater remediation facilities to treat runoff from small suburban watershed discharging through one pipe at Barlows Landing in Pocasset	\$14,100	- 0 -	\$10,000 (CPR)	\$4,100
1996	Point Independence Stormwater Design	Wareham	Design stormwater infiltration systems for Point Independence, a densely developed neighborhood in Onset contributing to shellfish bed closures in Broad & Muddy Coves.	\$19,950	\$15,000	- 0 -	\$4,950
1995	Riverside-Oneset Stormwater Design	Wareham	Design stormwater infiltration systems for the Riverside and Oneset Heights neighborhoods in Onset contributing to shellfish bed closures in Broad and Muddy Cove	\$20,000	\$15,000	- 0 -	\$5,000
1993	CSO Sluice Gate	New Bedford	Repair a failed sluice gate contributing to Combined Sewer Overflows (CSO) to Clarks Cove	\$83,500	\$33,500	- 0 -	\$50,000
1993	Buttonwood Brook Assessment	Dartmouth	Evaluation of land use, resources, and pollutant loadings impacting water quality and shellfish in Buttonwood Brook, largest freshwater input to Apponagansett Bay.	\$28,800	\$18,800	- 0 -	\$10,000
1992	Electric Avenue Stormwater Design & Construction	Bourne	Design and construct stormwater infiltration structures to treat runoff from two discharges contributing to shellfish bed closures at the mouth of Buttermilk Bay.	\$135,000	\$100,000	- 0 -	\$35,000
1992	Hen Cove Stormwater Design & Construction	Bourne	Design & Construct stormwater infiltration structures to treat runoff from 3 discharges contributing to shellfish bed closures in Hen Cove	\$96,250	\$35,000	- 0 -	\$61,250 \$40,000 Gale Report \$21,250 Construction
90-97	<b>TOTALS</b>			<b>\$1,366,479</b>	<b>\$543,900</b>	<b>\$247,162</b>	<b>\$565,417</b>

Protecting Wetlands and Coastal Habitat							
Year	Project Name	Municipality	Purpose	Cost	Buzzards Bay Project Funds		Local Share
					Federal	State	
1995	Regional Conservation Agent	Marion, Rochester, Acushnet	Allow three Bay communities to hire a shared Conservation Agent to coordinate administration of the Massachusetts Wetlands Protection Act and local bylaws relating to resource protection.	\$41,800	\$26,400	- 0 -	\$ 15,400 (cash)
1996	Weweantic River Resource Mapping	Wareham	Map natural resources and pollution sources in Weweantic River watershed	\$8,500	\$6,000	- 0 -	\$2,500 (in-kind)
1996	Adamsville Herring Run Restoration	Westport	Construct and install a new 30ft. Denil-type fish ladder at Adamsville Pond in Westport.	\$1,975	\$875	- 0 -	\$1,100 (in-kind)
1997	Mattapoissett Herring Weir Reconstruction	Mattapoissett	Construct a new concrete fish ladder and water control structure at the Mattapoissett River Herring Weir.	\$200,000	\$5,000	\$180,000 (DEM)	\$15,000 (cash)
1997	Snipatuit Road Culvert Replacement	Rochester	Replace inadequate culverts beneath Snipatuit Road to facilitate fish passage up Mattapoissett River into Snipatuit Pond for spawning	\$38,830	\$23,000	- 0 -	\$15,830
90-97	<b>TOTALS</b>			<b>\$291,105</b>	<b>\$61,275</b>	<b>\$180,000</b>	<b>\$49,830</b>

Managing Nitrogen Sensitive Embayments							
Year	Project Name	Municipality	Purpose	Cost	Buzzards Bay Project Funds		Local Share
					Federal	State	
1996	Little Bay Build-Out Study	Fairhaven	Development build-out study of 3,500 acre Little Bay watershed and estimate existing and potential future nitrogen loadings at full watershed build-out.	\$2,750	\$1,250	- 0 -	\$1,500 (in-kind)
1996	Allens Pond Build-Out/Loading Analysis	Dartmouth	Development build-out study of 2,300 acre Allens Pond watershed and estimate existing and potential future nitrogen loadings at full watershed build-out through the use of a Geographic Information System (GIS)	\$13,650	\$10,000	- 0 -	\$3,650 (in-kind)
1996	West Falmouth Harbor Flushing Study	Falmouth	Field studies and computer modeling to estimate tidal flushing and residence times for use in developing an estimated maximum nitrogen loading for West Falmouth Harbor	\$27,000	\$10,000	- 0 -	\$10,000 (Town cash) \$7,000 (CCC cash)
1996	Westport River Build-Out Study	Westport	Townwide development build-out study for use in estimating existing and potential future nitrogen loadings to the Westport Rivers.	\$4,000	\$3,000	- 0 -	\$1,000 (in-kind)
1997	Eel Pond Nitrogen Management Plan	Mattapoisett	Watershed build-out study, water quality analysis, estimates of existing and potential future nitrogen loading, and recommended management options for Eel Pond, a small coastal pond on Mattapoisett Harbor.	\$12,500	\$10,000	- 0 -	\$2,500 (in-kind)
1997	Pocasset River, Hen Cove, Eel Pond Flushing Study	Bourne	Field studies and computer modeling to estimate tidal flushing and residence times for use in developing estimated maximum nitrogen loadings for Pocasset River, Hen Cove, and Eel Pond.	\$32,300	\$22,000	- 0 -	\$10,300 (cash & in-kind)
<b>90-97</b>	<b>TOTALS</b>			<b>\$92,200</b>	<b>\$57,250</b>	<b>- 0 -</b>	<b>\$35,950</b>

Preventing Oil Pollution							
Year	Project Name	Municipality	Purpose	Cost	Buzzards Bay Project Funds		Local Share
					Federal	State	
1990	Oil Spill Containment Boom	New Bedford/Fairhaven	Purchase 600 feet of Oil Spill Containment Boom	\$5,500	\$2,500	- 0 -	\$3,000 (cash)
1990	Oil Spill Containment Boom	Marion	Purchase 400 feet of Oil Spill Containment Boom	\$4,600	\$1,600	- 0 -	\$3,000 (cash)
1990	Oil Spill Containment Boom	Westport	Purchase 400 feet of Oil Spill Containment Boom	\$5,900	\$1,900	- 0 -	\$4,000 (cash)
1994	Oil Spill Containment Boom	Westport	Purchase 200 feet of Oil Spill Containment Boom	\$5,700	\$2,000	- 0 -	\$3,700 (in-kind)
1994	Oil Spill Containment Boom	Dartmouth	Purchase 400 feet of Oil Spill Containment Boom	\$7,275	\$3,500	- 0 -	\$3,775 (in-kind)
1994	Oil Spill Containment Boom	New Bedford	Purchase 200 feet of Oil Spill Containment Boom	\$4,450	\$2,000	- 0 -	\$2,450 (in-kind)
1994	Oil Spill Containment Boom	Fairhaven	Purchase 200 feet of Oil Spill Containment Boom	\$4,925	\$2,000	- 0 -	\$2,925 (in-kind)
1994	Oil Spill Containment Boom	Mattapoisett	200 feet of Containment Boom & Boat Trailer	\$5,080	\$2,500	- 0 -	\$1,980(in-kind) \$600.00 (cash)
1994	Oil Spill Containment Boom	Rochester	Purchase 200 feet of Oil Spill Containment Boom	\$3,400	\$2,000	- 0 -	\$1,400 (in-kind)
1994	Oil Spill Containment Boom	Marion	Purchase Oil Spill Response Boat Trailer	\$3,075	\$1,500	- 0 -	\$1,575 (in-kind)
1994	Oil Spill Containment Boom	Wareham	Purchase 200 feet of Oil Spill Containment Boom	\$18,000	\$2,000	- 0 -	\$16,000 (in-kind)
1994	Oil Spill	Bourne	Purchase 400 feet of Oil Spill Containment Boom	\$7,100	\$3,500	- 0 -	\$3,000(in-kind) \$600.00

	Containment Boom						(cash)
1994	Oil Spill Containment Boom	Falmouth	Purchase 200 feet of Oil Spill Containment Boom	\$5,200	\$2,000	- 0 -	\$3,200 (cash)
1994	Oil Spill Containment Boom	Gosnold	Purchase 100 feet of Oil Spill Containment Boom	\$1,000	\$1,000	- 0 -	in-kind
1997	Oil Spill Response Equipment	Westport	Equipment Trailer, absorbent boom & pads, navigation equipment	\$2,275	\$2,275	- 0 -	in-kind training
1997	Oil Spill Response Equipment	Dartmouth	Survival Suits, Drainguards, Absorbent Pads, navigation equipment	\$2,275	\$2,275	- 0 -	in-kind training
1997	Oil Spill Response Equipment	New Bedford	Survival Suits, Navigation equipment, Absorbent Pads, Stormdrain Cover	\$2,275	\$2,275	- 0 -	in-kind training
1997	Oil Spill Response Equipment	Fairhaven	Navigation equipment, Survival Suits, Stormdrain Covers, drainguards	\$2,275	\$2,275	- 0 -	in-kind training
1997	Oil Spill Response Equipment	Mattapoissett	Stormdrain Covers, drainguards, Absorbent Pads & Boom, Survival Suits	\$2,275	\$2,275	- 0 -	in-kind training
1997	Oil Spill Response Equipment	Rochester	Survival Suits, Absorbent Pads, Stormdrain Covers, response boat equipment	\$2,275	\$2,275	- 0 -	in-kind training
1997	Oil Spill Response Equipment	Marion	Equipment Storage & Transportation Trailer, Survival Suits, Stormdrain Covers	\$3,675	\$2,275	- 0 -	\$1,400 (cash) in-kind training
1997	Oil Spill Response Equipment	Wareham	Drainguard, Stormdrain Covers, Absorbent Boom, Survival Suits	\$2,275	\$2,275	- 0 -	in-kind training
1997	Oil Spill Response Equipment	Bourne	Absorbent Pads & Boom, Stormdrain Covers and drainguards, Survival Suits	\$2,275	\$2,275	- 0 -	in-kind training
1997	Oil Spill Response Equipment	Falmouth	Survival Suits, Absorbent Pads & Boom, Stormdrain Covers	\$2,275	\$2,275	- 0 -	in-kind training
1997	Oil Spill Response Equipment	Gosnold	200 feet of Oil spill containment boom	\$2,275	\$2,275	- 0 -	in-kind training

90-97	TOTALS	\$117,190	\$55,025	- 0 -	\$62,215 +
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Managing Sewage From Boats							
Year	Project Name	Municipality	Purpose	Cost	Buzzards Bay Project Funds		Local Share
					Federal	State	
1991	<b>Pumpout Boat</b>	Westport	Purchase equipment to retrofit a boat as a pumpout boat for collection of boat wastes.	\$6,000	\$5,000	- 0 -	\$1,000 (cash)
1991	<b>Boat Pumpout Tight Tank</b>	Westport	Install a tight tank for temporary storage of boat wastes collected by mobile pumpout boat at Route 88 State Boat Ramp.	\$4,691	\$2,691	- 0 -	\$2,000 (cash)
1994	<b>Land Based Boat Pumpout Station</b>	Westport	Construction of a land-based boat pumpout facility at Westport Point in Westport Harbor to collect boat wastes.	\$8,540	\$7,540	- 0 -	\$1,000 (cash) in-kind O&M
1991	<b>Mobile Pumpout Boat</b>	Dartmouth	Purchase materials & equipment to retrofit a boat & dock for use in Padanarum Harbor to collect boat wastes.	\$9,300	\$5,000	- 0 -	\$4,300 (cash in-kind)
1992	<b>Pumpout Study</b>	New Bedford	Evaluation of waste collection needs in New Bedford Harbor, Bay's largest commercial port.	\$9,000	\$6,000	- 0 -	\$3,000
1991	<b>Mobile Pumpout Boat</b>	Fairhaven	Purchase materials & equipment to retrofit a boat as a mobile pumpout boat for collection of boat wastes.	\$4,695	\$4,695	- 0 -	In-kind O&M
1992	<b>Boat Pumpout Sewer Extension</b>	Fairhaven	23 foot extension of municipal sewer service to the end of Union Wharf to accommodate disposal of wastes from mobile pumpout boat	\$2,545	\$2,545	- 0 -	In-kind O&M
1991	<b>Boat Pumpout Sewer Extension</b>	Mattapoisett	Construction of a land-based boat pumpout facility on Long Wharf in Mattapoisett Harbor to collect boat wastes.	\$10,316	\$10,316	- 0 -	In-kind O&M
1991	<b>Mobile Pumpout Boat</b>	Marion	Construction of a land-based boat pumpout facility on Island Wharf, Sippican Harbor for collection of boat wastes.	\$19,581	\$5,145	- 0 -	\$14,436 (cash)
1994	<b>Land Based Boat Pumpout Station</b>	Marion	Purchase of boat waste pumpout equipment to retrofit a new Pumpout Boat	\$22,150	\$5,400	- 0 -	\$16,750 (cash)
1990	<b>Mooring Plan and Boater Survey</b>	Wareham	Development of a mooring grid plan for Wareham River and Onset Bay and collection of information regarding boat sewage disposal	\$55,200	\$10,200	- 0 -	\$45,000 (cash)
1994	<b>Land Based Pumpout Station</b>	Bourne	Construction of a land-based boat pumpout facility at Bourne Marina , Taylor's Point to collect boat wastes.	\$5,000	\$5,000	- 0 -	In-kind O&M
90-97	<b>TOTALS</b>			<b>\$157,018</b>	<b>\$69,532</b>	<b>- 0 -</b>	<b>\$87,486</b>

\*\*\* An additional \$205,000 in federal Clean Vessel Act funds have supplemented Buzzards Bay Project funding since 1994 \*\*\*

Protecting Shellfish Resources							
Year	Project Name	Municipality	Purpose	Cost	Buzzards Bay Project Funds		Local Share
					Federal	State	
	Regional Sanitarian Creation	Marion, Rochester, Acushnet	Allow three Bay communities to hire a shared Health Agent to administer septic system regulations and assist DMF in coastline surveys for pollution sources.	\$45,000	\$25,000	- 0 -	\$20,000
	WRWA Monitoring Support	Westport			\$7,000	- 0 -	\$10,000 MET
	BOH Lab Equipment	Westport			\$3,000	- 0 -	
	SOS Bacteria Monitors	Marion			\$4,300	- 0 -	
	DMF Sanitary Survey Support	New Bedford Health Lab			\$9,000	- 0 -	
	DMF Sanitary Survey Support	Barnstable County Lab			\$6,600	- 0 -	
90-97	TOTALS				\$54,900	- 0 -	



Managing On-Site Wastewater Disposal Systems							
Year	Project Name	Municipality	Purpose	Cost	Buzzards Bay Project Funds		Local Share
					Federal	State	
1995	SepTrack	Westport	Computer & software to facilitate septic system inspection/maintenance by local Health officials	\$3,000	\$3,000	- 0 -	in-kind
1995	SepTrack	Dartmouth	Computer & software to facilitate septic system inspection/maintenance by local Health officials	\$3,000	\$3,000	- 0 -	in-kind
1995	SepTrack	New Bedford	Computer & software to facilitate septic system inspection/maintenance by local Health officials	\$3,000	\$3,000	- 0 -	in-kind
1995	SepTrack	Acushnet	Computer & software to facilitate septic system inspection/maintenance by local Health officials	\$3,000	\$3,000	- 0 -	in-kind
1995	SepTrack	Fairhaven	Computer & software to facilitate septic system inspection/maintenance by local Health officials	\$3,000	\$3,000	- 0 -	in-kind
1995	SepTrack	Mattapoisett	Computer & software to facilitate septic system inspection/maintenance by local Health officials	\$3,000	\$3,000	- 0 -	in-kind
1995	SepTrack	Rochester	Computer & software to facilitate septic system inspection/maintenance by local Health officials	\$3,000	\$3,000	- 0 -	in-kind
1995	SepTrack	Marion	Computer & software to facilitate septic system inspection/maintenance by local Health officials	\$3,000	\$3,000	- 0 -	in-kind
1995	SepTrack	Wareham	Computer & software to facilitate septic system inspection/maintenance by local Health officials	\$3,000	\$3,000	- 0 -	in-kind
1995	SepTrack	Falmouth	Computer & software to facilitate septic system inspection/maintenance by local Health officials	\$3,000	\$3,000	- 0 -	in-kind
1995	SepTrack	Bourne	Software to facilitate septic system inspection and maintenance by local Health officials	\$1,000	\$1,000	- 0 -	in-kind
1995	SepTrack	Gosnold	Software to facilitate septic system inspection and maintenance by local Health officials	\$1,000	\$1,000	- 0 -	in-kind
90-97	TOTALS			\$32,000	\$32,000	- 0 -	in-kind

Land Use Management							
Year	Project Name	Municipality	Purpose	Cost	Buzzards Bay Project Funds		Local Share
					Federal	State	
1994	Coastal Resource Mapping	Falmouth	GIS mapping of coastal features in West Falmouth (i.e. docks, shellfish beds, flood zones) for use in coastal resource management	\$15,230	\$13,730	- 0 -	\$1,500
1994	Coastal Resource Mapping	Dartmouth	GIS mapping of coastal features in Dartmouth (i.e. docks, shellfish beds, flood zones) for use in coastal resource management	\$34,210	\$24,240	- 0 -	\$9,970
1996	Coastal Resource Mapping	Dartmouth, New Bedford, Fairhaven	GIS mapping of coastal features (i.e. docks, shellfish beds, flood zones) in 3 contiguous municipalities for use in coastal resource management	\$29,000	\$19,000	- 0 -	\$10,000
1996	GIS Computer/Software	Westport	Computer and ArcView™ software to establish Geographic Information Systems (GIS) capabilities for use in land use and natural resource management.	\$6,000	\$4,500	- 0 -	\$1,500
1996	GIS Computer/Software	Acushnet	Computer and ArcView™ software to establish Geographic Information Systems (GIS) capabilities for use in land use and natural resource management.	\$6,000	\$4,500	- 0 -	\$1,500
1996	GIS Computer/Software	Rochester	Computer and ArcView™ software to establish Geographic Information Systems (GIS) capabilities for use in land use and natural resource management.	\$6,000	\$4,500	- 0 -	\$1,500
1996	GIS Computer/Software	Fairhaven	Computer and ArcView™ software to support Geographic Information Systems (GIS) capabilities for use in land use and natural resource management.	\$6,000	\$4,500	- 0 -	\$1,500
1996	GIS Computer/Software	Marion	Computer and ArcView™ software to establish Geographic Information Systems (GIS) capabilities for resource management.	\$6,000	\$4,500	- 0 -	\$1,500
1997	GIS Data Development	Westport	Digital mapping of townwide parcel and wetland resource data for use in GIS land use planning applications.	\$32,800	\$14,000	- 0 -	\$18,800
1997	GIS Data Development	Rochester & Acushnet	Digital mapping of townwide parcel and wetland resource data for use in GIS land use	\$32,380	\$23,500	- 0 -	\$8,880

			planning applications in 2 contiguous towns.				
1997	GIS Data Development	Mattapoisett	Digital mapping of townwide wetland resource data for use in GIS land planning applications.	\$2,100	\$1,500	- 0 -	\$600
1997	GIS Data Development	Marion	Digital mapping of townwide parcel and wetland resource data for use in GIS land use planning applications.	\$5,000	\$3,500	- 0 -	\$1,500
1996	ArcView GIS Training	All Towns	Three day training in the use of GIS software and specific applications for 30 Bay area municipal staff and officials.	\$14,640	\$8,640	- 0 -	\$6,000
90-97	TOTALS			\$195,360	\$130,610	- 0 -	\$64,750

## SECTION IV

# Institutional Coordination



Buzzards Bay Project staff (BBP) have successfully forged strong institutional arrangements with local, state and federal stakeholders. The emphasis however, has been on fostering partnerships with town regulatory boards because the majority of CCMP actions are directed at local government. The staff's focus has been on providing technical assistance to planning boards, boards of health and conservation commissions. This assistance takes the form of bylaw development, workshops, open space planning, septic system tracking, stormwater treatment designs, GIS capability and other useful implementation tools. Since CCMP approval in 1992, BBP staff have had the opportunity to work in all 11 major Buzzards Bay towns to varying degrees. The expertise that the staff has been able to provide has strengthened local capacity and accelerated CCMP implementation. In addition to technical assistance, the BBP has helped local grant writers with proposals, and secured highly competitive state and federal funds that were probably otherwise out of reach.

An excellent example of the BBP's ability to strengthen local capacity and facilitate CCMP implementation can be seen with the deployment of SepTrack. SepTrack is a specialized software package designed by the BBP to allow communities to better manage information related to onsite septic systems. SepTrack was initiated because local boards of health typically lack the ability to efficiently and effectively monitor septic system permits and inspection and maintenance information due to inefficient staffing and information processing equipment and systems. The BBP helped relieve this problem by providing computers and the specialized software to 11 boards of health in the watershed. Now, SepTrack is allowing these boards to be more productive and responsive, and freeing staff for much-needed field inspections, enforcement and pressing health and environmental issues.

Buzzards Bay Action Committee's (BBAC) monthly meetings have also been effective in furthering local partnerships. These sessions have allowed discussions that both promote the BBP's activities and provide an opportunity to hear from town representatives about community needs. The BBAC has used these exchanges to help establish the BBP's funding priorities and to ensure that the municipal perspective is integrated into the overall yearly agenda.

In addition to establishing strong local relations, the BBP has also developed a solid working arrangement within state government. This starts with the project being housed within the Massachusetts Coastal Zone Management Office (CZM) which provides a special institutional advantage. The project has used the prestige of CZM and the expertise of key staff to further the accomplishment of many program priorities within the Buzzards Bay watershed. CZM also provides valuable administrative support to the project.

Because nitrogen management is a key component of the CCMP, the project has concentrated much of its focus on increasing the state's profile in nitrogen-related issues. The BBP was instrumental in assisting the Massachusetts Department of Environmental Protection (DEP) to incorporate nitrogen management issues into its re-write of the state onsite septic system code in 1994. The project is also working close with DEP in the review of nitrogen issues involving sewage treatment upgrades in Buzzards Bay as well as other coastal watersheds. DEP is

utilizing the Buzzards Bay nitrogen methodology and is planning a workshop with BBP and EPA-New England to standardize this application. This arrangement has elevated the state's ability to manage nitrogen, and gone a long way toward assisting CCMP implementation.

The BBP and DEP have also combined as partners in the development and implementation of the Alternative Septic System Test Center. While the BBP secured funding for the project through an Environmental Technology Initiative grant, both organizations will capitalize on it. The purpose of the center is to evaluate and promote new onsite technologies with an emphasis on nitrogen removal. This will help with CCMP implementation, as the widening use of denitrifying systems is a major action called for in the CCMP. It will also serve DEP by providing state program managers with consistent testing protocols and a high level of confidence in the effectiveness of new technologies prior to permitting. The center will accelerate the regulatory process and allow for more alternative systems sooner.

At the federal level, the project has also institutionalized close working relationships with two key federal agencies, EPA and the Natural Resources Conservation Service (NRCS). The EPA Project Officer for the BBP was detailed for several years to the project office in Marion to assist with CCMP implementation. This allowed for the closest possible association with EPA-New England and enabled the BBP to better leverage EPA resources in support of the CCMP. This very close relationship continues today. In addition, an NRCS employee has been situated in the Marion office for the past six years to assist the communities with stormwater problems. Through this arrangement, the project has been able to concentrate much attention and funding on stormwater issues, one of the major water quality concerns highlighted in the CCMP. This accommodation has also enabled the project to develop an excellent relationship with NRCS, particularly important because the BBP has been able to draw on that agency's expertise in nonpoint source pollution.

Finally, the BBP receives overall policy direction and budget approval from its five member Steering Committee. Members represent EPA- New England, CZM, BBAC, the Coalition for Buzzards Bay (a citizen activist organization), and the Southeastern Regional Planning and Economic Development District. The committee provides the proper blend of federal, state, regional, and local government, as well as citizen representation. It makes the difficult funding decisions implicit with a shrinking resource base, but allows the project director and staff the necessary management flexibility to administer the details of ongoing projects.

## SECTION V

# Technical Assistance & Technology Transfer



The goal of the Buzzards Bay Project (BBP), as described throughout this report, is to provide technical assistance to those local agencies that must be relied on to implement the CCMP. This is demonstrated by such actions seen in the development of model bylaws such as the comprehensive stormwater management bylaw that was individually designed to complement the regulatory responsibilities of planning boards, boards of health and conservation commissions. This bylaw has been made available not only to Buzzards Bay communities, but has been presented in statewide and New England-wide forums as well.

In addition to stormwater, the other two areas where BBP staff has concentrated technical assistance are nitrogen management and wetlands protection. The BBP has developed an embayment ranking system relative to current and future nitrogen impacts that has been made available to Buzzards Bay municipalities so they can better assess those embayments that require management attention. In several cases such as Buttermilk Bay, Onset Bay and West Falmouth Harbor, BBP staff have provided concentrated technical assistance and have guided the work of local boards in controlling nitrogen loading. This innovative Buzzards Bay methodology is the centerpiece of the BBP's nitrogen strategy, and it has been transferred to many other embayments outside Buzzards Bay including Cape Cod and the South Shore portion of Massachusetts Bay. The BBP office receives several requests each year from embayments throughout New England that are interested in receiving the nitrogen management methodology.

Wetlands Protection is another area in which technical assistance receives a heavy emphasis. The BBP's wetlands specialist conducts approximately 10-15 workshops each year for local regulators. These include workshops in wetland delineation, plant identification and soils identification. In addition, the specialist makes an average of 20 visits per year to local conservation commissions to work with them on both stormwater regulations and wetland regulations, as well as covering the details of specific sites that are of concern to the commissions. The specialist has also designed user friendly handbooks that can be easily used in the field for identifying plants, soils and drawing wetland delineation lines.

Because the Buzzards Bay watershed is relatively small, the BBP has concentrated most of its technical assistance in on-site efforts and through local workshops. Emphasizing hands-on training and assistance and very specific and focused workshops. However, BBP staff have regularly made presentations in nitrogen management, stormwater control and alternative on-site septic systems. Venues for these presentations include the annual Massachusetts Association of Conservation Commissions, The New England Environmental Conference coordinated by Tufts University, the annual New England Interstate Water Pollution Control Commission's eight state nonpoint source meeting, and the New England Soil Scientists Conference.

Although the BBP no longer produces a newsletter, it has utilized other mechanisms to compensate for its outreach responsibilities. BBP staff attend the monthly meetings of the Buzzards Bay Action Committee, comprising representatives from each bay town, and give a lengthy report on all Project activities with emphasis on those areas that could be useful to local government. In addition, the BBP works closely with the Coalition for Buzzards Bay and utilizes that organization's newsletter to get the word out on key issues affecting the bay. The Project also uses press releases to local



newspapers to herald major accomplishments and report on grant money that is received by the BBP, as well as those funds that are passed through to the communities.

The BBP has produced dozens of fact sheets on all aspects of its program and regularly disseminates them to the towns. Additionally, the BBP has produced informational booklets for all its stormwater construction projects and disseminated them in the geographic areas surrounding the projects so the neighborhoods could understand all the aspects of the project from general information about stormwater to the specific management practice being utilized. In particular, the BBP has used the wetlands restoration/stormwater treatment project at Spragues Cove as a learning laboratory for the entire town of Marion. It has been included as the foremost Section 319 success story for Massachusetts.

Finally, the work of the BBP has been highlighted in two tech transfer pieces appearing in *Coastlines*, the newsletter of the National Estuary Program. *Coastlines* described the innovative approach to stormwater management undertaken in Buttermilk Bay, as well as the development of the ground-breaking septic system software package known as SepTrack. Because of this notoriety, the BBP has received many calls from around the country for additional information. SepTrack, in particular, has generated phenomenal interest as a desirable management tool.

## SECTION VI

# Overall Program Strengths & Limitations



The Buzzards Bay Project's (BBP) major strengths have been touched on in previous sections, but are worth summarizing here. The single greatest asset that the BBP possesses is its talented and hard working staff, combined with an ability to produce useful management tools and directed technical assistance. This has resulted in local capacity building that is critical to CCMP implementation. The BBP staff excels in applying scientific principles to program management, which translates to taking recommended CCMP activities and demonstrating how to accomplish them. This was approach was achievable because technical staff were hired to fill specific needs of the watershed municipalities.

Such a focused strategy was in part achievable because the watershed has only 15 municipalities, making it feasible for Project staff to develop the close working relationship with many municipal officials and town boards. The 6 years of implementation activities by the Buzzards Bay Project have made it recognized resource for elected and appointed officials and the staff of many municipal boards around Buzzards Bay.

Another strength is an ability to secure grant funds outside of the Section 320 program. This includes: federal Clean Water Act grants under Sections 104(b)(3), s.319, and 604(b); an EPA Pollution Prevention grant; an Environmental Technology Initiative grant; Massachusetts Transportation Bond funds; funding from the Massachusetts Environmental Trust; and enhancement funds through the Intermodal Surface Transportation Efficiency Act. In addition, the project was able to sufficiently impress its congressional delegation with accomplishments, to garner an additional \$1.2 million in add-on funding. The total of all these funding sources is in excess of \$2.5 million, a truly staggering figure for a program the size of Buzzards Bay. The combination of technical assistance provided by the staff, with the use of these additional grant dollars for remediation and other implementation activities has been a powerful one-two punch.

In addition to its overall technical assistance program, a few special initiatives (all discussed in more detail earlier) deserve mention. These include: the Toxics Use Reduction program that went a long way toward completing the Toxics Action Plan; establishment of the Tri-town Buttermilk Bay Nitrogen Overlay District, the first such designation in the country; the Alternative On-site Septic System Test Center; and the implementation throughout Buzzards Bay of SepTrack, the septic system tracking system that is rapidly becoming a national model.

Due to a shrinking resource base, in 1994 the BBP made the conscious decision several years ago to abandon the position of outreach coordinator, and instead fund the position of wetlands specialist. This was done to further emphasize CCMP implementation and bolster an area that was not receiving adequate attention. Buzzards Bay communities had a very mixed record in wetlands protection to that point, and the Steering Committee was unanimous in its belief that a wetlands position was a critical need. Another reason for going this route was the understanding that the Coalition for Buzzards Bay's (CBB) outreach program could partially mitigate the project's diminished effort. Although the CBB has been able to somewhat soften the loss of an outreach coordinator, lacking that position has restricted the project's ability to connect with the general public, an obvious shortcoming of the program. While elimination of the Project newsletter and outreach staff enabled more of the base funding budget to be directed to municipal technical assistance to the towns and specific implementation projects, confusion of

the Project's identity with the two collaborative non-profit organizations, the citizen-group Coalition for Buzzards Bay and the municipal official group Buzzards Bay Action Committee became increasingly commonplace. Many municipal officials for example believed that the Buzzards Bay Action Committee awarded the municipal grants instead of the Project, or couldn't understand why so many "Buzzards Bay" organizations existed.

Another possible shortcoming is the lack of programmatic introspection, that is, taking a step back and thoroughly evaluating program performance. This has been attempted from time to time, but in a more piecemeal fashion. It is hoped that the biennial review process will help facilitate this.

Finally, the major roadblock to successful implementation (aside from truly adequate funding) is the constant turnover in local government. This is a problem that is difficult to fix, and is one encountered in any effort to implement programs at the local level. Because the BBP must work primarily with local boards, this will always be problematic. While the project has done its best to help local boards institutionalize their programs, turnover in personnel will always be a major hindrance.

## Appendix A. Testimony of Success: Selected Correspondence and newspaper articles

One of the best indicators of the value of the Buzzards Bay Project is evidence that the Buzzards Bay Project is viewed as a valuable resource to municipal officials, non-profits, and the public. More important than being viewed as a valuable resource is the fact that the Buzzards Bay Project “gets things done”.

On the following pages are selected letters and press clippings which we offer as a testimony of our success. We believe the breadth of municipal boards and agencies involved demonstrates that the Buzzards bay Project is a positive and successful force in facilitating the implementation of the Buzzards Bay CCMP.

1. Letter regarding BBP technical assistance from Regional Health District, April 16, 1997
2. Newspaper article, BBP awards grants, July 26, 1997
3. Letter, Westport River Watershed Alliance thanks BBP for workshop May 8, 1995
4. Newspaper article, Town of Mattapoisett seeks BBP funds for stormwater remediation
5. Newspaper Article, wetlands controversy in Mattapoisett
6. Newspaper Article, town of Fairhaven receives boat pump-out grant
7. Newspaper Article, BBP wants oil spill proposals (1<sup>st</sup> grant round), December 31, 1993
8. Newspaper Article, 2<sup>nd</sup> round of oil spill grants awarded, April 1, 1997
9. Newspaper Article on 1997 oil spill grants
10. Letter from West Falmouth Boat Club, Inc. regarding BBP’s effort to develop a nitrogen management plan for West Falmouth Harbor, September 6, 1997
11. Article on BBP’s nitrogen plan for West Falmouth Harbor, February 14, 1997
12. Letter, Association for the Preservation of Cape Cod, Inc. support for Buzzards Bay Project’s alternative septic system test center, February 2, 1996
13. Letter, Coalition for Buzzards Bay Inc. support for Buzzards Bay Project’s alternative septic system test center, February 8, 1996
14. Letter, Town of Falmouth Board of Selectmen letter of support for BBP’s alternative septic system test center, February 7, 1996
15. Letter, Town of Mashpee letter of support for Buzzards Bay Project’s alternative septic system test center, February 2, 1996
16. Newspaper Article, BBP hires manager for alternative septic system test center project
17. Letter, Marion Conservation Commission request for Wetlands Technical assistance
18. Newspaper Article, Aucoot Cove water quality and BBP, July 28, 1994
19. Letter form Project to Lands Trust conveying two requested maps
20. Letter from Fairhaven High School class thanking Project staff member for participation
21. Newspaper Article, Shellfish beds reopen in New Bedford, July 20, 1996
22. Newspaper Article: BBP receives Congressional add-on implementation funding, October 20, 1992
23. Letter, Mass DEP requesting BBP review of Superfund ecological monitoring plan, October 20, 1996
24. Newspaper Article, Mattapoisett Holly Woods wetlands controversy
25. Letter, Falmouth Conservation Commission requesting BBP support for special district nomination, Nov. 1994
26. Newspaper Article, District regulations developed by BBP under debate, May 1997
27. Letter from Falmouth Conservation Commission, District regulations approved thanks to Project
28. Newspaper Article, Buzzards Bay water testing, August 21, 1992
29. Newspaper Article, BBP awards grant to Westport Board of Health for water testing, October 21, 1993
30. Newsletter Article by BBP on Westport nitrogen loading, September 1994
31. Newsletter, Westport nitrogen loading, October 1994
32. Newspaper article, Buzzards Bay Project offers help to rebuild wetland at Spragues Cove, July 8, 1992
33. Newspaper article, Marion gets \$10,000 in additional funding for Spragues Cove, September 2, 1992
34. Newspaper Article, Marion to build wetland at Spragues Cove February 24, 1994
35. Newspaper Article, Spragues Cove follow-up

36. Newspaper Article, another Spragues Cove follow up
37. Newspaper Article, Osprey platform installed at Spragues Cove, March 23, 1995
38. Newspaper Article, Volunteers plant at Spragues Cove (3<sup>rd</sup> season), April 17, 1997
39. USFWS newsletter article on Spragues Cove
40. Letter from EPA regional administrator giving referral to BBP on nitrogen issue
41. Newspaper Article, BBP involvement with development of Westport open space plan
42. Letter from Fairhaven resident, thanking Project for help, March 24, 1995
43. Letter from Mattapoissett Bike Path Committee requesting BBP technical assistance, February 13, 1997
44. Quarterly Report, City of Fall River, identifies BBP assistance on open space project September 30, 1996
45. Newspaper Article, Announces EPA Award for Pollution Prevention to Tri-Town Nitrogen Protection Overlay District, 6/25/92
46. Letter from Boston University thanking Joe Costa for teaching a class, April 28, 1997
47. Newspaper article, Fall River Herald announcing award of grants for coastal mapping, March 23, 1994
48. Newspaper article, Standard Times, announcing oil spill pact
49. Letter from Rochester Planning Board, thanking Project for help, August 16, 1996
50. Letter from Mass. Environmental Trust, announcing grant
51. Newspaper article, announcing regional conservation agent, May 25, 1993
52. Newspaper article, announcing Project grant program, February 7, 1995
53. Newspaper article, no discharge planning session, November 15, 1992
54. Letter from Falmouth Conservation Commission, supporting Project proposal, October 10, 1996
55. Letter from Mass. Association of Conservation Commissions, thanking Project, April 10, 1995
56. Letter from Concord Planning Commission, thanking Project, June 4, 1997
57. Newspaper article, announcing grant award to towns, January 30, 1997
58. Newspaper article, announcing Hen Cove funding
59. Newspaper article, announcing toxics reduction initiative
60. Newspaper article, Mattapoissett group supports development, May 21, 1996
61. Letter from Congressman Frank supporting Project, April 22, 1997
62. Letter from Mattapoissett Land Trust, requesting Project assistance, September 6, 1996
63. Newspaper article, toxics reduction, June 19, 1994
64. Letter from USDA Soil Conservation Service, thanking Project for help, December 28, 1993
65. Newsletter Article (Fairhaven Shellfishermen's Association) written by BBP staffer, 1996
66. Newspaper Article, Herring grant funding from BBP, March 31, 1994
67. Newspaper Article, Mattapoissett herring restoration moving forward, BBP funding, May 7, 1996
68. Letter from Bourne resident regarding possible collaboration with Project on conservation restriction and herring restoration, April 30, 1997.
69. Letter from state Representative to CZM director regarding BBP
70. Newspaper Article on Baywatchers report, November 24, 1996
71. MCZM newsletter Coastlines article on BBP septic system test center, December 1995
72. MCZM newsletter Coastlines article on BBP receiving DEP 319 grant
73. MCZM newsletter Coastlines article on BBP- Coalition storm drain mapping and stenciling, Spragues Cove
74. MCZM newsletter Coastlines article on BBP Pollution Prevention Grant, June 1993
75. MCZM newsletter Coastlines article on BBP Pollution Prevention Workshop, June 1994
76. MCZM newsletter Coastlines article on Wareham no-discharge designation, May 1992
77. MCZM newsletter Coastlines article on BBP, Buzzards Bay video available, February 1992

## Appendix B. Technical Assistance and Technical Transfer Products.

To achieve success, the Buzzards Bay Project has developed brochures, fact sheets, and newsletters to achieve very specific goals. SepTrack was developed to help Buzzards Bay area Boards of Health better track septic system permitting, inspections, and upgrades. Our Toxic Use Program newsletter was developed to increase business participation “buy in” of our program. Our nitrogen evaluations and technical reports were prepared to both educate and explain the Buzzards Bay Project’s Nitrogen Management approach to increase its widespread acceptance in the state. We even include here two proposals we prepared on behalf of towns that were funding. Through this sampling we also demonstrate the breadth of the technical assistance program that we offer.

1. Baywatchers Newsletter, Citizens Monitoring Program results, 1992-1995, Fall 1996
2. BBP “Bay Watch” Newsletter, Winter 1992, Wareham No-discharge headline
3. BBP “Bay Watch” Newsletter, Fall 1992, Title 5 headline
4. BBP “Bay Watch” Newsletter, Winter 1993, Wetlands Protection headline
5. BBP “Bay Watch” Newsletter, Winter 1992, Stormwater headline
6. BBP entry submission of Star Plating for Governor’s toxics reduction award
7. Options Newsletter, March 1993
8. Options Newsletter, August 1993
9. Options Newsletter, November 1993
10. Options Newsletter, March 1994
11. Options Newsletter, June 1994
12. Options Newsletter, August 1994
13. Options Newsletter, November 1994
14. Options Newsletter, December 1994
15. Options Newsletter, May 1995
16. Options Newsletter, June 1995
17. Options Newsletter, August 1995
18. Options Newsletter, September 1995
19. Options Newsletter, January 1996
20. Options Newsletter, March, 1996
21. NICE'3: National Industrial Competitiveness Through Energy Environment Economics
22. 1996 NICE' Grant: Brittany Dyeing & Printing Corporation
23. Newsletter Article: Governor's Award Program - 1995, For Outstanding Achievement in Toxics Use Reduction
24. Flyer: Governor's Award Program, Toxic Use Reduction Presented to Star Plating
25. BBP flyer, The Environmental Electronic Network (EEN)
26. Pamphlet: Governor's Award Program, Toxic Use Reduction
27. BBP flyer, Hazardous Materials Management and Chemical Reporting (1993)
28. BBP fact sheet, Buttermilk Bay Comprehensive Stormwater Remediation Project
29. BBP Fact sheet, Directory of Land Trusts
30. BBP Map included Town Mattapoisett Open Space Plan prepared by the BBP
31. Facsimile of color sign (3'x5') installed at the Spragues Cove Stormwater Remediation Project
32. BBP Fact Sheet, Open Space Planning Initiative, 12/96
33. BBP Fact Sheet, Restoring Herring Populations, 12/96
34. BBP Fact Sheet, Development of GIS Systems for use in Natural Resource planning, 1/97
35. BBP Fact Sheet, Onset Stormwater Solutions, 12/96
36. BBP Fact Sheet, BBP’s septic system tracking software, 3/96
37. EPA fact sheet on SepTrack
38. SepTrack Manual
39. BBP report, Analysis of wastewater disposal at the Falmouth Wastewater disposal facility

40. BBP Fact Sheet, Spragues Cove Constructed Wetland
41. Unified Rules and Regulations for Stormwater Management
42. Buzzards Bay Embayment Subwatershed Evaluation: Establishing Priorities for Management Action
43. BBP Handbook, Field Indicators for identifying Hydric Soils in New England
44. BBP Handbook, BBP's Guide to describing and documenting Soil Conditions
45. BBP Handbook, USFWS National List of wetland species, condensed by BBP
46. BBP Handbook, BBP Pocket Guide to Delineating Wetlands